RECLAMATION

Managing Water in the West

Coordinated Long-Term Operation of the Central Valley Project and State Water Project

Mid-Pacific Region
Bay-Delta Office

Draft Environmental Impact Statement

U.S. Department of the Interior
Bureau of Reclamation

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Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Executive Summary

ES.1 Introduction

This Draft Environmental Impact Statement (EIS) for the Coordinated Long-Term Operation of the Central Valley Project (CVP) and State Water Project (SWP) has been prepared by the Department of the Interior, Bureau of Reclamation (Reclamation). Reclamation is the Federal lead agency for compliance with the National Environmental Policy Act (NEPA) and is completing the EIS as ordered by the United States District Court for the Eastern District of California (District Court). The EIS evaluates long-term potential direct, indirect, and cumulative impacts on the environment that could result from operation of the CVP and SWP with implementation of the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) and the 2009 National Marine Fisheries Service (NMFS) BO. The BOs were issued pursuant to the Federal Endangered Species Act of 1973 as amended (U.S.C. Section 1531 et. seq.).

ES.2 Background

ES.2.1 Central Valley Project

The first Federal action authorizing the CVP was through the Rivers and Harbors Act of August 30, 1935. The CVP was reauthorized for construction, operation, and maintenance by the Secretary of the Interior (Secretary) pursuant to the Reclamation Act of 1902, as amended and supplemented (the Federal Reclamation laws), and by the Rivers and Harbors Act of August 26, 1937. In 1992, the Central Valley Project Authorization Act of August 26, 1937 was amended by Section 3406(a) of the Central Valley Project Improvement Act (CVPIA), Public Law 102-575. (http://www.usbr.gov/history/cvpintro.html)

The CVP is composed of 20 reservoirs with a combined storage capacity of more than 11 million acre-feet, over 11 hydroelectric powerplants, and more than 500 miles of major canals and aqueducts. The major CVP facilities are located in the Delta watershed including:

- **Major Reservoirs:** Trinity Lake (Trinity River), Whiskeytown Lake (Clear Creek); Shasta Lake (Sacramento River), Folsom Lake (American River), New Melones Reservoir (Stanislaus River), portions of the San Luis Reservoir complex (local drainages), and Millerton Lake (San Joaquin River).
- **Major Pumping Plants and Conveyance Facilities**: Red Bluff Pumping Plant (diverts water from Sacramento River into CVP Tehama-Colusa Canal), Folsom South Canal (diverts water from Folsom Lake to portions of Sacramento County), Contra Costa Canal Pumping Plant (diverts water from the Delta into CVP Contra Costa Canal), C.W. “Bill” Jones Pumping Plant (diverts water from the Delta into CVP Delta-Mendota Canal), Clear Creek

Tunnel (conveys water from Trinity Lake to Whiskeytown Lake), Pacheco Tunnel and Conduit (conveys water from San Luis Reservoir to Santa Clara and San Benito counties), and Friant Kern and Madera canals (convey water from Millerton Lake to the eastern San Joaquin Valley).

These facilities are operated as an integrated project, although they are authorized and categorized in distinct units or divisions.

ES.2.2 State Water Project

The State Legislature appropriated funds to the Department of Water Resources (DWR) to begin construction of the SWP under the State Central Valley Project Act (Water Code section 11100 et seq.), Burns-Porter Act (California Water Resources Development Bond Act), State Contract Act (Public Contract Code section 10100 et seq.), Davis-Dolwig Act (Water Code sections 11900 - 11925), and other acts of the State Legislature.

Major SWP facilities include:

- **Reservoirs:** Lake Oroville and the Thermalito Complex (Feather River); Antelope Lake, Lake Davis, and Frenchman Lake (upper Feather River upstream of Lake Oroville); portions of the San Luis Reservoir complex (local drainages); reservoirs located downstream of San Luis Reservoir along the California Aqueduct and other SWP conveyance facilities (Quail Lake, Pyramid Lake, Castaic Lake, Silverwood Lake, Crafton Hills Reservoir, and Lake Perris).
- **Major Pumping Plants and Conveyance Facilities**: Barker Slough Pumping Plant (diverts water into SWP North Bay Aqueduct); Clifton Court Forebay and Harvey O. Banks Pumping Plant (diverts water from the Delta into SWP South Bay Aqueduct and the SWP California Aqueduct); California Aqueduct and associated pumping plants (convey water to the San Joaquin Valley, San Luis Obispo and Santa Barbara counties along the central coast, and southern California); Coastal Branch of the California Aqueduct (conveys water to San Luis Obispo and Santa Barbara counties); and East Branch and West Branch (convey water to Southern California).

ES.2.3 Coordinated Operation of the CVP and SWP

The purpose of the Coordinated Operation Agreement (COA) (Public Law 99-546) is to ensure that the CVP and SWP each manage respective water rights from the Delta and share the obligations to protect other beneficial uses of water in the Sacramento Valley and the Delta. The State Water Resources Control Board (SWRCB) has placed conditions on the CVP and SWP water right permits and licenses to meet water quality and operational criteria within the Delta. Reclamation and DWR coordinate the operation of the CVP and SWP to meet these and other operating requirements pursuant to COA. Coordinated operation by agreed-on criteria can increase the efficiency of both the CVP and the SWP.

Implementation of the COA has evolved continually since 1986 as changes have occurred to CVP and SWP facilities, operational criteria, and the physical and regulatory environment. However, the COA has not been formally modified to address these newer operating conditions. For example, adoption of the CVPIA in 1992 changed purposes and operations of the CVP; application of Federal Endangered Species Act (ESA) responsibilities affected operations; and SWRCB water quality and flow standards have been revised.

ES.2.4 Federal Endangered Species Consultation

The following species and their critical habitats were considered in ESA consultations with the USFWS and NMFS for the coordinated long-term operation of the CVP and SWP.

- The Sacramento River winter-run Chinook Salmon (*Oncorhynchus tshawytscha*) evolutionarily significant unit (ESU) was originally listed as threatened in August 1989, under emergency provisions of the ESA, and formally listed as threatened in November 1990 (55 Federal Register (FR) 46515). They were re-classified as an endangered species on January 4, 1994 (59 FR 440).
- Central Valley spring-run Chinook Salmon (*O. tshawytscha*) ESU was listed as threatened on June 18, 2005 (70 FR 37160).
- The Central Valley Steelhead (*O. mykiss*) distinct population segment (DPS) was listed as threatened on January 5, 2006 (71 FR 834).
- Southern Oregon/Northern California Coast Coho Salmon (*O. kisutch*) ESU was listed as threatened on June 18, 2005 (70 FR 37160).
- Southern DPS of the North American Green Sturgeon (*Acipenser medirostris*) was listed as threatened on June 6, 2006 (71 FR 17757).
- The Southern Resident DPS of Killer Whales (*Orcinus orca*) was listed as endangered on November 18, 2005 (NMFS 2005).
- The Delta Smelt (*Hypomesus transpacificus*) was listed as threatened on March 5, 1993 (58 FR 12854). The species was recently proposed for re-listing as endangered under the ESA.

The Central California Coast Steelhead (*O. mykiss*) DPS was listed as threatened on January 5, 2006 (71 FR 834). The 2009 NMFS BO determined that the long-term operation of the CVP and SWP would not likely adversely affect Central California Coast Steelhead DPS and its critical habitat. Therefore, no further analysis of this DPS was performed and addressed in this EIS.

ES.2.4.1 Recent ESA Consultation Activities and Court Rulings

In August 2008, Reclamation submitted a biological assessment (BA) to the USFWS and NMFS for consultation. BO’s were issued by the USFWS (December 15, 2008) and NMFS (June 4, 2009) with separate Reasonable and Prudent Alternative (RPA) actions to allow the projects to continue operating without causing jeopardy to listed species or adverse modification to designated critical habitat. Reclamation provisionally accepted the two BOs and RPAs.

Lawsuits were filed in the District Court challenging various aspects of the 2008 USFWS BO and the 2009 NMFS BO and Reclamation's acceptance and implementation of the associated RPAs. The District Court consolidated many of the lawsuits into two proceedings that focused on each BO separately. The outcomes of the Consolidated Delta Smelt Cases and the Salmonid Consolidated Cases are summarized below.

- Consolidated Delta Smelt Cases
  - On November 16, 2009, the District Court ruled that Reclamation violated NEPA by failing to conduct a NEPA review of the potential impacts to the human environment before provisionally accepting and implementing the 2008 USFWS BO, including the RPA. Reclamation was ordered to review the USFWS BO and RPA in accordance with NEPA.
  - On December 14, 2010, the District Court found certain portions of the 2008 USFWS BO to be arbitrary and capricious, and remanded those portions of the BO to the USFWS without vacatur for further consideration. The District Court ordered Reclamation to review the BO and RPA in accordance with NEPA.
  - The decision of the District Court related to the USFWS BO was appealed to the United States Court of Appeals for the Ninth Circuit (Appellate Court). On March 13, 2014, the Appellate Court reversed the District Court decision and upheld the BO. Therefore, the remand order related to the USFWS BO was rescinded.
  - A mandate of the Appellate Court was issued on September 16, 2014.
  - Petitions for Writ of Certiorari were submitted to the U.S. Supreme Court; however, the U.S. Supreme Court decided not to hear the cases. The District Court issued the Final Order on October 1, 2014.
- Salmonid Consolidated Cases
  - On March 5, 2010, the District Court held that Reclamation violated NEPA by failing to undertake a NEPA analysis of potential impacts to the human environment before accepting and implementing the 2009 NMFS BO and RPA. Reclamation was ordered to review the USFWS BO and RPA in accordance with NEPA.
  - On September 20, 2011, in the Consolidated Salmonid Cases, the District Court found certain portions of the 2009 NMFS BO to be arbitrary and capricious, and remanded those portions of the BO to NMFS without vacatur for further consideration. The District Court ordered Reclamation to review the BO and RPA in accordance with NEPA.
  - The decisions of the District Court related to the 2009 NMFS BO were appealed to the Appellate Court. On December 22, 2014, the Appellate

Court reversed the District Court decision and upheld the BO. Therefore, the remand order related to the NMFS BO was rescinded.

- A mandate of the Appellate Court was issued on February 17, 2015. The District issued the Final Order on May 5, 2015.

ES.3 Need to Prepare this Environmental Impact Statement

To comply with the District Court's orders regarding NEPA for the coordinated long-term operation of the CVP and SWP, Reclamation initiated preparation of this EIS in 2011 addressing both the USFWS and NMFS RPAs. This EIS documents Reclamation's analysis of the effects of modifications to the coordinated long-term operation of the CVP and SWP that are likely to avoid jeopardy to listed species and destruction or adverse modification of designated critical habitat.

In accordance with the October 1, 2014, District Court's order in the *Delta Smelt Consolidated Cases*, the Final EIS and Record of Decision are to be completed on or before December 1, 2015.

Many of the provisions of the RPAs, as set forth in the 2008 USFWS BO and the 2009 NMFS BO, will require further study, monitoring, consultation, implementation of adaptive management programs, and subsequent environmental documentation for future facilities to be constructed or modified. Specific actions related to these provisions are not known at this time. Therefore, this EIS assumes the completion of future actions, including provisions of the RPAs, would be done in a manner that is consistent with ESA and does not address impacts during construction or start-up phases of these actions.

ES.4 Use of the Environmental Impact Statement

This EIS may be used by Reclamation or cooperating agencies that are participating in the preparation of this EIS to inform future decisions related to operation of the CVP and SWP, and implementation of the RPAs in the 2008 USFWS BO and 2009 NMFS BO.

This Draft EIS does not recommend a preferred alternative. A preferred alternative will be included in the Final EIS.

ES.5 Purpose and Need

NEPA regulations require a statement regarding "the underlying purpose and need to which the agency is responding in proposing the alternatives, including the proposed action" (40 Code of Federal Regulations (CFR) 1502.13).

ES.5.1 Purpose of the Action

The purpose of the action considered in this EIS is to continue the operation of the CVP in coordination with operation of the SWP, for its authorized purposes, in a manner that:

- Is similar to historic operational parameters with certain modifications;
- Is consistent with Federal Reclamation law; other Federal laws and regulations; Federal permits and licenses; State of California water rights, permits, and licenses; and
- Enables Reclamation and DWR to satisfy their contractual obligations to the fullest extent possible.

ES.5.2 Need for the Action

Continued operation of the CVP is needed to provide river regulation, navigation; flood control; water supply for irrigation and domestic uses; fish and wildlife mitigation, protection, and restoration; fish and wildlife enhancement; and power generation. The CVP and the SWP facilities are also operated to provide recreation benefits and in accordance with the water rights and water quality requirements adopted by the SWRCB.

The USFWS and NMFS concluded in their 2008 and 2009 BOs, respectively, that the coordinated long-term operation of the CVP and SWP, as described in the 2008 Reclamation Biological Assessment, jeopardized the continued existence of listed species and adversely modified critical habitat. The USFWS and NMFS provided RPAs in their respective BOs as an alternative to the project described in the 2008 BA that would not jeopardize listed species or adversely modify critical habitat.

The Appellate Court confirmed the District Court ruling that Reclamation must conduct a NEPA review to determine whether the acceptance and implementation of the RPA actions cause a significant effect to the human environment.

ES.6 Project Area

The project area boundaries are defined by the locations of most of the CVP facilities and their service areas; and all of the SWP facilities and the SWP service areas. The CVP facilities associated with Millerton Lake, including the Madera and Friant-Kern canals and their service areas, and the San Joaquin River Restoration Program are not part of the project area for this EIS because the operations of these facilities were not addressed in either the 2008 USFWS BO or 2009 NMFS BO.

ES.7 Study Period

It is anticipated that the coordinated long-term operation of the CVP and SWP, as described in the alternatives analyzed in this EIS, would continue to at least 2030 before major changes to CVP and SWP operations would be implemented. These changes could include projects considered as part of the cumulative effects analyses. Therefore, the EIS analyzes future conditions projected for the Year 2030. It is recognized that many changes would occur between existing conditions and 2030 that would also occur without changes to CVP and SWP operations, including local land use decisions and climate change.

ES.8 Summary Description of Alternatives

Identification of the No Action Alternative and the range of alternatives for this EIS were developed to respond to the purpose and need for the action and to comments received during the scoping process and preparation of the Draft EIS.

Twenty-three alternative concepts were identified during the scoping process and through meetings with stakeholders and agencies during preparation of this EIS. The alternative concepts were compared to screening criteria that were developed based on the purpose of the action. The alternative concepts were also reviewed to determine if they addressed substantial issues. Based upon the comparison of screening criteria to the alternative concepts, 17 of the 23 alternative concepts were identified to be included in one or more of the alternatives evaluated in this EIS. The alternative concepts were combined into five specific alternatives that were consistent with assumptions for the year 2030. Further development of the alternatives was informed by subsequent comments received during preparation of the Draft EIS.

All of the alternatives, including the No Action Alternative, include the same assumptions related to (1) climate change and sea level rise in Year 2030, and (2) development throughout California in accordance with existing general plans, existing contracts, and implementation of reasonable and foreseeable water resources management projects.

ES.8.1 Inclusion of the Second Basis of Comparison

The No Action Alternative is defined as the projections of current conditions and trends into the future without implementation of the alternatives. These projected conditions are defined as no change from current management direction or level of management intensity for this EIS.

For this EIS, the No Action Alternative is based upon the continued operation of the CVP and SWP in the same manner as occurred at the time of the publication of the Notice of Intent in March 2012. Thus, the No Action Alternative consists of the coordinated long-term operation of the CVP and SWP, including full implementation of the RPAs in the 2008 USFWS BO and 2009 NMFS BO. The No Action Alternative also includes changes not related to the long-term operation of the CVP and SWP or implementation of the RPAs in the 2008 USFWS BO and 2009 NMFS BO.

Numerous scoping comments requested that the No Action Alternative not include the RPAs in the 2008 USFWS BO and 2009 NMFS BO because, at that time, the District Court had remanded the BOs back to USFWS and NMFS. The comments indicated that the EIS should include a "basis of comparison" for the alternatives that was similar to conditions prior to implementation of the RPAs. Scoping comments also indicated that a "No Action Alternative scenario" without implementation of the RPAs in the 2008 USFWS BO and 2009 NMFS BO could be used to analyze the effects of implementing the RPAs.

Because the RPAs were provisionally accepted and the No Action Alternative represents a continuation of existing policy and management direction, the No Action Alternative includes the RPAs. However, in response to scoping comments and subsequent comments from stakeholders and interest groups, and to provide a basis for comparison of the effects of implementation of the RPAs (per the District Court's mandate), this EIS includes a "Second Basis of Comparison" that represents a condition in 2030 with coordinated long-term operation of the CVP and SWP without implementation of the 2008 USFWS BO and 2009 NMFS BO RPAs. All of the alternatives are compared to the No Action Alternative and to the Second Basis of Comparison to describe the effects that could occur in 2030 under both bases of comparison.

Because several of the 2009 NMFS BO RPA actions had already been initiated prior to issuance of the 2009 NMFS BO; those actions are included in the Second Basis of Comparison. Reasonably foreseeable actions included in the No Action Alternative that are not related to the 2008 USFWS BO or 2009 NMFS BO are also included in the Second Basis of Comparison.

ES.8.2 No Action Alternative

The definition of the No Action Alternative is based upon the following assumptions.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB; and requirements of the 2008 USFWS BO and the 2009 NMFS BO.
- Implementation of existing and future actions described in the 2008 USFWS BO and 2009 NMFS BO that would occur by 2030 without implementation of the BOs, including:
  - Restoration of more than 10,000 acres of intertidal and associated subtidal wetlands in Suisun Marsh and Cache Slough; and at least 17,000 to 20,000 acres of seasonal floodplain restoration in Yolo Bypass.
  - Gravel augmentation in the Sacramento Valley watershed.
  - Replacement of the Spring Creek Temperature Control Curtain.

- Habitat restoration of Battle Creek.
- Implementation of Red Bluff Pumping Plant.
- Implementation of the CVPIA Anadromous Fish Screen Program.
- Implementation of the American River Flow Management Standard.

- Implementation of existing and future actions not described in the 2009 NMFS BO that would occur by 2030 without implementation of any alternatives considered in this EIS, including:
  - Trinity River Restoration Program.
  - Clear Creek Mercury Abatement and Fisheries Restoration Project.
  - Iron Mountain Mine Superfund Site cleanup.
  - Mainstem Sacramento River and American River Gravel Augmentation Programs.
  - Nimbus Fish Hatchery Fish Passage Project.
  - FERC Relicensing for Middle Fork of the American River Project.
  - Lower Mokelumne River Spawning Habitat Improvement Project.
  - Dutch Slough Tidal Marsh Restoration.
  - Suisun Marsh Habitat Management, Preservation, and Restoration Plan Implementation.
  - Tidal Wetland Restoration in the Delta and Suisun Marsh.
  - San Joaquin River Restoration Program.
  - Stockton Deep Water Ship Channel Demonstration Dissolved Oxygen Project.
  - Grasslands Bypass Project.
  - Municipal Water Supply Projects identified in Urban Water Management Plans that have undergone environmental review and are reasonably foreseeable.
  - Water Transfer Projects.

