Environmental Water Account

Draft Supplemental Environmental Impact Statement/Environmental Impact Report —

to the EWA Final EIS/EIR

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
Sacramento, California

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Draft Supplemental Environmental Impact Statement/Environmental Impact Report – to the EWA Final EIS/EIR

Prepared by

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United States Fish and Wildlife Service

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Sacramento, California

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DRAFT
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT (EIS)/ ENVIRONMENTAL IMPACT REPORT (EIR) FOR THE ENVIRONMENTAL WATER ACCOUNT (EWA) FINAL EIS/EIR

State Clearinghouse # 1996032083
State of California

Co-Lead Agencies:
Lead Agency for the EIS: U.S. Department of the Interior, Bureau of Reclamation
Lead Agency for the EIR: California Department of Water Resources

Cooperating Agencies:
U.S. Fish and Wildlife Service
National Marine Fisheries Service
California Department of Fish and Game

ABSTRACT
This Draft Supplement to the Final EIS/EIR for the EWA provides an evaluation of the effects associated with extending the current EWA through 2011. The effects of the current EWA program were assessed in the July 2003 EIS/EIR and the January 2004 Final EIS/EIR. Records of Decision were signed in March and September 2004. The EIS/EIR, referred to henceforth as the "2004 EIS/EIR" addressed an EWA program to be carried out from 2004 to 2007. A Supplement is needed because the period of analysis addressed in the 2004 EIS/EIR was through 2007 and because several changes in the environmental setting/affected environment have occurred since the completion of the 2004 EIS/EIR.

The EWA consists of two primary elements: facilitation of fish population recovery through asset (water) acquisition and management, and use of the acquired assets to replace water deliveries (or supplies) interrupted by changes in State Water Project/Central Valley Project (Project) operations. This Draft Supplement analyzes three alternatives, including two action alternatives that involve the acquisition of EWA assets via stored surface water, stored groundwater, groundwater substitution, and crop idling purchases; with EWA asset management through source shifting, groundwater storage, and borrowing of Project water. The alternatives differ primarily in actions taken to protect fish and the quantities of assets acquired under each. The Supplement reviewed all resource areas addressed in the 2004 EIS/EIR to determine whether any changes to the regulatory or environmental settings would change the impact conclusions stated in the 2004 EIS/EIR. With the exception of fisheries and aquatic ecosystems, no other resource areas produced different conclusions or findings from that of the 2004 EIS/EIR.

This Draft Supplemental EIS/EIR is prepared in compliance with the National Environmental Policy Act (NEPA), Bureau of Reclamation NEPA procedures, and the California Environmental Quality Act (CEQA) and CEQA Guidelines.

Comments on this document must be submitted to the below address by December 10, 2007.

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Executive Summary

Purpose of Study and Environmental Impact Statement/Environmental Impact Report

The purpose of the Supplemental Environmental Impact Statement/Environmental Impact Report (EIS/EIR) to the Environmental Water Account (EWA) Final EIS/EIR (2004 EIS/EIR) is to provide an evaluation of the effects associated with extending the current EWA[1] through 2011. A Supplement is needed because the period of analysis addressed in the 2004 EIS/EIR was through 2007 and because several changes in the environmental setting/affected environment have occurred since the completion of the 2004 EIS/EIR. The Supplement has been prepared in accordance with the provisions of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). More specifically, the new and additional information that supplements the Final EIS/EIR complies with the Federal Council on Environmental Quality Regulations Section 1502.9(c) regarding preparation of a Supplement to an EIS, and CEQA Guidelines Section 15163(a) regarding preparation of a Supplement to an EIR.

The 2004 EIS/EIR addressed the EWA program through 2007. The EWA agencies propose to continue the EWA program beyond 2007. Therefore, this document supplements the 2004 EIS/EIR. In 2004, the EWA agencies began the preparation of an EIS/EIR for a proposed Long-Term EWA program. In 2006, the five EWA agencies determined that completion of the Long-Term EWA Draft EIS/EIR would be postponed until completion of multiple environmental and program-related documents including ongoing investigations into the apparent Delta pelagic organism decline and ongoing planning for the proposed Bay-Delta Conservation Plan. The EWA implementing agencies propose to extend the existing EWA program until these uncertainties are resolved.