ES.8.3 Second Basis of Comparison

The definition of the Second Basis of Comparison is based upon the following assumptions.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB without implementation of the 2008 USFWS BO and the 2009 NMFS BO.

- Implementation of existing and future actions that would occur by 2030 without implementation of the BOs, including actions that have already been constructed or have substantial progress:
  - Restoration of more than 10,000 acres of intertidal and associated subtidal wetlands in Suisun Marsh and Cache Slough; and at least 17,000 to 20,000 acres of seasonal floodplain restoration in Yolo Bypass.
  - Gravel augmentation in the Sacramento Valley and Stanislaus River watershed.
  - Replacement of the Spring Creek Temperature Control Curtain.
  - Habitat restoration of Battle Creek.
  - Implementation of Red Bluff Pumping Plant.
  - Implementation of the CVPIA Anadromous Fish Screen Program.
  - Implementation of the American River Flow Management Standard.
  - Trinity River Restoration Program.
  - Clear Creek Mercury Abatement and Fisheries Restoration Project.
  - Iron Mountain Mine Superfund Site cleanup.
  - Mainstem Sacramento River and American River Gravel Augmentation Programs.
  - Nimbus Fish Hatchery Fish Passage Project.
  - FERC Relicensing for Middle Fork of the American River Project.
  - Lower Mokelumne River Spawning Habitat Improvement Project.
  - Dutch Slough Tidal Marsh Restoration.
  - Suisun Marsh Habitat Management, Preservation, and Restoration Plan Implementation.
  - Tidal Wetland Restoration in the Delta and Suisun Marsh.
  - San Joaquin River Restoration Program.
  - Stockton Deep Water Ship Channel Demonstration Dissolved Oxygen Project.
  - Grasslands Bypass Project.
  - Municipal Water Supply Projects identified in Urban Water Management Plans that have undergone environmental review and are reasonably foreseeable.
  - Water Transfer Projects.

ES.8.4 Alternative 1

Alternative 1 was created because many comments requested an alternative that reflected conditions without implementation of the 2008 USFWS BO and the 2009 NMFS BO RPAs. Since the Second Basis of Comparison is not a true alternative, in accordance with NEPA guidelines, Reclamation could not select Second Basis of Comparison as a preferred alternative. Therefore, Alternative 1 is identical to the Second Basis of Comparison.

ES.8.5 Alternative 2

Alternative 2 was first included in the Notice of Intent and identified as a "preliminary proposed action" that included the operational actions of the 2008 USFWS BO and 2009 NMFS BO. Alternative 2 includes all of the RPA actions except:

- 2009 NMFS BO RPA Action I.2.5, Winter-Run Passage and Re-Introduction Program at Shasta Dam.
- 2009 NMFS BO RPA Action II.3, Structural Improvements for Temperature Management on the American River.
- 2009 NMFS BO RPA Action II.5, Fish Passage at Nimbus and Folsom Dams.
- 2009 NMFS BO RPA Action II.6, Implement Actions to Reduce Genetic Effects of Nimbus and Trinity River Fish Hatchery Operations.
- 2009 NMFS BO RPA Action III.2.1, Increase and Improve Quality of Spawning Habitat with Addition of Gravel.
- 2009 NMFS BO RPA Action III.2.2, Conduct Floodplain Restoration and Inundation Flows in Winter or Spring to Inundate Steelhead Juvenile Rearing Habitat on Stanislaus River.
- 2009 NMFS BO RPA Action III.2.3, Restore Freshwater Migratory Habitat for Juvenile Steelhead on Stanislaus River.
- 2009 NMFS BO RPA Action III.2.4, Fish Passage at New Melones, Tulloch, and Goodwin Dams.
- 2009 NMFS BO RPA Action IV.4, Tracy Fish Collection Facility Improvements to Reduce Pre-Screen Loss and Improve Screening Efficiency.
- 2009 NMFS BO RPA Action IV.4.2 Skinner Fish Collection Facility Improvements to Reduce Pre-Screen Loss and Improve Screening Efficiency.
- 2009 NMFS BO RPA Action IV.4.3 Tracy Fish Collection Facility and the Skinner Fish Collection Facility Actions to Improve Salvage Monitoring, Reporting and Release Survival Rates.
- 2009 NMFS BO RPA Action V Fish Passage.

ES.8.6 Alternative 3

Alternative 3 was developed based upon a scoping comment from the Coalition for a Sustainable Delta, including actions related to their "RPA Alternative 1," and a scoping comment received from Oakdale Irrigation District (OID) and South San Joaquin Irrigation District (SSJID). The definition of Alternative 3 is based upon the following assumptions.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB; without the operational requirements of the 2008 USFWS BO and the 2009 NMFS BO RPAs.
- Implementation of the 2012 operations plan for New Melones Reservoir proposed by OID and SSJID.
- Additional demands for American River water supplies for up to 17,000 acre-feet/year under a Warren Act contract for El Dorado Irrigation District and 15,000 acre-feet/year under a water service contract for El Dorado County Water Agency.
- Implementation of actions described in the scoping comments letter from the Coalition for a Sustainable Delta related to their "RPA Alternative 1."
  - The Old and Middle River (OMR) flow criteria under Alternative 3 are based on concepts addressed in the 2008 USFWS BO and 2009 NMFS BO related to adaptive restrictions for temperature, turbidity, salinity, and presence of Delta Smelt.
  - Flood control operations for the New Melones Reservoir would be the same as under the No Action Alternative. However, New Melones Reservoir would be operated for different fishery flows, water quality flows, and San Joaquin River base flows and pulse flows at Vernalis.
  - Implement predator control programs for Black Bass, Striped Bass, and Pikeminnow to protect salmonids and Delta Smelt, including establishment of new catch limits.
  - Restore or create at least 10,000 acres of tidally influenced seasonal or perennial wetlands (these conditions are the same as under the No Action Alternative and Second Basis of Comparison).
  - Establish a trap and haul program for juvenile salmonids entering the Delta from the San Joaquin River upstream of the Head of Old River in March through June with a release site near Chipps Island.
  - Modify ocean harvest limits for consistency with Viable Salmonid Population Standards; including harvest management plan to show that abundance, productivity, and diversity (age-composition) are not appreciably reduced.
- Implementation of future actions that would occur by 2030 without implementation of any alternatives considered in this EIS, as described above for the Second Basis of Comparison.

ES.8.7 Alternative 4

Alternative 4 was developed based upon a scoping comment from the Coalition for a Sustainable Delta, including actions related to their "RPA Alternative 2." The definition of Alternative 4 is based upon the following assumptions.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB; without the operational requirements of the 2008 USFWS BO and the 2009 NMFS BO, as described under Second Basis of Comparison.
- Implementation of actions described in the scoping comments letter from the Coalition for a Sustainable Delta related to their "RPA Alternative 2."
  - Limit floodplain development to protect salmonids and Delta Smelt by incorporating guidance into flood hazard mapping to comply with ESA; prioritizing consideration of ESA listed species and critical habitats in flood insurance studies; refine community rating system to provide credits for natural and beneficial functions; prohibit new development and substantial improvements to existing development within any designated floodway or within 170 feet of the ordinary high water line of any floodway.
  - Modify the requirements of the U.S. Army Corps of Engineers related to removal of vegetation on levees to allow for the planting of trees and shrubs along the levees; and installation of vegetation, woody material, and root re-enforcement material on the levees instead of riprap for erosion protection.
  - Implement predator control programs for Black Bass, Striped Bass, and Pikeminnow to protect salmonids and Delta Smelt, including establishment of new catch limits.
  - Restore or create at least 10,000 acres of tidally influenced seasonal or perennial wetlands (these conditions are the same as under the No Action Alternative and Second Basis of Comparison).
  - Establish a trap and haul program for juvenile salmonids entering the Delta from the San Joaquin River upstream of the Head of Old River in March through June with a release site near Chipps Island.
  - Modify ocean harvest limits to reduce by-catch of winter-run and spring-run Chinook Salmon to less than 10 percent of age-3 cohort in all years.
- Implementation of future actions that would occur by 2030 without implementation of any alternatives considered in this EIS, as described above for the Second Basis of Comparison.

ES.8.8 Alternative 5

Alternative 5 was developed considering comments from environmental interest groups during the scoping process. Alternative 5 is similar to the No Action Alternative with reduced potential for reverse flows in April and May and with associated increased Delta outflow; and use of the SWRCB D-1641 pulse flow at Vernalis. The definition of Alternative 5 is based upon the following assumptions.

- Continued long-term operation of the CVP and SWP in accordance with ongoing management policies, criteria, and regulations, including water right permits and licenses issued by the SWRCB; including the requirements of the 2008 USFWS BO and the 2009 NMFS BO.
- The OMR flow criteria similar to the RPA criteria in the 2008 USFWS BO and 2009 NMFS BO plus a requirement for positive OMR (no reverse flows) in April and May of all water year types.
- New Melones Reservoir operations are similar to assumptions under the No Action Alternative except additional requirements were added to meet the SWRCB D-1641 April and May pulse flows at Vernalis on the San Joaquin River.
- Additional demands for American River water supplies for up to 17,000 acre-feet/year under a Warren Act Contract for El Dorado Irrigation District and 15,000 acre-feet/year under a Warren Act Contract for El Dorado County Water Agency.
- Implementation of future actions that would occur by 2030 without implementation of any alternatives considered in this EIS, as described above for the No Action Alternative.

ES.9 Impact Analysis

An EIS must evaluate the effects of implementation of the alternatives on the environment; and any adverse environmental effects which cannot be avoided, the relationship between short-term uses of the human environment and long-term productivity; and any irreversible or irretrievable commitments of resources if the alternatives are implemented. The impact analyses section of each resource chapter (Chapters 5 through 21) address direct, indirect, and cumulative effects of the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

An EIS must also identify relevant, reasonable mitigation measures that are not already included in the proposed action or alternatives to the proposed action that could be used to avoid, minimize, rectify, reduce, eliminate, or compensate for the project's adverse environmental effects. Mitigation measures are presented for each resource to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse environmental effects of Alternatives 1 through 5 as compared to the No Action Alternative. Mitigation measures were not included to address adverse impacts under the alternatives as compared to the Second Basis of Comparison because this analysis was included in this EIS for information purposes only.

Tables ES.1 and ES.2 present summaries of the environmental changes of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison, respectively. These tables are located at the end of this Executive Summary. The results of the impact analysis indicated that there were no changes in conditions for the following comparisons, and these items are not included in Table ES.1 and ES.2.

- Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison.
  - Geology and Soils Resources.
  - Agricultural Resources.
  - Land Use.
  - Cultural Resources.
  - Indian Trust Assets.
- Alternative 1 as compared to the Second Basis of Comparison (all resources).
- Alternative 2 as compared to the No Action Alternative.
  - All resources except for Fish and Aquatic Resources (due to the lack of fish passage actions).
- Alternative 4 as compared to the Second Basis of Comparison.
  - All resources except for Fish and Aquatic Resources, Terrestrial Resources, Recreation Resources, and Socioeconomics (due to the inclusion of predator control, Delta fish passage, floodplain management, and ocean harvest limits for sport and commercial salmon fishing actions).

ES.10 Public Involvement and Next Steps

In accordance with NEPA review requirements, this Draft EIS will be available for public and agency review and comment for a 60-day period. Written comments from the public, reviewing agencies, and stakeholders will be accepted during the public comment period. Similar to the approach to public scoping, public meetings will be held in various locations statewide. These meetings will be held during the public comment period to provide information about the Draft EIS to the attendees.

A Final EIS will be prepared and circulated in accordance with NEPA requirements. The Final EIS will include responses to all substantial comments. The Final EIS will also include a preferred alternative. Reclamation will make the Final EIS available for 30 days before finalizing the Record of Decision (ROD).

In the ROD, which is the final step in the NEPA process, Reclamation will document its decision on which actions, if any, to take to address the primary objectives. Reclamation will also describe other risk reduction plans it considered, identify any mitigation plans, and describe factors and comments taken into consideration when making its decision.

Table ES.1 Comparison of Alternatives 1 through 5 to the No Action Alternative

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Surface Water Resources and Water Supplies
Alternative 1: Surface Water Resources and Water Supplies	**Trinity Lake** In wet years and dry years, storage would be similar in all months. In above normal years, storage would be similar in January through October; and increased in November and December (up to 6.0 percent). In below normal years, storage would be similar in January through October; and increased in November and December (up to 5.2 percent). In critical dry years, storage would be increased in all months (up to 11.5 percent). In all months, in all water year types, surface water elevations would be similar. **Trinity River downstream of Lewiston Dam** Over long-term conditions, flows would be similar in March through November; and increased in December through February (up to 10.5 percent). In wet years, flows would be similar in April through November; and increased in December through March (up to 12.6 percent). In dry years, flows would be similar all months. **Shasta Lake** In wet years, storage would be similar in December through August and October; and increased in September and November (up to 8.9 percent). In above normal years, storage would be similar in January through September; and increased in October through December (up to 8.1 percent). In below normal years, storage would be similar in March through September; and increased in October through February (up to 11.7 percent). In dry years, storage would be similar in February through October; and increased in November through January (up to 6.5 percent). In critical dry years, storage would be increased under all months (up to 16.8 percent). In all months, in all water year types, surface water elevations would be similar. **Sacramento River at Keswick** Over long-term conditions, similar flows would occur in October, February through May, July, and August; reduced flows in September and November (up to 27.4 percent); and increased flows in December, January, and June (up to 8.4 percent). In wet years, similar flows would occur in January through July; reduced flows in September through November (up to 43.7 percent); and increased flows in December and August (up to 17.0 percent). In dry years, similar flows would occur in July through October, December through March, and May; reduced flows in November (25.0 percent); and increased flows in April and June (up to 7.8 percent). **Sacramento River at Freeport** Over long-term conditions, similar flows would occur in October, December through May, and August; reduced flows in September, November, and July (up to 30.2 percent); and increased flows in June (12.8 percent). In wet years, similar flows would occur in January through June and October; reduced flows in July through September and November (up to 47.4 percent); and increased flows in December (6.6 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	In dry years, similar flows would occur in August through October and December through April; reduced flows in November and July (up to 13.6 percent); and increased flows in May and June (up to 13.5 percent). **Lake Oroville** In wet years, storage would be similar in January through August; and reduced in September through December (up to 21.8 percent). In above normal years, storage would be similar in February through August; and reduced in September through January (up to 15.2 percent). In below normal years, storage would be similar in May through July; and reduced in August through April (up to 21.5 percent). In dry years, storage would be similar in June; and reduced in all other months (up to 14.2 percent). In critical dry years, storage would be similar under all months. In all months, in all water year types, surface water elevations would be similar. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in November and April; reduced flows in July through September (up to 43.2 percent); and increased flows in October, December through March, May, and June (up to 37.4 percent). In wet years, similar flows would occur in October, November, and March through May; reduced flows in July through September (up to 64.9 percent); and increased flows in December through February and June (up to 35.1 percent). In dry years, similar flows would occur in December through April; reduced flows in July (34.4 percent); and increased flows in August through October, May, and June (up to 38.1 percent). **Folsom Lake** In wet years, storage would be similar in December through August; and increased in September through December (up to 12.1 percent). In above normal years, storage would be similar in January through July and September through October; increased in November and December (up to 8.9 percent); and reduced in August (5.4 percent). In below normal years, storage would be similar in February through May; reduced in June through September (up to 14.6 percent); and increased in October through January (up to 13.5 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in October through June; and increased in July through September (up to 12.1 percent). In all months, in all water year types, surface water elevations would be similar. **American River downstream of Nimbus Dam** Over long-term conditions, similar flows would occur in November through May and July; reduced flows in September and October (up to 30.9 percent); and increased flows in June (5.4 percent). In wet years, similar flows would occur in October, November, and January through July; reduced flows in September (47.7 percent); and increased flows in August (12.0 percent). In dry years, similar flows would occur in November through January, March through June, August, and September; reduced flows in October (14.1 percent); and increased flows in February and July (up to 7.9 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Clear Creek downstream of Whiskeytown Dam Flows identical June through April; and reduced in May (40.7 percent). **New Melones Reservoir** In wet years, storage would be similar in all months. In above normal years, storage would be similar in December through September; and increased in October and November (up to 6.0 percent). In below normal years, storage would be similar in November through September; and increased in October (5.4 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in July through September; and increased in October through June (up to 7.5 percent). In all months, in all water year types, surface water elevations would be similar. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, similar flows would occur in July through September; reduced flows in October, March, and April (up to 59.8 percent); and increased flows in November through February and June (up to 51.1 percent). In wet years, similar flows would occur in February and April; reduced flows in October, March, May, July, and August (up to 53.9 percent); and increased flows in September, November through January, and June (up to 103.2 percent). In dry years, similar flows would occur in July through September; reduced flows in October and April (up to 60.7 percent); and increased flows in November through March, May, and June (up to 55.5 percent). **San Joaquin River at Vernalis** Over long-term conditions, similar flows would occur in July through September and November through May; reduced flows in October (16.1 percent); and increased flows in June (8.4 percent). In wet years, similar flows would occur in July through September and November through May; reduced flows in October (14.4 percent); and increased flows in June (10.4 percent). In dry years, similar flows would occur in November through March and May through September; and reduced flows in October and April (up to 15.3 percent). **San Luis Reservoir** In wet years, storage would be increased in all months (up to 108.8 percent). Water storage elevations would be increased in all months (up to 12.0 percent). In above normal years, storage would be increased in all months (up to 151.4 percent). Water storage elevations would be increased in all months (up to 15.0 percent). In below normal years, storage would be increased in all months (up to 203.1 percent). Water storage elevations would be increased in all months (up to 19.0 percent). In dry years, storage would be increased in all months (up to 70.3 percent). Water storage elevations would be increased in all months (up to 11.6 percent). In critical dry years, storage would be increased in all months (up to 57.1 percent). Water storage elevations would be increased in all months (up to 10.8 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Yolo Bypass In wet years, flows into Yolo Bypass would be similar in January through September; reduced in October (20 percent); and increased in November and December (up to 17.4 percent). In above normal years, flows into Yolo Bypass would be similar in April through December; and increased in January through March (up to 16.2 percent). In below normal years, flows into Yolo Bypass would be similar in April through November; and increased in December through March (up to 33.9 percent). In dry years, flows into Yolo Bypass would be similar in January through November; and increased in December (6.2 percent). In critical dry years, flows into Yolo Bypass would be similar in all months. **Delta Outflow** In wet years, average monthly Delta outflow would increase in December, February, March, and June (up to 1,492 cfs); and decrease in July through November, January, April, and May (up to 13,683 cfs). In dry years, average monthly Delta outflow would be similar in September; decrease in July, August, and October through May (up to 3,114 cfs); and increase in June (385 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, average monthly OMR flows, would be more positive in June through August and March (up to 923 cfs); and more negative in April through June and September through February (up to 10,005 cfs). In dry years, average monthly OMR flows would be positive in July (up to 2,073 cfs), and more negative in August through June (up to 3,489 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 1,051 TAF (22 percent) more under Alternative 1 as compared to the No Action Alternative. Deliveries to CVP North of Delta agricultural water service contractors would be increased by 19 percent over the long-term conditions; 45 percent in dry years; and 59 percent in critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar in total; however, deliveries to the American River CVP contractors would be increased by 7 percent over the long-term conditions; 9 percent in dry years; and 8 percent in critical dry years. Deliveries to CVP South of Delta agricultural water service contractors would be increased by 31 percent over the long-term conditions; 49 percent in dry years; and 60 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be increased by 11 percent over the long-term conditions; 10 percent in dry years; and 7 percent in critical dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and in dry and critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be increased by 22 percent over the long-term conditions; 22 percent in dry years; and 25 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be increased by 22 percent over the long-term conditions; 24 percent in dry years; and 28 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be reduced by 9 percent over the long-term conditions; 6 percent in dry years; and 9 percent in critical dry years.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Deliveries of Article 21 water to SWP South of Delta water contractors would be increased by 504 percent over the long-term conditions; 2,265 percent in dry years; and 1,219 percent in critical dry years.
Alternative 3: Surface Water Resources and Water Supplies	**Trinity Lake** In wet, above normal years, below normal, and dry years, storage would be similar in all months. In critical dry years, storage would be increased in all months (up to 11.9 percent). In all months, in all water year types, surface water elevations would be similar. **Trinity River downstream of Lewiston Dam** Over long-term conditions, flows would be similar in March through November; and increased in December through February (up to 11.8 percent). In wet years, flows would be similar in April through October; reduced in November (7.0 percent); and increased in December through March (up to 15.1 percent). In dry years, flows would be similar in all months. **Shasta Lake** In wet years, storage would be similar in December through August; and increased in September and November (up to 8.7 percent). In above normal years, storage would be similar in January through October; and increased in November and December (up to 7.1 percent). In below normal years, storage would be similar in March through September; and increased in October through February (up to 11.9 percent). In dry years, storage would be similar in March through October; and increased in November through January (up to 7.4 percent). In critical dry years, storage would increase in all months (up to 12.2 percent). In all months, in all water year types, surface water elevations would be similar. **Sacramento River at Keswick** Over long-term conditions, similar flows would occur in October, February through May, July, and August; reduced flows in September and November (up to 20.1 percent); and increased flows in December, January, and June (up to 8.9 percent). In wet years, similar flows would occur in February through August; reduced flows in September through November (up to 42.1 percent); and increased flows in December and January (up to 16.9 percent). In dry years, similar flows would occur in July through September and December through May; reduced flows in November (24.6 percent); and increased flows in January and June (up to 7.3 percent). **Sacramento River at Freeport** Over long-term conditions, similar flows would occur in October, December through May, July, and August; reduced flows in September and November (up to 30.1 percent); and increased flows in June (12.1 percent). In wet years, similar flows would occur in January through May, July, and October; reduced flows in August, September, and November (up to 48.1 percent); and increased flows in December and June (up to 6.6 percent). In dry years, similar flows would occur in July through October and December through April; reduced flows in November (14.2 percent); and increased flows in May and June (up to 15.7 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Lake Oroville In wet years, storage would be similar in January through August; and increased in September through December (up to 18.5 percent). In above normal years, storage would be similar in February through August; and increased in September through January (up to 18.5 percent). In below normal years, storage would be similar in June through September; and increased in October through May (up to 22.5 percent). In dry years, storage would be similar in May through September; and increased in October through April (up to 12.3 percent). In critical dry years, storage would be similar under all months. In all months, in all water year types, surface water elevations would be similar. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in October, November, March, April, and July; reduced flows in August and September (up to 49.4 percent); and increased flows in December through February, May, and June (up to 33.9 percent). In wet years, similar flows would occur in October, November, February through May, and July; reduced flows in August and September (up to 70.0 percent) and increased flows in December, January, and June (up to 28.1 percent). In dry years, similar flows would occur in September and January through April; reduced flows in October through December and July (up to 14.5 percent); and increased flows in May, June, and August (36.9 percent). **Folsom Lake** In wet years, storage would be similar in December through August; and increased in September through December (up to 12.1 percent). In above normal years, storage would be similar in January through June, September, and October; and increased in November and December (up to 6.3 percent); and reduced in July and August (up to 6.7 percent). In below normal years, storage would be similar in February through July; reduced in August and September (up to 10.0 percent); and increased in October through January (up to 15.0 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in October through July; and increased in August and September (up to 11.6 percent). In all months, in all water year types, surface water elevations would be similar. **American River downstream of Nimbus Dam** Over long-term conditions, similar flows would occur in November, January through May, July, and August; reduced flows in September and October (up to 28.7 percent); and increased flows in June (5.8 percent). In wet years, similar flows would occur in October, November, and January through July; reduced flows in September (45.9 percent); and increased flows in August and December (up to 8.5 percent). In dry years, similar flows would occur in November through January and March through September; reduced flows in October (11.2 percent); and increased flows in February (6.1 percent). **Clear Creek downstream of Whiskeytown Dam** Flows identical June through April; and reduced in May (28.9 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	New Melones Reservoir In wet years, storage would be increased in all months (up to 13.3 percent). In above normal years, storage would be increased in all months (up to 23.3 percent). In below normal years, storage would be increased in all months (up to 19.8 percent). In dry years, storage would be increased in all months (up to 25.3 percent). In critical dry years, storage would be increased in all months (up to 37.8 percent). In all months, in all water year types, surface water elevations would be similar. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, reduced flows would occur in October and March through June (up to 58.3 percent); and increased flows in November through February and July through September (up to 36.81 percent). In wet years, similar flows would occur in April; reduced flows in October, March, and May (up to 52.9 percent); and increased flows in June through September and November through February (up to 67.8 percent). In dry years, similar flows would occur in March and July through September; reduced flows in October and April through June (up to 59.6 percent); and increased flows in November through February (up to 37.0 percent). **San Joaquin River at Vernalis** Over long-term conditions, similar flows would occur in November through September; and reduced flows in October (15.7 percent). In wet years, similar flows would occur in November through August; reduced flows in October (14.1 percent); and increased flows in September (5.7 percent). In dry years, similar flows would occur in November through March and July through September; and reduced flows in October and April through June (up to 15.2 percent). **San Luis Reservoir** In wet years, storage would be increased in all months (up to 96.3 percent). Water storage elevations would be increased in all months (up to 13.0 percent). In above normal years, storage would be increased in all months (up to 111.4 percent). Water storage elevations would be similar in October through March; and increased in April through September (up to 11.3 percent). In below normal years, storage would be increased in all months (up to 106.9 percent). Water storage elevations would be similar in September; and increased in October through August (up to 10.7 percent). In dry years, storage would be similar in September; and increased in October through August (up to 52.1 percent). Water storage elevations would be similar December through May and July through October; and increased in November and June (up to 6.8 percent). In critical dry years, storage would be similar in February through May; and increased in June through January (up to 29.2 percent). Water storage elevations would be similar in all months. **Yolo Bypass** In wet years, flows into Yolo Bypass would be similar in January through September; reduced in October (24.5 percent); and increased in November and December (up to 15.1 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	In above normal years, storage would be similar in April through January; and increased in February and March (up to 11.7 percent). In below normal years, flows into Yolo Bypass would be similar in April through November; and increased in December through March (up to 32.0 percent). In dry years, flows into Yolo Bypass would be similar in January through November; and increased in December (6.0 percent). In critical dry years, flows into Yolo Bypass would be similar in all months. **Delta Outflow** In wet years, average monthly Delta outflow would increase in December through March (up to 3,307 cfs); and decrease in April through November (up to 13,678 cfs). In dry years, average monthly Delta outflow would increase January, February, June, and July (up to 277 cfs); and decrease in August through December and March through May (up to 2,902 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, average monthly OMR flows would be more positive in July and August (up to 800 cfs); and more negative in September through June (up to 4,477 cfs). In dry years, average monthly OMR flows would be more positive in July and January (up to 728 cfs), and more negative in August through December and February through June (up to 1,847 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 726 TAF (15 percent) more under Alternative 3 as compared to the No Action Alternative. Deliveries to CVP North of Delta agricultural water service contractors would be increased by 13 percent over the long-term conditions; 30 percent in dry and critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar in total; however, deliveries to the American River CVP contractors would be similar over the long-term conditions and critical dry years; and increased deliveries by 7 percent in dry years. Deliveries to CVP South of Delta agricultural water service contractors would be increased by 28 percent over the long-term conditions; 34 percent in dry years; and 28 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be similar in critical dry years; and increased by 9 percent over the long-term conditions and 8 percent in dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and dry years; and increased by 15 percent in critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be increased by 17 percent over the long-term conditions and in dry years; and 13 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be increased by 17 percent over the long-term conditions and in dry years; and 14 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be increased by 128 percent over the long-term conditions; 384 percent in dry years; and 214 percent in critical dry years.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
Alternative 4: Surface Water Resources and Water Supplies	Same effects as described for Alternative 1 compared to the No Action Alternative.
Alternative 5: Surface Water Resources and Water Supplies	**Trinity Lake** Similar storage and surface water elevations in all months and all water year types. **Trinity River downstream of Lewiston Dam** Similar flows in all months for long-term conditions and wet and dry years. **Shasta Lake** Similar storage and surface water elevations in all months and all water year types. **Sacramento River at Keswick** Similar flows in all months for long-term conditions and wet and dry years. **Sacramento River at Freeport** Similar flows in all months for long-term conditions and wet and dry years. **Lake Oroville** Similar storage and surface water elevations in all months and all water year types. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in June through April; and reduced flows in May (6.6 percent). In wet years, similar flows would occur in all months. In dry years, similar flows would occur in September through April and June; reduced flows in May (27.1 percent); and increased flows in July and August (up to 8.9 percent). **Folsom Lake** Similar storage and surface water elevations in all months and all water year types. **American River downstream of Nimbus Dam** Similar flows in all months for long-term conditions and wet and dry years. **Clear Creek downstream of Whiskeytown Dam** Flows would be identical in all months. **New Melones Reservoir** In wet years, storage would be similar in all months. In above normal years, storage would be similar in October through June; and reduced in July through September (up to 5.7 percent). In below normal years, storage would be reduced in all months (up to 9.2 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	In dry years, storage would be reduced in all months (up to 10.2 percent). In critical dry years, storage would be reduced in all months (up to 18.9 percent). In all months, in all water year types, surface water elevations would be similar. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, flows would be similar in September through February and June; reduced flows would occur in March, July, and August (up to 8.0 percent); and increased flows in April and May (up to 22.4 percent). In wet years, similar flows would occur in October, November, January, February, and April through June; reduced flows in December, March, and July through September (up to 18.0 percent). In dry years, similar flows would occur in June through March; and increased flows in April and May (up to 47.3 percent). **San Joaquin River at Vernalis** Over long-term conditions and wet years, similar flows would occur in all months. In dry years, similar flows would occur in June through March; and increased flows in April and May (up to 15.7 percent).San Luis Reservoir **San Luis Reservoir** In wet years, storage would be similar in January through May; and increased in June through December (up to 10.0 percent). In above normal years, storage would be similar in all months. In below normal years, storage would be similar in November, February through April, August, and September; reduced in June and July (up to 9.2 percent); and increased in October, December, January, and May (up to 8.3 percent). In dry years, storage would be similar in October through March; and reduced in April through September (up to 17.3 percent). In critical dry years, storage would be similar in February and March; and reduced in April through January (up to 18.2 percent). Surface water elevations would be similar in all months, in all water years. **Yolo Bypass** Similar flows into the Yolo Bypass in all months and all water year types. **Delta Outflow** In wet years, average monthly Delta outflow would be similar. In dry years, average monthly Delta outflow would be similar in July through April; and increased in May and June (up to 1,377 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, OMR flows would be more positive or no change in September, October, January, and April through June (up to 171 cfs); and more negative in November, December, March, and August (up to 124 cfs). In dry years, OMR flows would be more positive or no change in October through March (up to 1,359 cfs); and more negative in June through September (up to 568 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 45 TAF (1 percent) less under Alternative 5 as compared to the No Action Alternative.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Deliveries to CVP North of Delta agricultural water service contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar over the long-term conditions and in dry and critical dry years in total and for the American River CVP contractors. Deliveries to CVP South of Delta agricultural water service contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries to CVP South of Delta M&I contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and dry years; and reduced by 7.7 percent in critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be reduced by 8 percent over the long-term conditions and 41 percent in critical dry years; and increased by 12 percent in dry years.
	Surface Water Quality
Alternative 1: Surface Water Quality	Salinity increases near Emmaton in June (5 to 41 percent depending upon water year type); decreases in July through March (5 to 79 percent); and is similar in April and May. Salinity increases near CVP and SWP, Contra Costa Water District, and Antioch (5 to over 47 percent) in February through August; and is similar or decreases (5 to over 39 percent) in September through January. Salinity decreases near Port Chicago in September through May (5 to 33 percent); and is similar in June through August. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.
Alternative 3: Surface Water Quality	Salinity decreases near Emmaton in September through January (5 to 68 percent); and is similar in February through August. Salinity increases CVP and SWP, Contra Costa Water District, and Antioch intakes (5 to over 50 percent) in February through June; and is similar or decreases (5 to over 30 percent) in July through January. Salinity decreases near Port Chicago in September through June (5 to 34 percent); and is similar in July and August. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near San Joaquin River at Antioch and Montezuma Slough over the long-term conditions. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.
Alternative 4: Surface Water Quality	Same effects as described for Alternative 1 compared to the No Action Alternative.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
Alternative 5: Surface Water Quality	Salinity near Emmaton is similar in all months. Salinity decreases near the CVP and SWP, Contra Costa Water District, and Antioch intakes (5 to over 29 percent) in April through June; and is similar in July through February. Salinity near Port Chicago is similar in all months. Similar mercury concentrations in Largemouth Bass throughout the Delta. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.
	Groundwater Resources
Alternative 1: Groundwater Resources	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Region** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping in the San Joaquin Valley would decrease by approximately 8 percent. July groundwater levels in all water year types would be higher by approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 50 feet in the Delta-Mendota, Tulare Lake, and Kern County subbasins; and 100 to over 500 feet in the Westside subbasin. The higher groundwater levels would reduce the potential for land subsidence. Groundwater quality in the San Joaquin Valley Groundwater Basin could decline. **San Francisco Bay Area, Central Coast, and Southern California Regions** Increases in CVP and SWP water supplies, could decrease groundwater pumping and decrease the potential for land subsidence.
Alternative 3: Groundwater Resources	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Region** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping in the San Joaquin Valley would decrease by approximately 6 percent. July groundwater levels in all water year types would be higher by approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 50 feet in the Delta-Mendota, Tulare Lake, and Kern County subbasins; and 100 to over 500 feet in the Westside subbasin. The higher groundwater levels would reduce the potential for land subsidence. Groundwater quality in the San Joaquin Valley Groundwater Basin could decline. **San Francisco Bay Area, Central Coast, and Southern California Regions** Increases in CVP and SWP water supplies, could decrease groundwater pumping and decrease the potential for land subsidence.
Alternative 4: Groundwater Resources	Same effects as described for Alternative 1 compared to the No Action Alternative.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
Alternative 5: Groundwater Resources	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Regions** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping, levels, and quality in the San Joaquin Valley would be similar. July groundwater levels in all water year types would decline approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; and 25 to 50 feet in the Westside subbasin. **San Francisco Bay Area, Central Coast, and Southern California Regions** Because the CVP and SWP water deliveries would be similar; groundwater pumping would be similar the potential for land subsidence would be similar.
	Energy Resources
Alternative 1: Energy Resources	CVP annual net generation would be similar. SWP annual net generation would be increased by 41 percent over the long-term condition; and by 58 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to decrease.
Alternative 3: Energy Resources	CVP annual net generation would be similar. SWP annual net generation would be increased by 27 percent over the long-term condition; and by 16 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to decrease.
Alternative 4: Energy Resources	Same effects as described for Alternative 1 compared to the No Action Alternative.
Alternative 5: Energy Resources	CVP and SWP annual net generation would be similar. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to be similar.
	Fish and Aquatic Resources
Alternative 1: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon Overall, the temperature model outputs for each of the Coho Salmon life stages suggest that the temperature of water released at Lewiston Dam generally would be similar under both scenarios, although the exceedance of water temperature thresholds would be slightly less frequent (1 percent). The higher water temperatures in November of critical dry years (and lower temperatures in December) would likely have little effect on Coho Salmon as water temperatures in the Trinity River are typically low during this time period. Given the similarity of the results and the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), likely to result in similar effects.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	<u>Spring-run Chinook Salmon</u> Although the water temperatures could adversely affect spring-run Chinook Salmon in the Trinity River, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences water temperatures as compared to the No Action Alternative. Overall, is likely to result in similar effects. <u>Fall-run Chinook Salmon</u> Water temperature changes, not likely have adverse effects because changes would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures (as well as egg mortality). Overall, likely to have similar effects. <u>Steelhead</u> Water temperature changes would not likely have adverse effects because these changes would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures. Overall, likely to have similar effects. <u>Green Sturgeon</u> Overall, given the similarities between average monthly water temperatures at Lewiston Dam, it is likely that temperature conditions for Green Sturgeon in the Trinity River or lower Klamath River and estuary would be similar. <u>Reservoir Fishes</u> Overall, the comparison of storage and the analysis of nesting suggest that effects would be similar. <u>Pacific Lamprey</u> On average, the temperature of water released at Lewiston Dam generally would be similar. Given the similarities in temperature, it is likely that the effects on Pacific Lamprey would be similar. This conclusion likely applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). <u>Eulachon</u> Given that the highest increases in flow under would be less than 10 percent in the Trinity River with a smaller relative change in the lower Klamath River and Klamath River estuary, and that water temperatures in the Klamath River are unlikely to be affected by changes upstream at Lewiston Dam, is the changes are likely to have a similar effect to influence Eulachon in the Klamath River. **Sacramento River System** <u>Winter-run Chinook Salmon</u> Effects on winter-run Chinook Salmon would be similar, with a small likelihood that winter-run Chinook Salmon escapement would be lower. This potential distinction may become more adverse due to the lack of fish passage. <u>Spring-run Chinook Salmon</u> The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly more adverse with a small likelihood that spring-run Chinook Salmon production would be higher. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. <u>Fall-run Chinook Salmon</u> The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly less adverse with a small likelihood that fall-run Chinook Salmon production would be higher. This potential distinction may become more adverse by the lack of without fish passage.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Late Fall-run Chinook Salmon The output from SALMOD indicated that late fall-run Chinook Salmon production would be similar, although production could be slightly lower in some water year types and about 4 percent higher in critical dry years. The analyses attempting to assess the effects on routing, entrainment, and salvage of juvenile salmonids in the Delta suggest that salvage (as an indicator of potential losses of juvenile salmon at the export facilities) of Sacramento River-origin Chinook Salmon is predicted to be higher in every month. Although survival in the Delta may be lower, given the similarity in the SALMOD outputs, it is likely that the effects on fall-run Chinook Salmon would be similar. Effects may become more adverse due to the lack of without fish passage. Steelhead The model results suggest that overall, effects on steelhead could be slightly less adverse, particularly in the Feather River. This potential distinction may become more adverse due to the lack of fish passage. Green Sturgeon The temperature model outputs for the Sacramento and Feather rivers suggest that thermal conditions and effects on Green Sturgeon in the Sacramento and Feather rivers generally would be slightly less adverse. This conclusion is supported by the water temperature threshold exceedance analysis that indicated that the water temperature thresholds for Green Sturgeon spawning, incubation, and rearing would be exceeded less frequently under Alternative 1 in the Sacramento River. The water temperature threshold for Green Sturgeon spawning, incubation, and rearing would also be exceeded less frequently during some months in the Feather River, but would be exceeded more frequently in September. Given the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the reduced frequency of exceedance of temperature thresholds could benefit Green Sturgeon in the Sacramento and Feather rivers. White Sturgeon Overall, the temperature model outputs suggest that thermal conditions and effects on White Sturgeon in the Sacramento River generally would be slightly less adverse. This conclusion is supported by the water temperature threshold exceedance analysis that indicated that the water temperature thresholds for White Sturgeon spawning, incubation, and rearing would be exceeded less frequently in the Sacramento River. Given the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the reduced frequency of exceedance of temperature thresholds could benefit White Sturgeon in the Sacramento River. Delta Smelt Overall, Alt likely would result in increased adverse effects on Delta Smelt primarily due to the potential for increased percentage entrainment during larval and juvenile life stages, and less favorable location of Fall X2 in wetter years, and on average. Longfin Smelt Overall, based on the increase in frequency and magnitude of negative OMR flows and the lower Longfin Smelt abundance index values, especially in dry and critical dry years, potential adverse effects on the Longfin Smelt population likely would be greater. Sacramento Splittail Slight increase in spawning habitat for Sacramento Splittail as a result of the increased area of potential habitat (inundation) and the potential for a slight increase in the frequency of inundation.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Reservoir Fishes The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar to or slightly lower. This suggests that conditions in the reservoirs would be less likely to support self-sustaining populations of black bass. Pacific Lamprey Based on the somewhat increased flows and reduced temperatures during their spawning and incubation period, it likely that conditions for and effects on Pacific Lamprey in the Sacramento, Feather, and American rivers would not differ in a biologically meaningful manner. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey). Striped Bass, American Shad, and Hardhead In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Based on the slightly increased flows and decreased temperatures during their spawning and incubation period, it is likely that conditions for and effects on Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers would not differ in a biologically meaningful manner. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon Given the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the differences in the frequency of exceedance of suitable temperatures for spawning and rearing could affect the potential for adverse effects on the fall-run Chinook Salmon populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain. This potential distinction may become more adverse due to the lack of fish passage. Steelhead Given the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the differences in the magnitude and frequency of exceedance of suitable temperatures for the various lifestages could affect the potential for adverse effects on the steelhead populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain. This potential distinction may become more adverse due to lack of fish passage. White Sturgeon While flows in the San Joaquin River upstream of the Stanislaus River are expected be similar, flow contributions from the Stanislaus River could influence water temperatures in the San Joaquin River where White Sturgeon eggs or larvae may occur during the spring and early summer. The magnitude of influence on water temperature would depend on the proportional flow contribution of the Stanislaus River and the temperatures in both the Stanislaus and San Joaquin rivers. The potential for an effect on White Sturgeon eggs and larvae would be influenced by the proportion of the population occurring in the San Joaquin River. In consideration of this uncertainty, it is not possible to distinguish potential effects on White Sturgeon between alternatives. Reservoir Fishes Overall, predicted nest survival is generally above 40 percent in all months evaluated, although survival would vary among months. Given the relatively high survival in general and the uncertainty caused by the inconsistency in changes in survival, it is likely that effects would be similar under both alternatives. Other Species In general, lamprey species can tolerate higher temperatures than salmonids, up to around 72°F during their entire life history. Because lamprey ammocoetes remain in the river for several years, any substantial flow reductions or temperature increases could adversely affect these larval lamprey.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Given the similar flows and temperatures during their spawning and incubation period, it is likely that the potential to affect lamprey species in the Stanislaus and San Joaquin rivers would be similar. In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the similar flows and temperatures during their spawning and incubation period, it is likely that the potential to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be similar. **Pacific Ocean** Killer Whale Given conclusions from NMFS (2009c), and the fact that at least 75 percent of fall-run Chinook Salmon available for Southern Residents are produced by Central Valley hatcheries, it is likely that Central Valley fall-run Chinook Salmon as a prey base for killer whales would not be appreciably affected.
Alternative 2: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon, spring-run and fall-run Chinook Salmon, steelhead, Green Sturgeon, Reservoir Fishes, Pacific Lamprey, River Lamprey, and Eulachon Similar effects. **Sacramento River System** Winter-run, spring-run, fall-run, and late fall-run Chinook Salmon, and steelhead The effects may become more adverse due to the lack of fish passage. Green Sturgeon, White Sturgeon, Delta Smelt, Longfin Smelt, Sacramento Splittail, Reservoir Fishes, Pacific Lamprey, River Lamprey, Striped Bass, American Shad, and Hardhead Similar effects **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon and Steelhead The effects may become more adverse due to the lack of fish passage. White Sturgeon, Reservoir Fishes, and Other Species Similar effects. **Pacific Ocean** Killer Whale Similar effects.
Alternative 3: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon and Spring-run Chinook Salmon Although the water temperature and flow changes could have slight beneficial effects, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures. Overall, likely to result in similar effects on the spring-run Chinook Salmon population in the Trinity River.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	<u>Fall-run-run Chinook Salmon</u> Although the water temperature and flow changes suggest a lower potential for adverse effects on fall-run Chinook Salmon in the Trinity River, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures (as well as egg mortality). Overall, likely to have similar effects. <u>Steelhead</u> Although water temperatures suggest a slightly lower potential for adverse effects on steelhead in the Trinity River, the relatively small differences in flows and water temperatures under would likely result in similar effects on the steelhead population. <u>Green Sturgeon</u> Given the similarities between average monthly water temperatures at Lewiston Dam, it is likely that temperature conditions for Green Sturgeon in the Trinity River or lower Klamath River and estuary would be similar. <u>Reservoir Fishes</u> Overall, while reservoir storage and nest survival would be slightly higher, it is uncertain whether these differences would be biologically meaningful. Thus, it is likely that effects on black bass would be similar. <u>Pacific Lamprey</u> Overall, it is likely that effects on Pacific Lamprey would be similar. This conclusion likely also applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). <u>Eulachon</u> Given that the highest increases in flow would be less than 10 percent in the Trinity River, with a smaller relative increase in the lower Klamath River and Klamath River estuary, and that water temperatures in the Klamath River would unlikely to be affected by changes upstream at Lewiston Dam, it is likely that effects would have a similar potential to influence Eulachon in the Klamath River. **Sacramento River System** <u>Winter-run Chinook Salmon</u> Potentially more adverse due to lack of fish passage, The predator control measures could reduce winter-run Chinook Salmon mortality. <u>Spring-run Chinook Salmon</u> The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly less adverse with a small likelihood that spring-run Chinook Salmon production would be higher. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. The ocean harvest restriction component and predator control measures could reduce spring-run Chinook Salmon mortality. Overall, given the small differences between Alternative 3 and the No Action Alternative conditions and the uncertainty regarding the non-operational components, distinguishing a clear difference is not possible. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Fall-run-run Chinook Salmon The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly less adverse with a small likelihood that fall-run Chinook Salmon production would be higher. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. The ocean harvest restriction component and predator control measures could reduce fall-run Chinook Salmon mortality. Overall, given the small differences between Alternative 3 and the No Action Alternative conditions and the uncertainty regarding the non-operational components, distinguishing a clear difference is not possible. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. Late Fall-run-run Chinook Salmon It is likely that the effects on late fall-run Chinook Salmon would be similar. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. The ocean harvest restriction component and predator control measures could reduce late fall-run Chinook Salmon mortality. Overall, given the small differences between Alternative 3 and the No Action Alternative conditions and the uncertainty regarding the non-operational components, distinguishing a clear difference is not possible. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. Steelhead The model results suggest that overall, effects on steelhead could be slightly less adverse, particularly in the Feather River. This potential distinction may be partially offset and become more adverse by the lack of the benefits of implementation of fish passage. The ocean harvest restriction component and predator control measures could reduce steelhead mortality. Overall, given the small differences between Alternative 3 and the No Action Alternative conditions and the uncertainty regarding the non-operational components, distinguishing a clear difference is not possible. Green Sturgeon Given the general similarity in results and inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), the effects likely would be similar. White Sturgeon Given the general similarity in results and the inherent uncertainty associated with the resolution of the temperature model, the effects likely would be similar. Delta Smelt Overall, likely would result in adverse effects, primarily due to increased percentage entrainment during larval and juvenile life stages, and less favorable location of Fall X2 in wetter years, and on average. Longfin Smelt Overall, based on the increase in frequency and magnitude of negative OMR flows and the lower Longfin Smelt abundance index values, potential adverse effects likely would be greater.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	<u>Sacramento Splittail</u> Flows entering the Yolo Bypass generally would be somewhat higher, especially during below normal years in December through March. These increases would occur during periods of relatively low flow in the bypass, and could slightly increase the frequency of potential inundation. This could provide somewhat greater value to Sacramento Splittail because of the increased area of potential habitat (inundation) and the potential for a slight increase in the frequency of inundation. <u>Reservoir Fishes</u> The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar to or slightly lower. This suggests that conditions in the reservoirs could be less likely to support self-sustaining populations of black bass. However, it is uncertain whether this effect would be biologically meaningful. Thus, it is likely that effects on black bass would be similar. <u>Pacific Lamprey</u> Pacific Lamprey would be subjected to the same temperature conditions described above for salmonids. Based on the somewhat increased flows and slightly decreased temperatures during their spawning and incubation period, it is likely that Alternative 3 would have a slightly lower potential to adversely affect Pacific Lamprey in the Sacramento, Feather, and American rivers. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey). <u>Other Species</u> Changes in average monthly water temperature would be small. In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Given the somewhat increased flows and decreased water temperatures during their spawning and incubation period, it is likely to have a lower potential to adversely affect Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers. Predation controls related to Striped Bass would result in adverse effects. **Stanislaus River/Lower San Joaquin River** <u>Fall-run-run Chinook Salmon</u> Overall, likely would have slightly beneficial effects on the fall-run Chinook Salmon population in the San Joaquin River watershed. Beneficial effects to juvenile fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions under would benefit fall-run Chinook Salmon. <u>Steelhead</u> Given the frequency of exceedance under both Alternative 3 and the No Action Alternative, water temperature conditions for steelhead in the Stanislaus River would be generally stressful in the fall, late spring, and summer months. The differences in temperature exceedance (both positive and negative) would be relatively small, with no clear benefit. However, because Alternative 3 generally would exceed thresholds less frequently during the warmest months, slightly improved conditions. This potential distinction may become more adverse due to the lack of fish passage. Additional beneficial effects to juvenile steelhead as a result of trap and haul passage across through the Delta. It remains uncertain, however, if predator management actions would benefit steelhead. <u>White Sturgeon</u> While flows in the San Joaquin River upstream of the Stanislaus River are expected be similar, flow contributions from the Stanislaus River could influence water temperatures in the San Joaquin River where White Sturgeon eggs or larvae may occur during the spring and early summer. The magnitude of