Changes that Require a Supplement

NEPA and CEQA require a supplement when there are substantial changes in a proposed project or the circumstances under which the project is undertaken that are relevant to environmental concerns. A supplement is also required when new information of substantial importance becomes available and is relevant to

1 The current EWA was assessed in the EIS/EIR finalized in January 2004 and the EWA Record of Decision was signed in March of 2004. The EIS/EIR, referred to henceforth as the "2004 EIS/EIR" addressed an EWA program to be carried out from 2004 to 2007, which was the end of stage 1 of CALFED.

the environmental analysis. In the case of the EWA, the essence of the project as originally proposed has not substantially changed; however, the implementation timeframe that was originally anticipated may be extended by up to four years. Additionally, several years have passed since the 2004 EIS/EIR was completed and the existing environmental and regulatory settings (i.e., the environmental and regulatory basis of comparison for the purposes of the CEQA impacts analysis) are now different relative to some environmental topics and/or new information is now available. In that regard, the hydrologic modeling used in evaluating biological/aquatic resource impacts now has additional capabilities relative to understanding the implications of certain fish actions under the EWA program. This Supplement has been prepared in light of the aforementioned changes in circumstances and new information in order to carefully and systematically evaluate if and how such changes and new information affect the analysis presented in the 2004 EIS/EIR. This Supplement, along with the 2004 EIS/EIR, provides the public, reviewing agencies, and decision-makers with a complete up-to-date analysis of the EWA program as currently under consideration.

Statement of Purpose and Need/Project Objectives

The purpose and need/project objectives for the proposed action are to: 1) provide a highly flexible, immediately implementable, water management strategy that protects the at-risk native Delta-dependent fish species affected by SWP/CVP operations and facilities, 2) contributes to the recovery of these fish species, 3) allows timely water management responses to changing environmental conditions and changing fish protection needs, 4) improves water supply reliability for water users downstream from the Delta, and 5) does not result in uncompensated water cost to the Projects' water users. This water management strategy must also be consistent with the preferred program alternative selected by the CALFED Bay-Delta Program (CALFED) agencies in the CALFED Record of Decision (ROD).

EWA Description

The EWA program consists of two primary elements: facilitation of fish population recovery through asset (water) acquisition and management, and use of the acquired assets to replace water deliveries (or supplies) interrupted by changes in project operations. That is, the EWA program helps facilitate fish population recovery by reducing pumping in the Delta when fish are most at risk. EWA agencies would also acquire water either for direct environmental use, or to repay State Water Project (SWP) and Central Valley Project (CVP) contractors whose supplies would have otherwise been interrupted by actions taken to benefit fish.

EWA agencies may take actions to benefit fish that include:

- **Pump Reductions –** Decreasing export pumping from the Delta when at-risk fish species are determined to be within the vicinity of the SWP and CVP pumping stations.
- **Delta Cross Channel Gates Closure –** Closing the Delta Cross Channel (DCC) Gates (beyond closures required without the EWA) to restore natural flow patterns and to encourage fish to migrate through the most suitable water channels away from the SWP and CVP pumping stations.
- **Instream Flow Augmentation –** Increasing the streamflow of rivers tributary to the Delta (through releases of EWA assets stored in onstream reservoirs) to improve spawning, migration, and rearing habitats.
- **Delta Outflow Augmentation –** Increasing the Delta outflow quantity to repel saline San Francisco/San Pablo Bay water from the Delta, to improve the water quality in Delta habitats, and to improve fish outmigration.

The asset acquisition measures available to the EWA agencies include:

- **Stored Reservoir Water Purchase –** Purchasing surface water stored in non-Project reservoirs (not CVP or SWP reservoirs).
- **Groundwater Substitution –** Purchasing surface water supplies (typically stored in a reservoir) while the users forego their surface water supplies and pump an equivalent amount of groundwater as an alternative supply.
- **Crop Idling/Crop Shifting –** Purchasing water from agricultural users who then idle land that would otherwise have been in production or shift to less water-intensive crops.
- **Stored Groundwater Purchase –** Purchasing groundwater assets that were previously stored by the selling agency with the intent to sell a portion of those assets at a later date. This option differs from groundwater substitution in that groundwater substitution transfers would not come from water that had been previously stored.
- **Variable Assets –** Obtaining water through a regulatory or operational change in the Delta that allows water to be diverted from the Delta specifically for the EWA.