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	influence on water temperature would depend on the proportional flow contribution of the Stanislaus River and the temperatures in both the Stanislaus and San Joaquin rivers. The potential for an effect on White Sturgeon eggs and larvae would be influenced by the proportion of the population occurring in the San Joaquin River. In consideration of this uncertainty, it is not possible to distinguish potential effects on White Sturgeon. Reservoir Fishes While the analyses suggest that the effects could be more adverse, it is uncertain whether these differences would be biological meaningful. Therefore, it is likely that the effects on black basses in New Melones Reservoir would be similar. Other Species In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the slightly lower flows and temperatures during their spawning and incubation period, it is likely that the potential effects to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be somewhat more adverse. Predation controls related to Striped Bass would result in adverse effects. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected. Beneficial effects due to benefits to fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the fall-run Chinook Salmon population.
Alternative 4: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon, spring-run and fall-run Chinook Salmon, steelhead, Green Sturgeon, Reservoir Fishes, Pacific Lamprey, River Lamprey, and Eulachon The effects are identical as described under Alternative 1 as compared to the No Action Alternative. **Sacramento River System** Winter-run, spring-run, fall-run, and late fall-run Chinook Salmon, and steelhead The effects in the Sacramento River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Beneficial effects to Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the Chinook Salmon population. Green Sturgeon, White Sturgeon, Delta Smelt, Longfin Smelt, Sacramento Splittail, Reservoir Fishes, Pacific Lamprey, River Lamprey, American Shad, and Hardhead The effects in the Sacramento River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Striped Bass The effects in the Sacramento River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Predation controls related to Striped Bass would result in adverse effects.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Stanislaus River/Lower San Joaquin River Fall-run Chinook Salmon and Steelhead The effects in the Stanislaus River/Lower San Joaquin River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Beneficial effects to Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the Chinook Salmon population. White Sturgeon, Reservoir Fishes, and Other Species The effects in the Stanislaus River/Lower San Joaquin River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Striped Bass The effects in the Stanislaus River/Lower San Joaquin River system would be similar as described under Alternative 1 as compared to the No Action Alternative. Predation controls related to Striped Bass would result in adverse effects. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected. Beneficial effects due to benefits to fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the fall-run Chinook Salmon population.
Alternative 5: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon, Spring-run Chinook Salmon, Fall-run Chinook Salmon, Steelhead, and Green Sturgeon Effects would be similar. Reservoir Fishes Effects would be similar. Pacific Lamprey Effects would be similar. Eulachon Effects would be similar. **Sacramento River System** Winter-run Chinook Salmon, Spring-run Chinook Salmon, Fall-run Chinook Salmon, Late Fall-run Chinook Salmon, Steelhead, Green Sturgeon, and White Sturgeon Effects would be similar.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Delta Smelt, Longfin Smelt, and Sacramento Splittail Effects would be similar. Reservoir Fishes Effects would be similar. Pacific Lamprey and Other Species Effects would be similar. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon and Steelhead The analysis of temperatures indicates somewhat higher temperatures and a higher likelihood of exceedance of suitable temperatures for spawning, and lower likelihood of exceeding suitable temperature for rearing of fall-run Chinook Salmon. The effect of higher temperatures is reflected in the slightly higher overall mortality of fall-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model for fall-run Chinook Salmon in the Stanislaus River. The frequency of exceedance of temperature thresholds for steelhead smoltification and rearing would be more stressful. However, with higher flows in April and May and lower temperatures in April and May could benefit steelhead spawning. Fish passage would reduce the temperatures effects. White Sturgeon While flows in the San Joaquin River upstream of the Stanislaus River are expected be similar, flow contributions from the Stanislaus River could influence water temperatures in the San Joaquin River where White Sturgeon eggs or larvae may occur during the spring and early summer. The magnitude of influence on water temperature would depend on the proportional flow contribution of the Stanislaus River and the temperatures in both the Stanislaus and San Joaquin rivers. The potential for an effect on White Sturgeon eggs and larvae would be influenced by the proportion of the population occurring in the San Joaquin River. In consideration of this uncertainty, it is not possible to distinguish potential effects on White Sturgeon. Reservoir Fishes While the analyses suggest that the effects could be more adverse, it is uncertain whether these differences would be biological meaningful. Therefore, it is likely that the effects on black basses in New Melones Reservoir would be similar. Other Species Given the similar or higher flows and similar or higher temperatures during their spawning and incubation period, it is likely that the potential to affect lamprey species in the Stanislaus and San Joaquin rivers would be greater. Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the similar or higher flows and temperatures during their spawning and incubation period, it is likely that the potential effects to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be somewhat more adverse. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Terrestrial Biological Resources
Alternative 1: Terrestrial Resources	Similar or increased flows along Trinity, Sacramento, American, and Feather rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Stanislaus River in the spring; therefore, could be reduced terrestrial habitat conditions. Reduced floodplain habitat along lower Clear Creek. Similar terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Increased salt water habitat in the western Delta in the fall months of wet and above normal water years could adversely affect species that have acclimated to freshwater conditions.
Alternative 3: Terrestrial Resources	Similar or increased flows along Trinity, Sacramento, American, and Feather rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Stanislaus River in the spring; therefore, could be reduced terrestrial habitat conditions. Reduced floodplain habitat along lower Clear Creek. Similar or improved terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Increased salt water habitat in the western Delta in the fall months of wet and above normal water years could adversely affect species that have acclimated to freshwater conditions.
Alternative 4: Terrestrial Resources	Same effects as described for Alternative 1 compared to the No Action Alternative; except for increased terrestrial vegetation along the riparian corridors related to recruitment of riparian vegetation.
Alternative 5: Terrestrial Resources	Similar flows along Trinity, Sacramento, American, and Feather rivers in the spring to support riparian terrestrial habitat. Increased flows along the Stanislaus River in the spring; therefore, could be improved terrestrial habitat conditions. Similar floodplain habitat along lower Clear Creek. Similar terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Similar freshwater and salt water habitats.
	Visual Resources
Alternative 1: Visual Resources	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Visual resources would be increased by 6 percent in wet and critical dry years at San Luis Reservoir, by 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern California regions.
Alternative 3: Visual Resources	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Visual resources would be increased by 8 percent in wet years and 6 percent in above normal years at San Luis Reservoir, by 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions.
Alternative 4: Visual Resources	Same effects as described for Alternative 1 compared to the No Action Alternative.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
Alternative 5: Visual Resources	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, San Luis Reservoir, and other reservoirs that store CVP and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions.
	Recreation Resources
Alternative 1: Recreation Resources	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Recreational resources would be increased by 6 percent in wet and critical dry years at San Luis Reservoir, by 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern California regions. Recreational resources similar on Trinity River; improved on the Sacramento River downstream of Keswick Dam; and both improved and reduced on the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, American River downstream of Nimbus Dam, and the Stanislaus River downstream of Goodwin Dam depending upon the month.
Alternative 3: Recreation Resources	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Recreational resources would be increased by 8 percent in wet years and 6 percent in above normal years at San Luis Reservoir, by 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions. Recreational resources similar on Trinity River, Sacramento River downstream of Keswick Dam, and American River downstream of Nimbus Dam; and both improved and reduced on the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, and the Stanislaus River downstream of Goodwin Dam depending upon the month. Recreational opportunities related to Striped Bass fishing would be reduced.
Alternative 4: Recreation Resources	Reservoir and flow-related recreational opportunities would be as described for Alternative 1 compared to the No Action Alternative. Recreational opportunities related to Striped Bass fishing would be reduced.
Alternative 5: Recreation Resources	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, San Luis Reservoir, and other reservoirs that store CVP and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions. Recreational resources similar or improved on Trinity, Sacramento, and American rivers; and both improved and reduced on the Feather and Stanislaus rivers.
	Air Quality and Greenhouse Gas Emissions
Alternative 1: Air Quality	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern California regions.
Alternative 3: Air Quality	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 6 percent in the Central Valley, 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
Alternative 4: Air Quality	Same effects as described for Alternative 1 compared to the No Action Alternative.
Alternative 5: Air Quality	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions.
	Public Health
Alternative 1: Public Health	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir; and a 7 percent increase at San Luis Reservoir. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.
Alternative 3: Public Health	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near San Joaquin River at Antioch and Montezuma Slough over the long-term conditions.
Alternative 4: Public Health	Same effects as described for Alternative 1 compared to the No Action Alternative.
Alternative 5: Public Health	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir. Similar mercury concentrations in Largemouth Bass throughout the Delta.
	Socioeconomics
Alternative 1: Socioeconomics	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar (within 5 percent of existing values). M&I water supply costs would decrease by 10 percent in the Sacramento Valley and increase by 14 percent in the San Joaquin Valley. Recreational economic factors would increase related to use of San Luis Reservoir. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 30 percent. Recreational economic factors would increase related to use of reservoirs that store CVP and SWP water.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Central Coast Region M&I water-related employment would be similar. M&I water supply costs would increase by 6 percent. Recreational economic factors would increase related to use of reservoirs that store SWP water. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 14 percent. Recreational economic factors would increase related to use of reservoirs that store SWP water.
Alternative 3: Socioeconomics	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would increase by 6 percent in the Sacramento Valley and by 21 percent in the San Joaquin Valley. Recreational economic factors related to Striped Bass would be reduced. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 21 percent. Recreational economic factors would increase related to use of reservoirs that store CVP and SWP water. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would increase related to use of reservoirs that store SWP water. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 14 percent. Recreational economic factors would be similar.
Alternative 4: Socioeconomics	Same effects as described for Alternative 1 compared to the No Action Alternative for non-recreational economic factors. Reduced recreational economic factors related to Striped Bass fishing.
Alternative 5: Socioeconomics	**Trinity River Region** Similar conditions.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
	Central Valley Region Agricultural and M&I water-related employment would be similar. M&I water supply costs would be similar in the Sacramento and San Joaquin valleys. Recreational economic factors would be similar. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would be similar. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would be similar. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would be similar.
	Environmental Justice
Alternative 1: Environmental Justice	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 11 to 21 percent in the San Francisco Bay Area Region, and by 21 percent in the Central Coast and Southern California regions. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.
Alternative 3: Environmental Justice	Decrease potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 6 percent in the Central Valley, 9 to 17 percent in the San Francisco Bay Area Region, and by 17 percent in the Central Coast and Southern California regions. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 6 percent decrease near San Joaquin River at Antioch and Montezuma Slough over the long-term conditions.
Alternative 4: Environmental Justice	Same effects as described for Alternative 1 compared to the No Action Alternative.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the No Action Alternative
Alternative 5: Environmental Justice	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions. Similar mercury concentrations in Largemouth Bass throughout the Delta.