In addition to managing the acquired water, the EWA agencies may use the following asset management measures:

- **Source Shifting –** Providing water earlier or delaying water deliveries to a Project contractor. Under the earlier delivery, the EWA agencies would be essentially borrowing storage space from the contractors' facilities for a fee until the time the contractor would normally have received the water. Under the delayed delivery, the EWA agencies would be essentially holding water in San Luis Reservoir for a fee and returning the water at a later date.

- **Stored Water –** Purchasing stored water from the south-of-Delta sources to be used as collateral for borrowing (released only when all other assets have been expended), and to function as long-term storage space after the water has been released; and.

- **Borrowing Project Water –** Borrowing CVP or SWP water, if the water can be repaid without affecting deliveries to Project contractors. The EWA could also borrow Project storage space if the Projects do not need that space for other designated uses.

- **Exchange of EWA Assets –** Exchanging EWA assets for assets of a character, such as location, seasonality or year-type, more suitable to EWA purposes.

No Action/No Project Alternative

The No Action/No Project Alternative describes the future conditions without the EWA program, defined as those CVP/SWP operational and environmental conditions that would reasonably be expected in the foreseeable future if the EWA program were not approved. The No Action Alternative assumes the existing regulatory and legal constraints. This alternative also describes the conditions that would occur if the EWA program did not receive funding in the future.

If the EWA program were not implemented, some actions to protect fish and benefit the environment would continue under the existing baseline of fishery protection. The agencies have reinitiated consultation on the current biological opinions; these revised opinions would establish the fish actions in the No Action Alternative. While the fish actions in these revised biological opinions are unknown, they would likely be less than with the EWA program.

Flexible Purchase Alternative (The Proposed Action/Proposed Project)

The Flexible Purchase Alternative would allow the EWA agencies the ability to acquire up to 600,000 acre-feet of water assets (although the EWA agencies would typically acquire 200,000 to 300,000 acre-feet annually, except in years with high fish needs) to address pump reductions and other fish actions, and to compensate the CVP/SWP for water otherwise lost due to those actions. These actions would include reducing Delta export pumping, closing the DCC gates, augmenting Delta outflow, or increasing instream flows. The EWA agencies would have the flexibility to choose from these actions to best protect at-risk fish, and would not need to solely focus on actions within the Delta. The Flexible Purchase Alternative would provide higher levels of fish actions than either of the other alternatives.

The Flexible Purchase Alternative analysis only assesses the effects associated with purchases up to 600,000 acre-feet. If pumping would be likely to put at risk the continued existence of a species listed as endangered or threatened under the Endangered Species Act (ESA), the Project Agencies would curtail pumping even if purchases already totaled 600,000 acre-feet and all assets were used. However, the EWA agencies would need supplemental environmental documentation before they could acquire more water to compensate water users for these actions.

Fixed Purchase Alternative

In the Fixed Purchase Alternative, the EWA agencies could take the same types of fish actions identified in the No-Action/No Project and Flexible Purchase Alternatives, but the assets available would limit the magnitude of the actions. This alternative limits the EWA agencies to purchases of the 185,000 acre-feet identified in the CALFED ROD (35,000 acre-feet upstream from the Delta and 150,000 acre-feet in the Export Service Area) and would not use functional equivalency to adjust purchase location. Water purchases would be limited to the 185,000 acre-feet per year regardless of water year type. In this alternative, the volumes that the EWA agencies would purchase from each region would remain constant every year. The Fixed Purchase Alternative has the benefits of variable assets, source shifting, and groundwater storage as described in the ROD. In this alternative, the EWA agencies would acquire variable assets at the same rate as in the Flexible Purchase Alternative.

The Fixed Purchase Alternative analysis only assesses the effects associated with purchases up to 185,000 acre-feet. If pumping would be likely to put at risk the continued existence of a species listed as endangered or threatened under the ESA, the Project Agencies would curtail pumping even if purchases already totaled 185,000 acre-feet and all assets were used. However, the EWA agencies would need supplemental environmental documentation before they could acquire more water to compensate water users for these actions.

Comparison of Alternatives

Table ES-1 presents a comparison of the EWA asset acquisition and strategies for the project alternatives.

Table ES-1. Comparison of EWA Alternatives

EWA Actions	No Action/No Project	Flexible Purchase Alternative	Fixed Purchase Alternative
Fish Actions			
Pumping Reductions	Reductions because of regulatory requirements only; limited ability to repay water not delivered due to pump curtailments	Ability to provide fish protection actions at Delta pumps beyond those required by regulations, but limited to the total volume of water acquired, variable assets, and debt without interrupting water supply. Availability of 600 TAF[1] of water increases opportunity for fish actions and ability to repay Projects for water not delivered during pump curtailments.	Ability to provide fish protection actions at Delta pumps beyond those required by regulations, but limited to total volume of water acquired, variable assets, and debt without interrupting water supply. Availability of 185 TAF of water increases opportunity for fish actions and ability to repay Projects for water not delivered during pump curtailments.
Upstream Flow Enhancements for Fish Recovery/Enhancements	No potential for upstream flow enhancements beyond existing programs	The magnitude of potential benefits would vary between rivers but would be limited by the volume of upstream purchases moved during the transfer window, which could be up to 600,000 acre-feet.	The magnitude of potential benefits would vary between rivers but would be limited by the volume of upstream purchases moved during the transfer window, which could be up to 35,000 acre-feet.
Asset Acquisition			
Stored Reservoir Purchase	No purchases	Purchases of up to 135 TAF in dry years; wet year purchases would be limited to the Delta[2] pump capacity available to EWA of approximately 50-60 TAF	Limited to 35 TAF Upstream from the Delta
Groundwater Substitution (Upstream from the Delta)	No purchases	Purchases of up to 340 TAF in dry years, but only approximately 50-60 TAF in wet years; groundwater substitution would most likely be exercised in dry years but not in wet years due to pump capacity	Limited to 35 TAF Upstream from the Delta; probably would not be exercised in most years because 35 TAF can be obtained from stored water sources
Groundwater Purchase (Upstream from the Delta)	No purchases	Purchases of up to 10 TAF in dry and wet years.	Limited to 10 TAF Upstream from the Delta; probably would not be exercised in most years because 35 TAF can be obtained from stored water sources
Groundwater Purchase (Export Service Area)	No purchases	150 TAF maximum; stored groundwater purchase would not be available each year	Purchase of up to 150 TAF maximum; stored groundwater purchase would not be available each year
Crop Idling (rice Upstream from the Delta);	No purchases	Purchases of up to 290 TAF in dry years and approximately 50-60 TAF in wet years. Crop idling would probably not be exercised in wet years.	Limited to 35 TAF Upstream from the Delta; probably would not be exercised in most years because 35 TAF can be obtained from stored water sources
Crop Idling (cotton within Export Service Area)	No purchases	Purchases of up to 260 TAF; higher amounts would be expected for wet years when EWA has less pump capacity to export water from Delta	Purchase of up to 150 TAF maximum within Export Service Area

EWA Actions	No Action/No Project	Flexible Purchase Alternative	Fixed Purchase Alternative
Variable Assets	Projects can access water from Joint Point of Diversion; Relaxation of the Section 10 Constraint; and Relaxation of the Export/ Inflow Ratio	Variable amounts of water available to EWA each year through changes in Delta operations.	Same as Flexible Purchase Alternative
Asset Management Activities			
Groundwater Storage (banking)	No storage	Up to 200 TAF	200 TAF addressing CALFED ROD first year EWA requirement
Source Shifting	Available to water users	Source shifting to protect San Luis is available	Source shifting to protect San Luis is available
Project Water Borrowing	No project borrowing to repay water not delivered due to pump curtailments	Potential for borrowing water for later repayment of up to 100 TAF	Potential for borrowing water for later repayment of up to 100 TAF

Notes:
[1]TAF = thousand acre feet
[2]Hydrologic modeling of Delta pump capacity indicates that there would be 50 TAF of excess capacity available to EWA during wet years and up to 520 TAF in dry years. Delta pump capacity is a limiting factor on the quantity of water EWA agencies can purchase and export to the CVP/SWP service areas.

Because of its wider potential range of purchases and actions, the Flexible Purchase Alternative would have a greater potential for environmental, physical, and socioeconomic effects in wet years than the Fixed Purchase Alternative. However, the Management Agencies would have greater potential for operational changes that benefit fish while keeping the Project contractors whole (provide for replacement water), plus greater opportunities for Delta outflow benefits and for upstream flow enhancements. During dry years, less water would be available for the Projects to export to Project contractors, and the Delta pumps would have more pumping capacity available for EWA use than in wet years.