1 **Table ES.2 Comparison of No Action Alternative and Alternatives 1 through 5 to the Second Basis of Comparison**

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Surface Water Resources and Water Supplies
No Action Alternative: Surface Water Resources and Water Supplies	**Trinity Lake** In wet years, below normal, and dry years, storage would be similar in all months. In above normal years, storage would be similar in January through October; and less in November and December (up to 5.7 percent). In critical dry years, storage would be less in all months (up to 10.3 percent). In all months, in all water year types, surface water elevations would be similar. **Trinity River downstream of Lewiston Dam** Over long-term conditions (over the 82-year analysis period), flows would be similar in March through November; and reduced in December through February (up to 9.5 percent). In wet years, flows would be similar in April through November; and reduced in December through March (up to 11.2 percent). In dry years, flows would be similar all months. **Shasta Lake** In wet years, storage would be similar in October and December through August; and reduced in September and November (up to 8.2 percent). In above normal years, storage would be similar in January through September; and reduced in October through December (up to 7.5 percent). In below normal years, storage would be similar in March through September; and reduced in October through February (up to 10.5 percent). In dry years, storage would be similar in January through October; and reduced in November and December (up to 6.1 percent). In critical dry years, storage would be reduced under all months (up to 14.4 percent). In all months, in all water year types, surface water elevations would be similar. **Sacramento River at Keswick** Over long-term conditions, similar flows would occur in October, February through May, July, and August; increased flows in September and November (up to 37.7 percent); and reduced flows in December, January, and June (up to 7.8 percent). In wet years, similar flows would occur in January through July; increased flows in September through November (up to 77.7 percent); and reduced flows in December and August (up to 14.6 percent). In dry years, similar flows would occur in July through October, December through March, and May; increased flows in November (33.4 percent); and reduced flows in April and June (up to 7.3 percent). **Sacramento River at Freeport** Over long-term conditions, similar flows would occur in October, December through May, and August; increased flows in September, November, and July (up to 43.3 percent); and reduced flows in June (11.4 percent). In wet years, similar flows would occur in January through June and October; increased flows in July through September and November (up to 90.3 percent); and reduced flows in December (10.7 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	In dry years, similar flows would occur in August through October and December through April; increased flows in November and July (up to 15.8 percent); and reduced flows in May and June (up to 11.9 percent). **Lake Oroville** In wet years, storage would be similar in January through August; and reduced in September through December (up to 17.9 percent). In above normal years, storage would be similar in February through August; and reduced in September through January (up to 13.2 percent). In below normal years, storage would be similar in May through July; and reduced in August through April (up to 17.7 percent). In dry years, storage would be similar in June; and reduced in all other months (up to 12.5 percent). In critical dry years, storage would be similar under all months. In all months, in all water year types, surface water elevations would be similar. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in November and April; increased flows in July through September (up to 76.1 percent); and reduced flows in October, December through March, May, and June (up to 27.2 percent). In wet years, similar flows would occur in October through November and March through May; increased flows in July through September (up to 184 percent) and reduced flows in December through February (up to 26.0 percent). In dry years, similar flows would occur in November through March; increased flows in April and July (up to 52.4 percent); and reduced flows in August through October and May and June (up to 27.6 percent). **Folsom Lake** In wet years, storage would be similar in December through August; and reduced in September through November (up to 10.8 percent). In above normal years, storage would be similar in January through June, September, and October; reduced in November and December (up to 8.2 percent); and increased in July and August (up to 5.7 percent). In below normal years, storage would be similar in February through May; reduced in October through January (up to 11.9 percent); and increased in July through September (up to 17.1 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in October through June; and reduced in July through September (up to 10.8 percent). In all months, in all water year types, surface water elevations would be similar. **American River downstream of Nimbus Dam** Over long-term conditions, similar flows would occur in November through May and July; increased flows in September and October (up to 44.7 percent); and reduced flows in June and August (up to 6.1 percent). In wet years, similar flows would occur in October through November and January through July; increased flows in September (91.1 percent) and reduced flows in December and August (up to 10.7 percent). In dry years, similar flows would occur in all months except October, February and July; increased flows in October (16.5 percent); and reduced flows in February and July (up to 7.3 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Clear Creek downstream of Whiskeytown Dam Flows identical June through April; and increased in May (40.7 percent). **New Melones Reservoir** In wet, below normal, and dry years, storage would be similar in all months. In above normal years, storage would be similar in all months except October when storage would be reduced by 5.7 percent. In critical dry years, storage would be similar in February, March, and July through September; and reduced in October through January and April through June (up to 6.9 percent). In all months, in all water year types, surface water elevations would be similar. Stanislaus River downstream of Goodwin Dam Over long-term conditions, similar flows would occur in May and July through September; increased flows in October, March, and April (up to 148.7 percent); and reduced flows in November through February and June (up to 33.8 percent). In wet years, similar flows would occur in February and April; increased flows in October, March, May, July, and August (up to 117.1 percent); and reduced flows in September, November through January, and June (up to 50.8 percent). In dry years, similar flows would occur in July through September; increased flows in October and April (up to 154.3 percent); and reduced flows in November through March, May, and June (up to 35.7 percent). San Joaquin River at Vernalis Over long-term conditions, similar flows would occur in July through September and November through May; increased flows in October (19 percent); and reduced flows in June (8 percent). In wet years, similar flows would occur in July through September and November through May; increased flows in October (16.8 percent); and reduced flows in June (9.4 percent). In dry years, similar flows would occur in November through March and May through September; and increased flows in October and April (up to 18.3 percent). **San Luis Reservoir** In wet years, storage would be similar in June and September; increased in March, July, and August (up to 9.6 percent); and reduced in October through February, April, and May (up to 57.2 percent). Surface water elevations would be less in all months (up to 10.7 percent). In above normal years, storage would be similar in July and September; increased in August (9.5 percent); and reduced in October through June (up to 71.2 percent). Surface water elevations would be less in all months (up to 13.0 percent). In below normal years, storage would be similar in July and September; increased in August (20.4 percent); and reduced in October through June (up to 67.1 percent). Surface water elevations would be less in all months (up to 16.0 percent). In dry years, storage would be similar in September; increased in July (34.2 percent); and reduced in October through June and August (up to 44.0 percent). Surface water elevations would be similar in September through January; and less in February through August (up to 10.4 percent). In critical dry years, storage would be similar in September; increased in July (60.2 percent); and reduced in August and October through June (up to 51. percent). Surface water elevations would be similar in October through January; and reduced in February through September (up to 9.7 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Yolo Bypass In wet years, flows into Yolo Bypass would be similar in January through September; increased in October (25 percent); and reduced in November and December (up to 14.8 percent). In above normal years, flows into Yolo Bypass would be similar in April through December; and reduced in January through March (up to 13.9 percent). In below normal years, flows into Yolo Bypass would be similar in April through November; and reduced in December through March (up to 25.3 percent). In dry years, flows into Yolo Bypass would be similar in January through November; and reduced in December (5.9 percent). In critical dry years, flows into Yolo Bypass would be similar in all months. **Delta Outflow** In wet years, average monthly Delta outflow in July through November, January, April, and May (up to 13,683 cfs); and decrease in December, February, March, and June (up to 1,590 cfs). In dry years, average monthly Delta outflow would be similar or increase in all months (up to 3,114 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, average monthly OMR flows would be more positive in September through February, April, and May (up to 10,005 cfs); and more negative in March and June through August (up to 923 cfs). In dry years, average monthly OMR flows would be more positive in August through June (up to 3,489 cfs), and more negative in June (2,073 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 1,051 TAF (18 percent) less under the No Action Alternative as compared to the Second Basis of Comparison. Deliveries to CVP North of Delta agricultural water service contractors would be reduced by 16 percent over the long-term conditions; 31 percent in dry years; and 37 percent in critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar in total; however, deliveries to the American River CVP contractors would be reduced by 6 percent over the long-term conditions; 8 percent in dry years; and 7 percent in critical dry years. Deliveries to CVP South of Delta agricultural water service contractors would be reduced by 24 percent over the long-term conditions; 33 percent in dry years; and 37 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be reduced by 10 percent over the long-term conditions; 9 percent in dry years; and 7 percent in critical dry years. Deliveries to the Eastside contractors would be similar under the long-term conditions and dry and critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be reduced by 18 percent over the long-term conditions; 18 percent in dry years; and 20 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be reduced by 18 percent over the long-term conditions; 19 percent in dry years; and 22 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be increased by 9 percent over the long-term conditions; 7 percent in dry years; and 9 percent in critical dry years.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Deliveries of Article 21 water to SWP South of Delta water contractors would be reduced by 83 percent over the long-term conditions; 96 percent in dry years; and 92 percent in critical dry years.
Alternative 2: Surface Water Resources and Water Supplies	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Surface Water Resources and Water Supplies	**Trinity Lake** Similar storage and surface water elevations in all months and all water year types. **Trinity River downstream of Lewiston Dam** Similar flows in all months for long-term conditions and wet and dry years. **Shasta Lake** Similar storage and surface water elevations in all months and all water year types. **Sacramento River at Keswick** Similar flows in all months for long-term conditions and wet and dry years. **Sacramento River at Freeport** Similar flows in all months for long-term conditions and wet years. In dry years, similar flows would occur in July through May; and increased flows in June (11 percent). **Lake Oroville** Similar storage and surface water elevations in all months and all water year types. **Feather River downstream of Thermalito Complex** Over long-term conditions, similar flows would occur in November and January through June; reduced flows in October, December, and September (up to 12.5 percent); and increased flows in July and August (up to 17.0 percent). In wet years, similar flows would occur in November and January through May; reduced flows in October, December, and September (up to 14.6 percent); and increased flows in June through August (up to 10.9 percent). In dry years, similar flows would occur in November and January through June; reduced flows in August through October (up to 21.2 percent); and increased flows in July (37.1 percent). **Folsom Lake** Similar storage and surface water elevations in all months and all water year types. **American River downstream of Nimbus Dam** Similar flows in all months for long-term conditions and wet and dry years. **Clear Creek downstream of Whiskeytown Dam** Flows would be identical in all months.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	New Melones Reservoir In wet years, storage would be similar in March through May; and increased in June through February (up to 8.4 percent). In above normal years, storage would be increased in all months (up to 16.3 percent). In below normal years, storage would be increased in all months (up to 14.7 percent). In dry years, storage would be increased in all months (up to 19.6 percent). In critical dry years, storage would be increased in all months (up to 32.1 percent). In all months, in all water year types, surface water elevations would be similar. **Stanislaus River downstream of Goodwin Dam** Over long-term conditions, similar flows would occur in October, December, January, and March; reduced flows would occur in November, May, and June (up to 52.3 percent); and increased flows in February, April, July, and August through September (up to 26.8 percent). In wet years, similar flows would occur in October, November, January, and April; reduced flows in May and June (up to 44.8 percent); and increased flows in December, February, March, and July through September (up to 68.6 percent). In dry years, similar flows would occur in July through October; reduced flows in November through March and May through June (up to 36.0 percent); and increased flows in April (40.2 percent). **San Joaquin River at Vernalis** Over long-term conditions, similar flows would occur in July through May; and reduced flows in June (11.8 percent). In wet years, similar flows would occur in September through January, March through May, and July; reduced flows in June (8.3 percent); and increased flows in August and February (6.2 percent). In dry years, similar flows would occur in July through March; reduced flows in May and June (up to 12.3 percent); and increased flows in April (6.6 percent). **San Luis Reservoir** In wet years, storage would be similar in July through November and March through May; and reduced in December through February and June (up to 15.7 percent). Surface water elevations would be similar in all months. In above normal years, storage would be similar in November; increased in August and September (up to 12.1 percent); and reduced in October and December through July (up to 21.7 percent). Surface water elevations would be similar in March through December; and reduced in January and February (up to 6.0 percent). In below normal years, storage would be similar in August and September; and reduced in October through July (up to 40.1 percent). Surface water elevations would be similar in all months. In dry years, storage would be reduced in January through September (up to 19.2 percent); and increased in October through December (up to 13.2 percent). Surface water elevations would be similar in all months. In critical dry years, storage would be reduced in October through August (up to 28.5 percent); and increased in September (7.6 percent). Surface water elevations would be similar September through January; and reduced in February through August (up to 7.4 percent). **Yolo Bypass** In wet years, flows into the Yolo Bypass would be similar in November through September; and reduced in October (5.6 percent).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	In above normal, below normal, dry, and critical dry years, flows into the Yolo Bypass would be similar in all months. **Delta Outflow** In wet years, average monthly Delta outflow would increase in November through February and July through September (up to 2,546 cfs); and decrease in October and March through June (up to 1,127 cfs). In dry years, average monthly Delta outflow would increase in November through April, July and August (up to 3,391 cfs); and decrease October, May, and June (up to 373 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, flows would be more positive in September through February, April, and May (up to 5,528 cfs); and more negative in March and June through August (up to 1,453 cfs). In dry years, flows would be more positive in August through May (up to 3,249 cfs); and more negative flows in June and July (up to 1,345 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 326 TAF (6 percent) less under Alternative 3 as compared to the Second Basis of Comparison. Deliveries to CVP North of Delta agricultural water service contractors would be similar over the long-term conditions; and reduced by 11 percent in dry years and 19 percent in critical dry years. Deliveries to CVP North of Delta M&I contractors (including American River CVP contractors) would be similar in long-term conditions and dry and critical dry years. Deliveries to CVP South of Delta agricultural water service contractors would be similar over the long-term conditions; and reduced by 10 percent in dry years and 20 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be similar in long-term conditions and dry and critical dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and dry years; and increased by 11 percent in critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry years; and reduced by 10 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be similar over the long-term conditions and in dry years; and reduced by 11 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be similar over the long-term conditions and in dry and critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be reduced by 62 percent over the long-term conditions; 80 percent in dry years; and 76 percent in critical dry years.
Alternative 5: Surface Water Resources and Water Supplies	**Trinity Lake** In wet, below normal, and dry years, storage would be similar. In above normal years, storage would be similar in January through October; and reduced in November and December (up to 5.3 percent). In critical dry years, storage would be reduced in all months (up to 10.0 percent). In all months, in all water year types, surface water elevations would be similar.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Trinity River downstream of Lewiston Dam Over long-term conditions, flows would be similar in March through November and January; and reduced in December and February (up to 9.6 percent). In wet years, flows would be similar in January and April through November; and reduced in December, February, and March (up to 13.9 percent). In dry years, flows would be similar in all months. **Shasta Lake** In wet years, storage would be similar in October and December through August; and reduced in November and September (up to 8.1 percent). In above normal years, storage would be similar in February through September; and reduced in October through December (up to 7.5 percent). In below normal years, storage would be similar in March through September; and reduced in October through February (up to 9.9 percent). In dry years, storage would be similar in January through October; and reduced in November through December (up to 5.9 percent). In critical dry years, storage would be reduced in all months (up to 16.8 percent). In all months, in all water year types, surface water elevations are similar. **Sacramento River at Keswick** Over long-term conditions, flows would be similar in July, August, October, and February through April; reduced in December, January, May and June (up to 8.2 percent); and increased in September and November (up to 38.5 percent). In wet years, flows would be similar in January through July; reduced in December and August (up to 15.0 percent); and increased in September through November (up to 77.3 percent). In dry years, similar flows would occur in July through October and December through March; reduced in April through June (up to 10.1 percent); and increased flows in November (32.1 percent). **Sacramento River at Freeport** Over long-term conditions, flows would be similar in October and December through April; reduced in May and June (up to 11.5 percent); and increased in July through September and November (43.4 percent). In wet years, flows would be similar in October and January through June; reduced in December (6.2 percent); and increased in July through September and November (up to 89.0 percent). In dry years, similar flows would occur in August through October and December through April; reduced in May and June (up to 13.6 percent); and increased flows in July and November (up to 19.3 percent). **Lake Oroville** In wet years, storage would be similar in January through August; and reduced in September through December (up to 18.1 percent). In above normal years, storage would be similar in March through August; and reduced in September through February (up to 14.0 percent). In below normal years, storage would be similar in May through July; and reduced in August through April (up to 17.1 percent). In dry years, storage would be similar in May and June; and reduced in July through April (up to 11.4 percent). In critical dry years, storage would be similar in all months. Surface water elevations would be similar in all months, in all years.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Feather River downstream of Thermalito Complex Over long-term conditions, similar flows would occur in November and April; reduced flows in October, December through March, May, and June (up to 27.7 percent); and increased flows in July through September (up to 76.2 percent). In wet years, similar flows would occur in October, November, March through May; reduced flows in December through February and June (up to 25.6 percent); and increased flows in July through September (up to 181.9 percent). In dry years, similar flows would occur in November through April; reduced flows in October, May, June, August, and September (up to 45.4 percent); and increased flows in July (60.4 percent). **Folsom Lake** In wet years, storage would be similar in December through July; and reduced in August through November (up to 7.4 percent). In above normal years, storage would be similar in January through June, August, and October; reduced in September, November, and December (up to 8.3 percent); and increased in July (5.4 percent). In below normal years, storage would be similar in February through May; reduced in August through January (up to 13.2 percent); and increased in June and July (up to 10.2 percent). In dry years, storage would be similar in all months. In critical dry years, storage would be similar in August and June; and reduced in July (8.0 percent). Surface water elevations would be similar in all months, in all years. **American River downstream of Nimbus Dam** Over long-term conditions, similar flows would occur in November through July; reduced flows in August (5.8 percent); and increased in September and October (42.4 percent). In wet years, similar flows would occur in October, November, and January through July; reduced flows in December and August (up to 13.7 percent); and increased flows in September (88.2 percent). In dry years, similar flows would occur in November through September; and increased flows in October (16.7 percent). **Clear Creek downstream of Whiskeytown Dam** Flows identical June through April; and increased in May (40.7 percent). **New Melones Reservoir** In wet years, storage would be reduced in all months (up to 9.3 percent). In above normal years, storage would be reduced in all months (up to 9.9 percent). In below normal years, storage would be reduced in all months (up to 13.1 percent). In dry years, storage would be reduced in all months (up to 14.3 percent). In critical dry years, storage would be reduced in all months (up to 23.2 percent). Surface water elevations would be similar in all months, in all water year types.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Stanislaus River downstream of Goodwin Dam Over long-term conditions, similar flows would occur in August; reduced flows would occur in November through February, June, July, August, and September (up to 35.8 percent); and increased flows in October and March through May (up to 144.8 percent). In wet years, similar flows would occur in February and April; reduced flows in November through January and June through September (up to 52.8 percent); and increased flows in October and March (up to 113.1 percent). In dry years, similar flows would occur in July through September; reduced flows in November through March and June (up to 35.7 percent); and increased flows in October, April, and May (150.1 percent). **San Joaquin River at Vernalis** Over long-term conditions, similar flows would occur in November through March, May, and July through September; reduced flows in June (8.2 percent); increased flows in October and April (18.7 percent). In wet years, similar flows would occur in November through May and July through September; reduced flows in June (9.8 percent); and increased flows in October (16.2 percent). In dry years, similar flows would occur in November through March and June through September; and increased flows in October, April, and May (up to 24.5 percent). **San Luis Reservoir** In wet years, storage would be reduced in all months (up to 48.9 percent). Surface water elevations would be similar in September and March; and reduced in October through February and April through August (up to 9.9 percent). In above normal years, storage would be reduced in all months (up to 59.3 percent). Surface water elevations would be similar in September; and reduced in October through August (up to 12.9 percent). In below normal years, storage would be reduced in all months (up to 70.0 percent). Surface water elevations would be similar in September; and reduced in October through August (up to 16.7 percent). In dry years, storage would be reduced in all months (up to 51.4 percent). Surface water elevations would be similar in October through December; and reduced in January through September (up to 13.9 percent). In critical dry years, storage would be reduced in all months (46.3 percent). Surface water elevations would be reduced in all months (up to 13.5 percent). **Yolo Bypass** In wet years, flows would be similar in February through September; reduced flows in November through January (up to 15.0 percent); and increased in October (15.8 percent). In above normal years, flows would be similar in April through December; and reduced flows in January through March (up to 14.8 percent). In below normal years, flows would be similar in April through November; and reduced flows in December through March (up to 24.0 percent). In dry years, flows would be similar in January through November; and reduced flows in December (up to 7.4 percent). In critical dry years, flows would be similar in all months.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Delta Outflow In wet years, average monthly Delta outflow would be increased in July through November, January, and April and May (up to 13,666 cfs); and reduced in December, February, March, and June (up to 1,713 cfs). In dry years, average monthly Delta outflow would be increased in July through May (up to 3,384 cfs); and reduced in June (526 cfs). **Reverse Flows in Old and Middle Rivers** In wet years, OMR flows would be more positive in September through February, April and May (up to 10,017 cfs); and more negative in March and June through August (up to 964 cfs). In dry years, OMR flows would be more positive in September through June (up to 4,724 cfs); and more negative in July and August (up to 2,620 cfs). **CVP and SWP Exports and Deliveries** Long-term average annual exports would be 1,096 TAF (19 percent) less under Alternative 5 as compared to the Second Basis of Comparison. Deliveries to CVP North of Delta agricultural water service contractors would be reduced by 16 percent over the long-term conditions, 31 percent in dry years, and 36 percent in critical dry years. Deliveries to CVP North of Delta M&I contractors would be similar in long-term conditions and dry and critical dry years; however American River Contractors would be reduced by 7 percent over the long-term conditions; 8 percent in dry years; and 8 percent in critical dry years. Deliveries to CVP South of Delta agricultural water service contractors would be reduced by 25 percent over the long-term conditions, 35 percent in dry years and 38 percent in critical dry years. Deliveries to CVP South of Delta M&I contractors would be reduced by 10 percent in long-term conditions, 9 percent in dry years, and 8 percent in critical dry years. Deliveries to the Eastside contractors would be similar under long-term conditions and dry years; and reduced by 11 percent in critical dry years. Deliveries without Article 21 water to SWP North of Delta water contractors would be reduced by 19 percent over the long-term conditions, 18 percent in dry years, and 21 percent in critical dry years. Deliveries without Article 21 water to SWP South of Delta water contractors would be reduced by 19 percent over the long-term conditions, 20 percent in dry years, and 23 percent in critical dry years. Deliveries of Article 21 water to SWP North of Delta water contractors would be increased by 13 percent over the long-term conditions, 11 percent in dry years, and 15 percent in critical dry years. Deliveries of Article 21 water to SWP South of Delta water contractors would be reduced by 85 percent over the long-term conditions, 95 percent in dry years, and 95 percent in critical dry years.
	Surface Water Quality
No Action Alternative: Surface Water Quality	Salinity increases near Emmaton in July through March (5 to 125 percent depending upon water year type); decreases in June (5 to 29 percent); and is similar in April and May. Salinity increases near the CVP and SWP, Contra Costa Water District, and Antioch intakes (5 to over 65 percent) in September through January; and is similar or decreases (5 to over 30 percent) in spring and summer months. Salinity increases near Port Chicago in January through March (5 to 50 percent); and is similar in June through August.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.
Alternative 2: Surface Water Quality	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Surface Water Quality	Salinity increases near Emmaton in January through March and July through September (5 to 32 percent); decreases in June (5 to 26 percent); and is similar in October through December, April, and May. Salinity decreases near Jones and Banks Pumping Plants in January through May (5 to 18 percent); and is similar in remaining months. Salinity increases near the Contra Costa Water District and Antioch intakes (5 to 30 percent) in January and February; and is similar or decreases (5 to over 10 percent) in remaining months. Salinity increases near Port Chicago in January through March (5 to 34 percent); and is similar in April through December. Similar mercury concentrations in Largemouth Bass throughout the Delta. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.
Alternative 5: Surface Water Quality	Salinity increases near Emmaton in July through May (5 to 124 percent depending upon water year type); and decreases in June (5 to 29 percent). Salinity increases near the CVP and SWP, Contra Costa Water District, and Antioch intakes (5 to over 60 percent) in September through January or February; and decreases (5 to over 30 percent) in remaining months. Salinity increases near Port Chicago in September through May (5 to 50 percent); and is similar in June through August. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions. Similar selenium concentrations in whole body fish, bird eggs, and fish fillets.
	Groundwater Resources
No Action Alternative: Groundwater Resources	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Regions** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping in the San Joaquin Valley would increase by approximately 8 percent. July groundwater levels in all water year types would decline approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 50 feet in the Delta-Mendota, Tulare Lake, and Kern County subbasins; and 100 to over 200 feet in the Westside subbasin. The reduction in groundwater levels could cause additional land subsidence. Groundwater quality in the San Joaquin Valley Groundwater Basin could decline.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	San Francisco Bay Area, Central Coast, and Southern California Regions Reductions in CVP and SWP water supplies, could increase groundwater pumping and increase the potential for land subsidence.
Alternative 2: Groundwater Resources	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Groundwater Resources	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Regions** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping, levels, and quality in the San Joaquin Valley would be similar. July groundwater levels in all water year types would decline approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 50 feet in the Delta-Mendota, Tulare Lake, and Kern County subbasins; and up to 100 feet in the Westside subbasin. **San Francisco Bay Area, Central Coast, and Southern California Regions** Reductions in CVP and SWP water supplies, could increase groundwater pumping and increase the potential for land subsidence.
Alternative 5: Groundwater Resources	**Trinity River Region** Groundwater conditions would be similar. **Central Valley Regions** Groundwater pumping and levels in the Sacramento Valley would be similar. Groundwater pumping in the San Joaquin Valley would increase by approximately 8 percent. July groundwater levels in all water year types would decline approximately 2 to 10 feet in the in most of the central and southern San Joaquin Valley; 10 to 100 feet in the Delta-Mendota and Tulare Lake subbasins; up to 200 feet in the Kern County subbasins; and up to 500 feet in the Westside subbasin. The reduction in groundwater levels could cause additional land subsidence. Groundwater quality in the San Joaquin Valley Groundwater Basin could decline. **San Francisco Bay Area, Central Coast, and Southern California Regions** Reductions in CVP and SWP water supplies, could increase groundwater pumping and increase the potential for land subsidence.
	Energy Resources
No Action Alternative: Energy Resources	CVP annual net generation would be similar. SWP annual net generation would be reduced by 29 percent over the long-term condition; and by 37 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.
Alternative 2: Energy Resources	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
Alternative 3: Energy Resources	CVP annual net generation would be similar. SWP annual net generation would be reduced by 10 percent over the long-term condition; and by 58 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.
Alternative 5: Energy Resources	CVP annual net generation would be similar. SWP annual net generation would be reduced by 30 percent over the long-term condition; and by 39 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.
	Fish and Aquatic Resources
No Action Alternative: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon Overall, the temperature model outputs for each of the Coho Salmon life stages suggest that the temperature of water released at Lewiston Dam generally would be similar, although the exceedance of water temperature thresholds would be slightly more frequent (1 percent). Given the similarity of the results and the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), there would be similar effects on the Coho Salmon population in the Trinity River. Spring-run Chinook Salmon Overall, water temperature could have adverse effects on spring-run Chinook Salmon in the Trinity River; however, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures. Thus, given these relatively minor changes in temperature and temperature threshold exceedance, and the inherent uncertainty associated with the resolution of the temperature model (average monthly outputs), likely to have similar effects on the spring-run Chinook Salmon population in the Trinity River. Fall-run Chinook Salmon Although the combined analysis based on water temperature suggests that operations could be slightly more adverse, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in water temperatures (as well as egg mortality). Overall, given these small differences and the inherent uncertainty in the temperature model, likely to have similar effects on the fall-run Chinook Salmon population in the Trinity River. Steelhead Although the water temperature and flow changes could have adverse effects on steelhead in the Trinity River, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures under the No Action Alternative as compared to the Second Basis of Comparison. Overall, the likely to result in similar effects on the steelhead population in the Trinity River. Green Sturgeon Overall, given the similarities between average monthly water temperatures at Lewiston Dam, it is likely that temperature conditions for Green Sturgeon in the Trinity River or lower Klamath River and estuary would be similar. Reservoir Fishes Overall, the comparison of storage and the analysis of nesting suggest that effects would be similar.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Pacific Lamprey Given the somewhat reduced flows and similar temperatures, it is likely that the effects would be similar. This conclusion likely applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). Eulachon Given that the highest reductions in flow would be less than 10 percent in the Trinity River, which would represent even a smaller proportion in the lower Klamath River and Klamath River estuary, and that water temperatures in the Klamath River are unlikely to be affected by changes upstream at Lewiston Dam, it is likely the conditions would be similar for Eulachon in the Klamath River. **Sacramento River System** Winter-run Chinook Salmon The model results suggest that effects on winter-run Chinook Salmon would be similar, with a small likelihood that winter-run Chinook Salmon escapement would be higher. This potential distinction between the two scenarios, however, may be increased by the benefits of implementation of fish passage. Spring-run Chinook Salmon The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly more adverse with a small likelihood that spring-run Chinook Salmon production would be lower under the No Action Alternative. This potential distinction may be offset by the benefits of implementation of fish passage. Fall-run Chinook Salmon The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly more adverse with a small likelihood that fall-run Chinook Salmon production would be lower. This potential distinction may be offset by the benefits of implementation of fish passage on the Sacramento and American rivers. Late Fall-run Chinook Salmon The model results suggest that overall, effects on late fall-run Chinook Salmon could be slightly more adverse with a small likelihood that late fall-run Chinook Salmon production would be lower. This potential distinction may be offset by the benefits of implementation of fish passage. Steelhead The model results suggest that overall, effects on steelhead could be slightly more adverse, particularly in the Feather River. This potential distinction may be offset by the benefits of implementation of fish passage on the Sacramento and American rivers. Green Sturgeon Overall, the increased frequency of exceedance of temperature thresholds could increase the potential for adverse effects on Green Sturgeon in the Sacramento and Feather rivers. White Sturgeon Overall, the increased frequency of exceedance of temperature thresholds could increase the potential for adverse effects on White Sturgeon in the Sacramento River. Delta Smelt Overall, likely would result in better conditions for Delta Smelt, primarily due to lower percentage entrainment for larval and juvenile life stages, and more favorable location of Fall X2 in wetter years, and on average.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Longfin Smelt Overall, based on the decrease in frequency and magnitude of negative OMR flows and the higher Longfin Smelt abundance index values, especially in dry and critical dry years, potential adverse effects on the Longfin Smelt population likely would be less. Sacramento Splittail Overall, the slight adverse effects related to spawning habitat for Sacramento Splittail because of the decreased area of potential habitat (inundation) and the potential for a slight decrease in the frequency of inundation. Reservoir Fishes The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar or slightly higher. Overall, the results of the nest survival analysis suggest that conditions in the reservoirs would be more likely to support self-sustaining populations of black bass. Pacific Lamprey Based on the somewhat reduced flows and increased temperatures during their spawning and incubation period, it is unlikely that conditions for and effects on Pacific Lamprey in the Sacramento, Feather, and American rivers would differ in a biologically meaningful manner. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey). Striped Bass, American Shad, and Hardhead In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Based on the slightly decreased flows and increased temperatures during their spawning and incubation period, it is unlikely that conditions for and effects on Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers would differ in a biologically meaningful manner. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon Given the inherent uncertainty associated with the resolution of the temperature model, the differences in the frequency of exceedance of suitable temperatures for spawning and rearing could affect the potential for adverse effects on the fall-run Chinook Salmon populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain and it likely that the effects on fall-run Chinook Salmon in the Stanislaus River would be similar. Implementation of a fish passage project, likely would provide some benefit to fall-run Chinook Salmon if volitional passage were provided and additional habitat could be accessed. Steelhead Given the inherent uncertainty associated with the resolution of the temperature model, the differences in the magnitude and frequency of exceedance of suitable temperatures for the various life stages could affect the potential for adverse effects on the steelhead populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain. Implementation of a fish passage project, likely would provide some benefit to steelhead. Reservoir Fishes Overall, the potential for adverse effects on reservoir fishes could slightly higher because of the overall relative reductions in reservoir storage and the slightly improved nest survival in some months.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Other Species In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the similar flows and temperatures during their spawning and incubation period, it is likely that the potential to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be similar. **Pacific Ocean** Killer Whale Given conclusions from NMFS (2009c), and the fact that at least 75 percent of fall-run Chinook Salmon available for Southern Residents are produced by Central Valley hatcheries, it is likely that Central Valley fall-run Chinook Salmon as a prey base for killer whales would not be appreciably affected.
Alternative 2: Fish and Aquatic Resources	**Trinity River Region** The effects are identical as described under the No Action Alternative as compared to the Second Basis of Comparison. **Sacramento River System** Winter-run Chinook Salmon The model results suggest that effects on winter-run Chinook Salmon would be similar, with a small likelihood that winter-run Chinook Salmon escapement would be higher. Spring-run Chinook Salmon The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly more adverse with a small likelihood that spring-run Chinook Salmon production would be lower under the No Action Alternative. Fall-run Chinook Salmon The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly more adverse with a small likelihood that fall-run Chinook Salmon production would be lower. Late Fall-run Chinook Salmon The model results suggest that overall, effects on late fall-run Chinook Salmon could be slightly more adverse with a small likelihood that late fall-run Chinook Salmon production would be lower. Steelhead The model results suggest that overall, effects on steelhead could be slightly more adverse, particularly in the Feather River. Green Sturgeon, White Sturgeon, Delta Smelt, Longfin Smelt, Sacramento Splittail, Reservoir Fishes, Pacific Lamprey, Striped Bass, American Shad, and Hardhead The effects are identical as described under the No Action Alternative as compared to the Second Basis of Comparison. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon Given the inherent uncertainty associated with the resolution of the temperature model, the differences in the frequency of exceedance of suitable temperatures for spawning and rearing could affect the potential for adverse effects on the fall-run Chinook Salmon populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain and it likely that the effects on fall-run Chinook Salmon in the Stanislaus River would be similar.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Steelhead Given the inherent uncertainty associated with the resolution of the temperature model, the differences in the magnitude and frequency of exceedance of suitable temperatures for the various life stages could affect the potential for adverse effects on the steelhead populations in the Stanislaus River. However, the direction and magnitude of this effect is uncertain. Reservoir Fishes and Other Species The effects are identical as described under the No Action Alternative as compared to the Second Basis of Comparison. **Pacific Ocean** Killer Whale The effects are identical as described under the No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon and Spring-run Chinook Salmon Although the water temperature and flow changes could have slight beneficial effects, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures. Overall, likely to result in similar effects on the spring-run Chinook Salmon population in the Trinity River. Fall-run Chinook Salmon Although the water temperature and flow changes suggest a lower potential for adverse effects on fall-run Chinook Salmon in the Trinity River, these effects would not occur in every year and are not anticipated to be substantial based on the relatively small differences in flows and water temperatures (as well as egg mortality). Overall, likely to have similar effects. Steelhead Water temperatures suggest similar effects on the steelhead population. Green Sturgeon Water temperatures suggest similar effects on Green Sturgeon in the Trinity River or lower Klamath River and estuary. Reservoir Fishes Overall, reservoir storage and nest survival suggest similar effects on black bass. Pacific Lamprey Overall, it is likely that effects on Pacific Lamprey would be similar. This conclusion likely also applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). Eulachon It is likely that effects would have a similar potential to influence Eulachon in the Klamath River.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Sacramento River System Winter-run Chinook Salmon Potentially slightly more beneficial due to lack of fish passage, if fish passage is successful in providing access to higher quality habitat, The predator control measures could reduce winter-run Chinook Salmon mortality. Spring-run Chinook Salmon The model results suggest that overall, effects on spring-run Chinook Salmon could be slightly more adverse with a small likelihood that spring-run Chinook Salmon production would be lower. The ocean harvest restriction component and predator control measures could reduce spring-run Chinook Salmon mortality. Fall-run Chinook Salmon The model results suggest that overall, effects on fall-run Chinook Salmon could be slightly less adverse with a small likelihood that fall-run Chinook Salmon production would be higher. However, the potential for salvage loss also would be higher. The ocean harvest restriction component and predator control measures could reduce fall-run Chinook Salmon mortality. Overall, effects on fall-run Chinook Salmon would be slightly less adverse. Late Fall-run Chinook Salmon Overall, it is likely that the effects on late fall-run Chinook Salmon would be similar. The ocean harvest restriction component and predator control measures could reduce late fall-run Chinook Salmon mortality. Steelhead The model results suggest that overall, effects on steelhead could be slightly more adverse, particularly in the Feather and American rivers. The ocean harvest restriction component and predator control measures could reduce steelhead mortality. Green Sturgeon Given the general similarity in results and inherent uncertainty associated with the resolution of the temperature model, the slightly reduced frequency of exceedance of temperature thresholds could result in beneficial effects on sturgeon. White Sturgeon Given the general similarity in results and inherent uncertainty associated with the resolution of the temperature model, the slightly reduced frequency of exceedance of temperature thresholds could result in beneficial effects on sturgeon. Delta Smelt Overall, effects would be similar based on reduced entrainment and more favorable location of Fall X2. Longfin Smelt Overall, based on the decrease in frequency and magnitude of negative OMR flows and the higher Longfin Smelt abundance index values, potential beneficial effects likely would be greater.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Sacramento Splittail Flows entering the Yolo Bypass generally would be somewhat lower. This could provide somewhat lower value to Sacramento Splittail because of the decreased area of potential spawning habitat. Reservoir Fishes The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar. Thus, it is likely that effects on black bass would be similar. Pacific Lamprey Pacific Lamprey would be subjected to the same temperature conditions described above for salmonids. Based on the somewhat increased flows and slightly decreased temperatures during their spawning and incubation period, it is likely that Alternative 3 would have a slightly lower potential to adversely affect Pacific Lamprey in the Sacramento, Feather, and American rivers. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey). Other Species Changes in average monthly water temperature would be small. In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Given the somewhat increased flows and decreased water temperatures during their spawning and incubation period, it is likely that Alternative 3 would have a lower potential to adversely affect Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers. Predation controls related to Striped Bass would result in adverse effects. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon Overall, likely would have similar effects on the fall-run Chinook Salmon population in the San Joaquin River watershed. Beneficial effects to juvenile fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions under fall-run Chinook Salmon would benefit the fall-run Chinook Salmon population. Steelhead Given the frequency of exceedance under both Alternative 3 and the Second Basis of Comparison, water temperature conditions for steelhead in the Stanislaus River would be generally similar. Additional beneficial effects to juvenile steelhead as a result of trap and haul passage across through the Delta. It remains uncertain, however, if predator management actions would benefit steelhead. White Sturgeon While flows in the San Joaquin River upstream of the Stanislaus River are expected be similar, flow contributions from the Stanislaus River could influence water temperatures in the San Joaquin River where White Sturgeon eggs or larvae may occur during the spring and early summer. The magnitude of influence on water temperature would depend on the proportional flow contribution of the Stanislaus River and the temperatures in both the Stanislaus and San Joaquin rivers. The potential for an effect on White Sturgeon eggs and larvae would be influenced by the proportion of the population occurring in the San Joaquin River. In consideration of this uncertainty, it is not possible to distinguish potential effects on White Sturgeon.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Reservoir Fishes While the analyses suggest that the effects could be more favorable, it is uncertain whether these differences would be biological meaningful. Therefore, it is likely that the effects on black basses in New Melones Reservoir would be similar. Other Species In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the slightly lower flows and temperatures during their spawning and incubation period, it is likely that the potential effects to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be similar. Predation controls related to Striped Bass would result in adverse effects. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected.
Alternative 4: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon, spring-run and fall-run Chinook Salmon, steelhead, Green Sturgeon, Reservoir Fishes, Pacific Lamprey, River Lamprey, and Eulachon The effects would be identical. **Sacramento River System** Winter-run, spring-run, fall-run, and late fall-run Chinook Salmon, and steelhead The effects in the Sacramento River system would be similar. Beneficial effects to Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the Chinook Salmon population. Green Sturgeon, White Sturgeon, Delta Smelt, Longfin Smelt, Sacramento Splittail, Reservoir Fishes, Pacific Lamprey, River Lamprey, American Shad, and Hardhead The effects in the Sacramento River system would be identical. Striped Bass The effects in the Sacramento River system would be similar. Predation controls related to Striped Bass would result in adverse effects. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon and Steelhead The effects in the Stanislaus River/Lower San Joaquin River system would be similar. Beneficial effects to Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the Chinook Salmon population. White Sturgeon, Reservoir Fishes, and Other Species The effects in the Stanislaus River/Lower San Joaquin River system would be identical.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Striped Bass The effects in the Stanislaus River/Lower San Joaquin River system would be similar. Predation controls related to Striped Bass would result in adverse effects. **Pacific Ocean** Killer Whale It is unlikely that the Chinook Salmon prey base of killer whales, supported heavily by hatchery production of fall-run Chinook Salmon, would be appreciably affected. Beneficial effects due to benefits to fall-run Chinook Salmon as a result of trap and haul passage across through the Delta and ocean harvest restrictions. It remains uncertain, however, if predator management actions would benefit the fall-run Chinook Salmon population.
Alternative 5: Fish and Aquatic Resources	**Trinity River Region** Coho Salmon, Spring-run Chinook Salmon, Fall-run Chinook Salmon, Steelhead, and Green Sturgeon Monthly water temperature generally would be similar (less than 0.5ºF differences), with the exception of drier years when temperatures could be as much as 2.2ºF cooler in November and 1.5ºF in December. Average monthly water temperatures could be slightly (up to 0.6ºF) higher during July and August and lower (up to 0.7ºF) in September. Lower September temperatures may result in slightly better conditions for spring-run Chinook Salmon spawning. Similarly, temperature conditions could be slightly better for fall-run Chinook Salmon spawning because of the reduced temperatures in November during critical dry years. Water temperature thresholds for Coho Salmon, fall-run Chinook Salmon, and steelhead would be exceeded slightly more frequently (less than 1 percent), whereas thresholds for spring-run Chinook Salmon would be exceeded less frequently (up to 4 percent) in August in September. These temperature results are reflected in the egg mortality results for fall-run Chinook Salmon, which indicate slightly higher mortality under Alternative 5 compared to the Second Basis of Comparison, with differences less than 0.3 percent in most year types and 1.9 percent in critical dry years. The minor changes in water temperatures and mortality suggest that conditions for Coho Salmon, fall-run Chinook Salmon, steelhead, and Green Sturgeon in the Trinity River would be similar. However, the reduced threshold exceedances for spring-run Chinook Salmon, although small, could be biologically meaningful under some conditions. Reservoir Fishes Overall, the comparison of storage and the analysis of nesting suggest that effects would be similar. Pacific Lamprey It is likely that the effects would be similar. This conclusion likely applies to other species of lamprey that inhabit the Trinity and lower Klamath rivers (e.g., River Lamprey). Eulachon It is likely the conditions would be similar for Eulachon in the Klamath River. **Sacramento River System** Winter-run Chinook Salmon The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds. This is reflected in the slightly lower survival of winter-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model. Flow changes would have small effects on the