Although both the Fixed Purchase and Flexible Purchase alternatives could achieve similar benefits, the Flexible Purchase Alternative would have a greater potential to achieve fishery protection, enhancement, and recovery goals than the Fixed Purchase Alternative. The behavior of fish at the Delta pumps—the timing of their arrival (typically winter and spring; December through June) and the length of their stay—varies year-to-year and cannot be predicted in advance. Years in which the fish arrive late and leave early may require fewer pump reductions than other years and the Fixed Purchase Alternative may have adequate assets to cover those reductions as well as providing water for upstream fish enhancements.

In years in which the fish arrive early and leave later, pump reductions may occur more often, resulting in the potential for insufficient assets to address Project water commitments under the Fixed Purchase Alternative. In such years, the Flexible Purchase Alternative would have a greater potential for meeting both the Project water commitments and the fish enhancement benefits intended for EWA under the CALFED ROD.

Major Conclusions and Findings

The Supplement reviewed all resource areas addressed in the 2004 EIS/EIR to determine whether any changes in the regulatory setting or environmental setting would change the impact conclusions stated in the 2004 EIS/EIR. Table ES-2 lists whether there is a regulatory, an environmental, or no substantive change. Additionally, the Supplement considered the effects of climate change (although not evaluated quantitatively), which was not included as a resource area in the 2004 EIS/EIR.

With the exception of fisheries and aquatic ecosystems, none of the changes listed in Table ES-2 changed the conclusions and findings of the 2004 EIS/EIR. (See Appendix A for a list of the impacts, mitigation measures, and beneficial impacts included in the 2004 EIS/EIR that are also applicable to this Supplement. The Delta fisheries sections of the tables are deleted and are superseded with the information below. Additionally, Placer and Tulare Counties are deleted from the tables because they would not be a participant in the EWA program evaluated in this Supplement[2].)

Table ES-2. Changes to the Resource Area Regulatory and Environmental Settings

Resource Area	Regulatory Setting Change[1]	Environmental Setting Change[1]	No Substantive Change
Water supply			X
Water quality		X	
Groundwater			X
Geology and soils			X
Air quality	X	X	
Fisheries and aquatic ecosystems	X	X	
Vegetation and wildlife	X		
Regional and agricultural economics		X	
Agricultural social issues		X	
Agricultural land use		X	
Recreation		X	
Flood control			X
Power	X		
Cultural			X
Visual			X
Environmental justice		X	
Indian Trust Assets			X

Notes:
[1] Indicates regulatory and environmental setting changes from the 2004 EIS/EIR. See resource area sections in Chapter 3 for need for new analysis and significance determinations.

[2] Since publication of the 2004 EIS/EIR, the EWA agencies have decided that they would not purchase water through crop idling from the Friant Division. Tulare County contains primarily Friant Division contractors; therefore, Tulare County was removed from the Export Service Area. Placer County Water Agency has indicated that they would not sell water through crop idling to the EWA agencies; therefore, Placer County was removed from the Upstream from the Delta region.

A substantive change has occurred to the regulatory and environmental setting for fisheries and aquatic ecosystems which is the focus of this Supplement. The following sections describe adverse impacts, beneficial impacts, and mitigation measures associated with Delta fish that are in addition to the findings of the 2004 EIS/EIR for fisheries and aquatic ecosystems.

Impacts and Beneficial Effects

Table ES-3 compares the effects for the Flexible and Fixed Purchase Alternatives. The following text also describes the impacts and beneficial effects for the three main areas of analysis: Delta outflow, X2, and entrainment, relative to the Baseline Conditions.

- The Flexible and Fixed Purchase Alternatives would result in a less than significant reduction of Delta outflow in October through December, due in part to the conservation measures included as part of the project.
- The Flexible Purchase Alternative would have a less than significant impact on X2 location during June through December. The Fixed Purchase Alternative would have a less than significant impact on X2 location during April through December.
- The Flexible Purchase Alternative would have a significant adverse impact on two non-native species (threadfin shad and American shad) for entrainment indices. This would be a significant and unavoidable impact.
- The Fixed Purchase Alternative would have a less-than-significant impact on two non-native species (threadfin shad and American shad) for entrainment indices.

Beneficial Impacts

- The Flexible and Fixed Purchase Alternatives would have a beneficial effect on Delta outflow during the most critical periods of the year, January and February.
- The Flexible Purchase Alternative would have a beneficial effect on X2 location during January through May. The Fixed Purchase Alternative would have a beneficial effect on X2 location during January through March.
- The Flexible and Fixed Purchase Alternatives would have a beneficial effect on entrainment indices for all listed species and most native species.

Conservation Measures

The fisheries and aquatic ecosystems chapter does not include any mitigation measures, but does include conservation measures (conservation measures included in the ASIP (Appendix C) are incorporated into the EWA project). These conservation measures have not changed from the 2004 EIS/EIR and

ASIP. However, the updated impacts analysis incorporates one conservation measure at a new time of year:

- The EWA agencies will avoid acquisition and transfer of water that would reduce flows essential to maintaining populations of native aquatic species in the source river.

Table ES-3. Summary Comparison of Effects of the EWA Action Alternatives

Potentially Affected Resource Parameter	Flexible Purchase Alternative	Fixed Purchase Alternative
Outflow	B-Jan-Feb	B-Jan-Feb
Changes in location of X2 (Monthly)	B- Jan-May	B-Jan-Mar
Entrainment		
Delta Smelt	B	B
Delta Smelt - Pre-spawning and Adults[1]	B	B
Delta Smelt - Juveniles[2]	B	B
Striped bass	LTS	LTS
Longfin Smelt	B	B
Threadfin Shad	S	LTS
Fall-Run Chinook[3]	B	B
Late Fall-Run Chinook[3]	B	B
Winter-Run Chinook[3]	B	B
Spring-Run Chinook[3]	B	B
Steelhead[3]	B	B
Splittail	LTS	LTS
American shad	S	LTS

Notes:
This table compares the effects and level of significance of the action alternatives to Baseline conditions.
B = Beneficial
LTS = Less than Significant Impact (May Contain Beneficial Impacts)
S = Significant Impact
[1]January through March
[2]April through June
[3]Entrainment indices based on loss ratios instead of only salvage numbers

Compliance with Applicable Laws and Regulations

This Supplemental EIS/EIR complies with NEPA and CEQA requirements. The Proposed Action/Proposed Project, as defined herein, would comply with all Federal, State, and local laws and permitting requirements.

Identification of Environmentally Preferred Alternative

Although the Fixed Purchase and Flexible Purchase alternatives involve similar water acquisition and management actions, their primary delineator is the magnitude of benefits that each alternative could provide for protecting at-risk fish species and at the same time addressing water supply commitments of the CVP and SWP. The Flexible Alternative would include higher levels of asset acquisition, which would allow the EWA agencies to take more actions to benefit fish. The Fixed Purchase Alternative would limit assets requiring the Management Agencies to prioritize their actions to address pump reductions only. The Flexible Purchase Alternative is the environmentally preferred alternative because of the increased benefits it would provide.

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Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

AF	acre-feet
APCD	Air Pollution Control District
ASIP	Action Specific Implementation Plan
AQMD	Air Quality Management District
BA	biological assessment
BDCP	Bay Delta Conservation Plan
BO	Biological Opinion
CALFED	CALFED Bay-Delta Program
CCF	Clifton Court Forebay
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CMP	conservation management practice
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
DCC	Delta Cross Channel
DMC	Delta-Mendota Canal
Delta WQCP	Delta Water Quality Control Plan
DRRIP	Drought Risk Reduction Investment Program
DSRAM	Delta smelt risk assessment matrix
DWR	Department of Water Resources
E/I ratio	export/inflow ratio
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
EWA	Environmental Water Account
FMMP	Farmland Mapping and Monitoring Program
IEP	Interagency Ecological Program
JPOD	Joint Point of Diversion
KLCI	Knights Landing catch index
M&I	municipal and industrial
MSCS	Multi-Species Conservation Strategy

msl	mean sea level
MWD	Metropolitan Water District
NAAQS	National Ambient Air Quality Standards
NCCPA	Natural Community Conservation Planning Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOC	Notice of Completion
NOI	Notice of Intent
NOP	Notice of Preparation
OCAP	Operations Criteria and Plan
ppt	parts per thousand
POD	pelagic organism decline
Reclamation	United States Department of the Interior, Bureau of Reclamation
ROD	Record of Decision
SB	Senate Bill
SDIP	South Delta Improvements Program
SVWMA	Sacramento Valley Water Management Agreement
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre feet
UCCE	University of California Crop Extension
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VAMP	Vernalis Adaptive Management Plan
Western	Western Area Power Administration
X2	2 parts per thousand salinity near-bottom isohaline
Yuba Accord	Lower Yuba River Accord
Yuba County WA	Yuba County Water Agency