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	availability of spawning and rearing habitat for winter-run Chinook Salmon as indicated by the decrease in flow (habitat)-related mortality predicted by SALMOD. Through Delta survival of juvenile winter-run Chinook Salmon would be similar as indicated by the DPM results; and the OBAN results suggest that Delta survival could be higher. Entrainment may also be reduced as indicated by the OMR flow analysis. Median adult escapement to the Sacramento River would be reduced slightly as indicated by the IOS model results which incorporate temperature, flow, and mortality effects on each life stage over the entire life cycle of winter-run Chinook Salmon. However, the OBAN model results indicate an increase in escapement over a more limited time period (1971 to 2002). Considering all the above analyses for the winter-run Chinook Salmon population, the changes in overall effects are highly uncertain. However, the upstream fish passage could benefit the winter-run Chinook Salmon population in the Sacramento River. <u>Spring-run Chinook Salmon</u> The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds in the Sacramento and Feather rivers. There would be little change in flows or temperatures in Clear Creek. The effect of increased temperatures is reflected in the slightly lower overall survival of spring-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model for spring-run in the Sacramento River. In drier years, the likelihood of adverse temperature effects would be increased. Flow changes would likely have small effects on the availability of spawning and rearing habitat for spring-run Chinook Salmon in the Sacramento River as indicated by the decrease in flow (habitat)-related mortality predicted by SALMOD. Through Delta survival of juvenile spring-run Chinook Salmon would be similar as indicated by the DPM results, and entrainment could be reduced as indicated by the salvage analysis. Overall, similar or somewhat greater adverse effects on the spring-run Chinook Salmon population in the Sacramento River watershed, particularly in drier water year types. However, given that most of the spring-run Chinook Salmon are on the tributaries where the effects of changes are minimal and with the fish passage actions, it is likely that the effects would be similar or beneficial. <u>Fall-run Chinook Salmon</u> The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds in the Sacramento and Feather rivers. There would be little change in flows or temperatures in Clear Creek, but these differences might not be biologically meaningful because the temperature outputs represent conditions at Igo, a location upstream of most fall-run Chinook Salmon spawning and rearing. The effect of increased temperatures is reflected in the slightly lower overall survival of fall-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model for fall-run in the Feather and American rivers. In drier years, the likelihood of adverse temperature effects would be increased. Flow changes would likely have small effects on the availability of spawning and rearing habitat for fall-run Chinook Salmon in the Sacramento River as indicated by the slight decrease in spawning WUA in the Sacramento and Feather Rivers and slight increases in spawning WUA for fall-run Chinook Salmon in the American River. Fry and juvenile rearing WUA would be increased slightly in the Sacramento River and this is reflected in a decrease in flow (habitat)-related mortality predicted by SALMOD. Through-Delta survival of juvenile fall-run Chinook Salmon would be similar as indicated by the DPM results, and entrainment could be reduced as indicated by the OMR flow analysis. Overall, effects likely to be similar or slightly greater adverse effects on the fall-run Chinook Salmon population in the Sacramento River watershed, particularly in drier water year types. Fish passage actions could result in beneficial effects. <u>Late Fall-run Chinook Salmon</u> The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds. This is reflected in the slightly lower survival of late fall-run Chinook Salmon eggs predicted by Reclamation's salmon mortality model. Flow changes would have small effects on the availability of spawning habitat for late fall-run Chinook Salmon as indicated by the WUA analysis. Fry rearing habitat would be slightly increased, but juvenile rearing WUA would decrease during some months. These effects are reflected in the decrease in flow (habitat)-related and the increase in temperature-related egg and fry mortality predicted by SALMOD. Juvenile rearing mortality is also predicted to increase. Through Delta survival of juvenile late fall-run Chinook Salmon would be increased as indicated by the DPM results, and entrainment may be reduced as indicated by the OMR flow analysis.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Overall, likely to have lesser adverse effects on the late fall-run Chinook Salmon population in the Sacramento River. Fish passage actions would increase the beneficial effects. Steelhead The analysis of temperatures indicates somewhat higher temperatures and greater likelihood of exceedance of thresholds in the Sacramento and Feather rivers. In drier years, the likelihood of adverse temperature effects would be increased. There would be little change in flows or temperatures in Clear Creek. Overall, likely to have somewhat greater adverse effects on the steelhead population in the Sacramento River watershed, particularly in drier water year types because of the temperature effects. Fish passage could provide additional benefit for steelhead. Green Sturgeon Overall, the increased frequency of exceedance of temperature thresholds could increase the potential for adverse effects on Green Sturgeon in the Sacramento and Feather rivers. White Sturgeon Overall, the increased frequency of exceedance of temperature thresholds could increase the potential for adverse effects on White Sturgeon in the Sacramento River. Delta Smelt Overall, likely would result in better conditions for Delta Smelt, primarily due to lower percentage entrainment for larval and juvenile life stages, and more favorable location of Fall X2 in wetter years, and on average. Longfin Smelt Overall, based on the decrease in frequency and magnitude of negative OMR flows and the higher Longfin Smelt abundance index values, especially in dry and critical dry years, potential adverse effects on the Longfin Smelt population likely would be less. Sacramento Splittail Overall, the slight adverse effects related to spawning habitat for Sacramento Splittail because of the decreased area of potential habitat (inundation) and the potential for a slight decrease in the frequency of inundation. Reservoir Fishes The analysis of black bass nest survival based on changes in water surface elevation during the spawning period indicated that the likelihood of high (greater than 40 percent) nest survival in most of the reservoirs would be similar or slightly higher. Overall, the results of the nest survival analysis suggest that conditions in the reservoirs would be more likely to support self-sustaining populations of black bass. Pacific Lamprey Based on the somewhat reduced flows and increased temperatures during their spawning and incubation period, it is likely that conditions for and effects on Pacific Lamprey in the Sacramento, Feather, and American rivers be more adverse. This conclusion likely applies to other species of lamprey that inhabit these rivers (e.g., River Lamprey).

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Striped Bass, American Shad, and Hardhead In general, Striped Bass, American Shad, and Hardhead can tolerate higher temperatures than salmonids. Based on the slightly decreased flows and increased temperatures during their spawning and incubation period, it is unlikely that conditions for and effects on Striped Bass, American Shad, and Hardhead in the Sacramento, Feather, and American rivers would differ in a biologically meaningful manner. **Stanislaus River/Lower San Joaquin River** Fall-run Chinook Salmon The analysis of temperatures indicates lower temperatures and a lesser likelihood of exceedance of suitable temperatures for spawning and rearing of fall-run Chinook Salmon in the Stanislaus River below Goodwin Dam and in the San Joaquin River at Vernalis. The effect of lower temperatures is reflected in the slightly lower overall mortality of fall-run Chinook Salmon eggs predicted by Reclamation's salmon survival model for fall-run in the Stanislaus River. As described above, the instream flow patterns are anticipated to benefit fall-run Chinook Salmon in the Stanislaus River and downstream in the lower San Joaquin River below Vernalis. Overall, would have less adverse effect on the fall-run Chinook Salmon population in the San Joaquin River watershed. Steelhead Given the frequency of exceedance and the generally stressful temperature conditions in the river, the substantial lower temperatures in October and April suggest that there would be less potential to adversely affect steelhead. Reservoir Fishes Overall, the potential for adverse effects on reservoir fishes could slightly higher because of the overall relative reductions in reservoir storage and the slightly reduced nest survival in some months. Other Species In general, Striped Bass and Hardhead also can tolerate higher temperatures than salmonids. Given the similar flows and temperatures during their spawning and incubation period, it is likely that the potential to affect Striped Bass and Hardhead in the Stanislaus and San Joaquin rivers would be similar. **Pacific Ocean** Killer Whale Given conclusions from NMFS (2009c), and the fact that at least 75 percent of fall-run Chinook Salmon available for Southern Residents are produced by Central Valley hatcheries, it is likely that Central Valley fall-run Chinook Salmon as a prey base for killer whales would not be appreciably affected.
	Terrestrial Biological Resources
No Action Alternative: Terrestrial Resources	Similar or increased flows along Trinity, Sacramento, American, and Stanislaus rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Feather River in the spring; therefore, could be reduced terrestrial habitat conditions. Improved floodplain habitat along lower Clear Creek. Similar terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Increased freshwater habitat in the western Delta.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
Alternative 2: Terrestrial Resources	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Terrestrial Resources	Similar or increased flows along Trinity, Sacramento, American, and Feather rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Stanislaus River in the spring; therefore, could be reduced terrestrial habitat conditions. Similar habitat along lower Clear Creek. Similar terrestrial conditions in Yolo Bypass related to water that flows from the Sacramento River at the Fremont Weir. Similar freshwater and salt water habitats.
Alternative 4: Terrestrial Resources	Similar effects except for increased terrestrial vegetation along the riparian corridors related to recruitment of riparian vegetation.
Alternative 5: Terrestrial Resources	Similar or increased flows along Trinity, American, and Stanislaus rivers in the spring to support riparian terrestrial habitat. Reduced flows along the Sacramento and Feather rivers in the spring; therefore, could be reduced terrestrial habitat conditions. Improved floodplain habitat along lower Clear Creek. Similar or decreased terrestrial conditions in Yolo Bypass related to similar or lower water that flows from the Sacramento River at the Fremont Weir. Increased freshwater habitat in the western Delta.
	Visual Resources
No Action Alternative: Visual Resources	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Visual resources would be reduced by 6 percent in wet and critical dry years at San Luis Reservoir, by 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.
Alternative 2: Visual Resources	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Visual Resources	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, San Luis Reservoir, and other reservoirs that store CVP and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions.
Alternative 5: Visual Resources	Visual resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Visual resources would be reduced by 6 percent in dry years and 9 percent in critical dry years at San Luis Reservoir, by 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Recreation Resources
No Action Alternative: Recreation Resources	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Recreational resources would be reduced by 6 percent in wet and critical dry years at San Luis Reservoir, by 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions. Recreational resources similar on Trinity River; reduced on the Sacramento River downstream of Keswick Dam; and both improved and reduced on the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, American River downstream of Nimbus Dam, and the Stanislaus River downstream of Goodwin Dam depending upon the month.
Alternative 2: Recreation Resources	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Recreation Resources	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, San Luis Reservoir, and other reservoirs that store CVP and SWP water in the San Francisco Bay Area, Central Coast, and Southern California regions. Recreational resources similar on Trinity River, Sacramento, Feather, and American rivers; and both improved and reduced on the Stanislaus River depending upon the month. Recreational opportunities related to Striped Bass fishing would be reduced.
Alternative 4: Recreation Resources	Reservoir and flow-related recreational opportunities would be similar. Recreational opportunities related to Striped Bass fishing would be reduced.
Alternative 5: Recreation Resources	Recreational resources would be similar at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir in all water year types; and at San Luis Reservoir in above normal, below normal, and dry years. Recreational resources would be reduced by 6 percent in dry years and 9 percent in critical dry years at San Luis Reservoir, by 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions. Recreational resources similar or improved on Trinity River, Sacramento River downstream of Keswick Dam, and American River downstream of Nimbus Dam; and both improved and reduced on the Sacramento River near Freeport, Feather River downstream of Thermalito Complex, and the Stanislaus River downstream of Goodwin Dam depending upon the month.
	Air Quality and Greenhouse Gas Emissions
No Action Alternative: Air Quality	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.
Alternative 1: Air Quality	No effects on air quality.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
Alternative 3: Air Quality	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions.
Alternative 5: Air Quality	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions.
	Public Health
No Action Alternative: Public Health	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir; and a 6 percent decrease at San Luis Reservoir. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.
Alternative 2: Public Health	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Public Health	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, New Melones Reservoir, and San Luis Reservoir. Similar mercury concentrations in Largemouth Bass throughout the Delta.
Alternative 5: Public Health	Similar water supply availability for wildland firefighting at Trinity Lake, Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir; and a 9 percent decrease at San Luis Reservoir. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.
	Socioeconomics
No Action Alternative: Socioeconomics	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would increase by 11 percent in the Sacramento Valley and decrease by 12 percent in the San Joaquin Valley. Recreational economic factors would decrease related to use of San Luis Reservoir. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would increase by 44 percent. Recreational economic factors would decrease related to use of reservoirs that store CVP and SWP water.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
	Central Coast Region M&I water-related employment would be similar. M&I water supply costs would decrease by 6 percent. Recreational economic factors would decrease related to use of reservoirs that store SWP water. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would increase by 17 percent. Recreational economic factors would decrease related to use of reservoirs that store SWP water.
Alternative 2: Socioeconomics	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Socioeconomics	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would be similar in the Sacramento Valley and by 6 percent in the San Joaquin Valley. Recreational economic factors related to Striped Bass would be reduced. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would increase by 13 percent. Recreational economic factors would be similar. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would be similar. Recreational economic factors would be similar. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would increase by 14 percent. Recreational economic factors would be similar.
Alternative 4: Socioeconomics	No effects on non-recreational socioeconomic factors. Reduced recreational economic factors related to Striped Bass fishing.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
Alternative 5: Socioeconomics	**Trinity River Region** Similar conditions. **Central Valley Region** Agricultural and M&I water-related employment would be similar. M&I water supply costs would increase by 11 percent in the Sacramento Valley and decrease by 14 percent in the San Joaquin Valley. Recreational economic factors would decrease related to use of San Luis Reservoir. **San Francisco Region** M&I water-related employment would be similar. M&I water supply costs would increase by 46 percent. Recreational economic factors would decrease related to use of reservoirs that store CVP and SWP water. **Central Coast Region** M&I water-related employment would be similar. M&I water supply costs would decrease by 6 percent. Recreational economic factors would decrease related to use of reservoirs that store SWP water. **Southern California Region** M&I water-related employment would be similar. M&I water supply costs would increase by 20 percent. Recreational economic factors would decrease related to use of reservoirs that store SWP water.
	Environmental Justice
No Action Alternative: Environmental Justice	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.
Alternative 2: Environmental Justice	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.
Alternative 3: Environmental Justice	Similar potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions. Similar mercury concentrations in Largemouth Bass throughout the Delta.

Alternative	Substantial Beneficial and Adverse Impacts as Compared to the Second Basis of Comparison
Alternative 5: Environmental Justice	Increase potential for emissions of criteria air pollutants and precursors, and/or exposure of sensitive receptors to substantial concentrations of air contaminants by 8 percent in the Central Valley, 10 to 18 percent in the San Francisco Bay Area Region, and by 18 percent in the Central Coast and Southern California regions. Similar mercury concentrations in Largemouth Bass in the most of the Delta; and a 7 percent increase near Rock Slough, San Joaquin River at Antioch, and Montezuma Slough over the long-term conditions.

Contents

Appendixes

Abbreviations and Acronyms

µg/g	Micrograms per gram
µg/L	Micrograms/liter
$\mu g/m^3$	Micrograms per cubic meter
µmhos/cm	Micromhos per centimeter
µS/cm	MicroSiemens per centimeter
AB	Assembly Bill
ACID	Anderson-Cottonwood Irrigation District
ACS	American Community Survey
AF	Acre-foot/Acre-feet
AFRP	Anadromous Fish Restoration Program
AFSP	Anadromous Fish Screen Program
AIP	Alternative Intake Project
ANN	Artificial Neural Network
AQMP	Air Quality Management Plan
ARB	California Air Resources Board
ARG	American River Group
AVEK	Antelope Valley-East Kern Water Agency
(b)(2)IT	B2 Interagency Team
BA	Biological Assessment
BARDP	Bay Area Regional Desalination Project
BCAA	bromochloroacetic acid
BCC	Birds of Conservation Concern
BCDC	San Francisco Bay Conservation and Development Commission
BCSD	Bias-correction and Spatial Disaggregation
BDCP	Bay Delta Conservation Plan
BIA	Bureau of Indian Affairs
BKD	Bacterial Kidney Disease
BLM	Bureau of Land Management
BO	Biological Opinion
BP	Before Present
BRT	Biological Review Team
BSPP	Barker Slough Pumping Plant
BVWD	Bella Vista Water District

°C	Centigrade degrees
CA	California Aqueduct
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standard
CAL FIRE	California Department of Forestry and Fire Prevention
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CalEPA	California Environmental Protection Agency
CAISO	California Independent System Operator Corporation
CALFED	CALFED Bay-Delta Program
CAL FIRE	California Department of Forestry and Fire Prevention
CAT	California Climate Action Team
CBMWD	Central Basin Municipal Water District
CCAA	California Clean Air Act
CCC	Criteria Continuous Concentration
CCF	Clifton Court Forebay
CCSD	Cambria Community Services District
CCTT	Clear Creek Technical Team
CCWD	Contra Costa Water District
CDFW	California Department of Fish and Wildlife (previously known as Department of Fish and Game)
CDP	Census Designated Place
CDPH	California Department of Public Health
CDWA	Central Delta Water Agency
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CGS	California Geological Survey
CH_4	Methane
CHRIS	California Historical Resources Information System
cm	centimeter
CMARP	Comprehensive Monitoring, Assessment and Research Program
CMC	Criteria Maximum Concentration
CMIP3	Coupled Model Intercomparison Project Phase 3

CNAGPRA	California Native American Grave Protection and Repatriation Act
CNAHC	California Native American Heritage Commission
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CPUC	California Public utilities Commission
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COA	Coordinated Operation Agreement
COC	Constituents of Concern
CRD	Contract Rate of Delivery
CRHR	California Register of Historical Resources
CRPR	California Rare Plant Rank
CSD	Community Service District
CSJWCD	Central San Joaquin Water Conservation District
CTR	California Toxics Rule
CVHM	Central Valley Hydrologic Model
CVOO	Central Valley Operations Office
CVP	Central Valley Project
CVPA	Central Valley Project Act
CVPIA	Central Valley Project Improvement Act
CVPM	Central Valley Production Model
CVRWQCB	Central Valley Regional Water Quality Control Board
CV-Salts	Central Valley Salinity Alternatives for Long-term Sustainability
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
D-893	State Water Resources Control Board Decision 893
D-1422	State Water Resources Control Board Decision 1422
D-1485	State Water Resources Control Board Decision 1485
D-1616	State Water Resources Control Board Decision 1616
D-1629	State Water Resources Control Board Decision 1629
D-1641	State Water Resources Control Board Decision 1641
DAT	Data Assessment Team
DBCP	Dibromochloropropane
DBW	Department of Boating and Waterways
DCC	Delta Cross Channel

DCCA	Dichloroacetic Acid
DCID	Deer Creek Irrigation District
DCT	Delta Condition Team
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
Delta	Sacramento-San Joaquin Rivers Delta Estuary
Delta Reform Act	Sacramento-San Joaquin Delta Reform Act of 2009
DFA	California Department of Food and Agriculture
DICU	Delta Island Consumptive Use
District Court	U.S. District Court for the Eastern District of California
DMC	Delta-Mendota Canal
DMC/CA Intertie	Delta-Mendota Canal and California Aqueduct Intertie
DO	Dissolved Oxygen
DOC	Dissolved organic carbon
DOI	Department of the Interior
DOM	Dissolved Organic Matter
DOSS	Delta Operations Salmonid and Sturgeon
DPC	Delta Protection Commission
DPM	Delta Passage Model
DPS	Distinct Population Segment
DSRAM	Delta Smelt Risk Assessment Matrix
dw	dry weight
DWR	California Department of Water Resources
EDWPA	El Dorado Water and Power Authority
EBMUD	East Bay Municipal Utility District
EC	Electrical Conductivity
ECe	Electrical Conductivity of a Saturated Soil Index
ECw	Electrical Conductivity
EFH	Essential Fish Habitat
E:I	Export to Inflow Ratio
EID	El Dorado Irrigation District
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EOM	end-of-month
EOS	End-of-September

EQ	exceedance quotient
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
ET	evapotranspiration
ETM	Estuarine Turbidity Maximum
EWA	Environmental Water Account
EWP	Environmental Water Program
°F	Fahrenheit degrees
FCAA	Federal Clean Air Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FID	Fresno Irrigation District
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FMMP	Farmland Mapping and Monitoring Program
FMP	Farm Process
FMS	Flow Management Standard
FMWT	Fall Midwater Trawl Survey
FP	Fully-Protected Species
FPPA	Farmland Protection Policy Act
FR	Federal Register
FRFH	Feather River Fish Hatchery
FRPA	Fish Restoration Program Agreement
FRPP	Farm and Ranch Land Protection Program
FRWP	Freeport Regional Water Project
ft	Foot/Feet
ft/s	Feet per second
FTE	full-time equivalent
GAMA	Groundwater Ambient Monitoring and Assessment
GBP	Grasslands Bypass Project
GCID	Glenn-Colusa Irrigation District
GCM	global climate model
GDP	gross domestic product
GHG	Greenhouse Gas
GIS	geographic information system
gpm	Gallons per minute
GORT	Gate Operations Review Team

GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWh	Gigawatt-hour
GWMP	Groundwater Management Plans
GWP	Global Warming Potential
HAP	Hazardous Air Pollutants
HC	Hydrocarbons
HCP	Habitat Conservation Plan
HFC	hydrofluorocarbons
HFC	High Flow Channel
HGMP	Hatchery Genetic Management Plan
HOR	Head of Old River
HORB	Head of Old River Barrier
I/E or I:E	Inflow to Export Ratio (San Joaquin River)
I-O	Input-Output Model
ID	Irrigation District
IEP	Interagency Ecological Program
IEUA	Inland Empire Utilities Agency
IFIM	Instream Flow Incremental Methodology
IHN	Infectious Hematopoietic Necrosis
ILRP	Irrigated Lands Regulatory Program
in	Inch/Inches
IPCC	Intergovernmental Panel on Climate Change
IPO	Interim Plan of Operation
IRWMP	Integrated Regional Water Management Plan
ISRMA	Interlakes Special Recreation Management Area
ITA	Indian Trust Assets
JCSD	Jurupa Community Services District
JPOD	Joint Point of Diversion
Km	Kilometers
KRCD	Kings River Conservation District
LACSD	Los Angeles County Sanitation District
lbs	Pounds
LFC	Low Flow Channel
LIM	Land Inventory and Monitoring System
LYRA	Lower Yuba River Accord

m	meter
m/day	meters per day
M&I	Municipal and Industrial
m/s	meter per second
MACT	Maximum Achievable Control Technology
MAF	Million acre-feet or Million acre-foot
MBTA	Migratory Bird Treaty Act
MCAA	Monochloroacetic Acid
MCL	Maximum Contaminant Level
MERP	Mercury Exposure Reduction Program
Metropolitan	Metropolitan Water District of Southern California
mg/L	Milligrams per liter
mgd	Million gallons per day
MIDS	Morrow Island Distribution System
MLD	Most Likely Descendent
mm	Millimeter
mmhos/cm	millimhos per centimeter
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MORE	Mokelumne River Water & Power Authority
MOU	Memorandum of Understanding
MRR	minimum release requirements
msl	Mean Sea Level
mS/cm	MilliSiemens per Centimeter
MVCD	Mosquito and Vector Control Districts
MW	Megawatt
MWDOC	Metropolitan Water District of Orange County
MWDSC	Metropolitan Water District of Southern California
MWh	Megawatt-hours
N	Nitrogen
N_2O	Nitrous oxide
NAA	No Action Alternative
NAAQS	National Ambient Air Quality Standard
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
NAICS	North American Industry Classification
NASS	National Agricultural Statistics Service
NAWMP	North American Waterfowl Management Plan

NBA	North Bay Aqueduct
NCPA	Northern California Power Agency
NCCP	Natural Community Conservation Plan
NDWA	North Delta Water Agency
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEPA	National Environmental Policy Act
ng/L	nanograms per liter
NHPA	National Historic Preservation Act
NHTSA	National Highway and Traffic Safety Administration
NMFS	National Marine Fisheries Service
NMFS BO	National Marine Fisheries Service 2009 Biological Opinion
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPPA	Native Plant Protection Act
NPS	National Park Service
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRWQC	National Recommended Water Quality Criteria
NSJCGBA	Northeastern San Joaquin County Groundwater Banking Authority
NSPS	New Source Performance Standards
NSR	New Source Review
NTR	National Toxics Rule
NTU	Nephelometric Turbidity Unit
NWR	National Wildlife Refuge
O_3	Ozone
OBB	Orange Blossom Bridge
OBTCC	Oak Bottom Temperature Control Curtain
OCAP	Operations Criteria and Plan
OEHHA	California Office of Environmental Health Hazard Assessment
OFF	Operations and Fishery Forum
OID	Oakdale Irrigation District
OMR	Old and Middle Rivers

OMWD	Olivenhain Municipal Water District
OWA	Oroville Wildlife Area
P	Phosphorous
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PBDE	Polybrominated Diphenyl Ethers
PBO	Programmatic Biological Opinion
PCB	Polychlorinated Biphenyls
PCE	Perchloroethylene
PCE	Primary Constituent Element
PCWA	Placer County Water Agency
PDA	Public-Domain Allotments
PEIS	Programmatic Environmental Impact Statement
PFC	perfluorocarbons
PFMC	Pacific Fishery Management Council
PG&E	Pacific Gas & Electric Company
PHG	Public Health Goal
PM	Particulate matter
PM_{10}	Particulate matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in aerodynamic diameter
POD	Pelagic Organism Decline
Porter-Cologne Act	Porter Cologne Water Quality Control Act
ppb	Parts per billion (by volume)
ppm	Parts per million (by volume)
PRC	California Public Records Code
Projects	Central Valley Project and State Water Project
PSD	Federal Prevention of Significant Deterioration
psu	Practical Salinity Unit
PTE	Potential To Emit
PWD	Palmdale Water District
RBDD	Red Bluff Diversion Dam
RBPP	Red Bluff Pumping Plant
RCWD	Rancho California Water District
Reclamation	Department of the Interior, Bureau of Reclamation
RHNA	Regional Housing Needs Assessment
RM	River Mile

RMP	Resource Management Plan
ROD	Record of Decision
ROG	Reactive Organic Gas
RPA	Reasonable and Prudent Alternative
RPS	California Renewable Portfolio Standard
RRDS	Roaring River Distribution System
RWQCB	Regional Water Quality Control Board
SA	Settlement Agreement
SAFCA	Sacramento Area Flood Control Agency
SB	Senate Bill
SBA	South Bay Aqueduct
SBC	Second Basis of Comparison
SBCWD	San Benito County Water District
SCDD	Spring Creek Debris Dam
SCE	Southern California Edison
SCI	Sacramento Catch Index
SCVWD	Santa Clara Valley Water District
SDWA	Safe Drinking Water Act
Secretary	Secretary of the Department of the Interior
SED	Substitute Environmental Document
SEWD	Stockton East Water District
SF6	sulfur hexafluoride
SGA	Sacramento Groundwater Authority
SGMA	California Sustainable Groundwater Management Act
Shasta-Trinity LRMP	Shasta-Trinity National Forest Land and Resource Management Plan
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJRRRP	San Joaquin River Restoration Program
SJRTC	San Joaquin River Technical Committee
SJVAPCD	San Joaquin Valley Air Pollution Control District
SLC	State Lands Commission
SLE	St. Louis Encephalitis Virus
SMP	Suisun Marsh Habitat Management, Preservation, and Restoration Plan
SMPA	Suisun Marsh Preservation Agreement
SMSCG	Suisun Marsh Salinity Control Gate
SMUD	Sacramento Municipal Utilities District

SNMP	Salt and Nitrate Management Plan
SO_2	Sulfur Dioxide
SOx	sulfur oxides
SOG	Stanislaus Operations Group (also known as the Stanislaus Operations Team [SOT])
SONCC	Southern Oregon/Northern California Coast
SRA	State Recreation Area
SRCA	Sacramento River Conservation Area
SRCD	Suisun Resource Conservation District
SRES	Special Report on Emissions Scenarios
SRTTG	Sacramento River Temperature Task Group
SRWA	Sacramento River Wildlife Area
SSC	Species of Special Concern
SSJID	South San Joaquin Irrigation District
SSWD	South Sutter Water District
SWAP	Statewide Agricultural Production Model
SWAMP	State Water Resources Control Board Surface Water Ambient Monitoring Program
SWG	Smelt Working Group
SWP	State Water Project
SWPOCO	State Water Project Operations Control Office
SWRCB	State Water Resources Control Board
TAC	Toxic Air Contaminant
TAF	Thousands of acre-feet
TBP	Temporary Barrier Project
TCAA	Trichloroacetic Acid
TCD	Temperature Control Device
TCDD	Tetrachlorodibenzodioxin
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TFCF	Tracy Fish Collection Facility
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
tpy	Tons per year
TRRP	Trinity River Restoration Program
TSS	Total Suspended Sediment
UCD	University of California, Davis
UCCE	University of California Cooperative Extension

USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USFWS BO	U.S. Fish and Wildlife Service 2008 Biological Opinion
USGS	U.S. Geological Survey
USGVMWD	Upper San Gabriel Valley Municipal Water District
UWMP	Urban Water Management Plan
VAMP	Vernalis Adaptive Management Program
VIC	Variable Infiltration Capacity
VOC	Volatile organic compound
VVWRA	Victor Valley Wastewater Reclamation Authority
WBMWD	Western Basin Municipal Water District
WBS	water balance subregion
WDCWA	Woodland-Davis Clean Water Agency
WEE	Western Equine Encephalitis
Western	Western Area Power Administration
WMA	Wildlife Management Area
WMD	Western Municipal Water District
WNV	West Nile Virus
WOMT	Water Operations Management Team
WQCP	Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary
WR	Water Rights
WRESL	water resources simulation language
WRO	Water Rights Order
WSD	Water Storage District
WSRCD	Western Shasta Resource Conservation District
WUA	Weighted Useable Area
ww	wet weight
WY	Water Year
YCWA	Yuba County Water Agency
YOY	Young-of-the-Year
Yuba Accord	Lower Yuba River Accord