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Chapter 1 Introduction

1.1 Purpose of Supplement to the EIS/EIR

In January 2004, the Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Environmental Water Account (EWA) was completed. As described in greater detail below, in Section 1.2, the CALFED Bay-Delta Program (CALFED) Programmatic EIS/EIR Record of Decision (ROD) provides for implementation of the EWA. The CALFED ROD defines the EWA as a 4-year program, unless the EWA agencies agree in writing to extend the program. The EIS/EIR completed in 2004 for the EWA, referred to henceforth as the "2004 EIS/EIR," analyzed the EWA program actions through 2007, which was the end of "Stage 1" identified in the ROD. In light of subsequent events and considerations, described below, the EWA program is proposed to be extended an additional four years, through 2011. The purpose of this Draft Supplemental EIS/EIR to the EWA Final EIS/EIR is to provide an evaluation of the effects associated with extending the EWA through 2011. A Supplement is needed because the period of analysis addressed in the 2004 EIS/EIR is through 2007 and because of several changes in the environmental setting/affected environment. The Supplement has been prepared in accordance with the provisions of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). More specifically, the new and additional information that supplements the 2004 EIS/EIR complies with the Federal Council on Environmental Quality Regulations Section 1502.9(c) regarding preparation of a Supplement to an EIS, and CEQA Guidelines Section 15163(a) regarding preparation of a Supplement to an EIR.

1.2 Project History

The EWA consists of two primary elements: (1) assisting in protection and recovery of at-risk native fish species; and (2) increasing water supply reliability by reducing uncertainty associated with fish recovery actions. The EWA program makes environmentally beneficial changes in the operations of the State Water Project (SWP) and the Federal Central Valley Project (CVP) (jointly referred to as the "Projects"). Protective actions for at-risk native fish would include reducing Delta exports, closing the Delta Cross Channel (DCC) beyond closures required without the EWA, increasing instream flows, and augmenting Delta outflows.

The EWA agencies (Bureau of Reclamation (Reclamation), Department of Water Resources (DWR), California Department of Fish and Game (CDFG), National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (USFWS)) acquire water assets to enable them to take protective actions for fish while increasing water supply reliability for water users. The EWA agencies obtain water assets by acquiring, banking, transferring, or borrowing water and then arranging for its conveyance. Water would be acquired through voluntary purchases in the water transfer market or by developing additional assets over time. The EWA program also obtains water through operational flexibility of Delta facilities.

The CALFED Programmatic EIS/EIR identified and analyzed the EWA, and the ROD stated that the EWA agencies would implement the program for the first four years of Stage 1.[1] The EWA agencies decided to analyze the EWA program through the end of Stage 1 in the 2004 EIS/EIR; implementing agencies anticipated making decisions on elements of other CALFED programs during this time that could affect the description of the EWA in the future. If the EWA agencies decided to continue the EWA beyond 2007, they could complete additional documentation on a longer-term program, incorporating any relevant changes to CALFED programs at that point.

The EWA agencies completed the Final EIS/EIR for the EWA in January 2004. The March 2004 ROD and Notice of Determination for the EIS/EIR documented the decision to implement the preferred alternative termed the Flexible Purchase Alternative. The Flexible Purchase Alternative allows the EWA agencies to acquire up to 600,000 acre-feet of water to use for fish actions through the following acquisition and management methods: (1) Delta operations: altering Delta Project operations, when environmental conditions allow, to export additional water (also called variable assets); (2) Water purchases: purchasing water from willing sellers both upstream from the Delta and within the Export Service Area; (3) Water storage: purchasing stored water from the Export Service Area sources to be used as collateral for borrowing (released only when all other assets have been expended), and to function as long-term storage space after the water has been released; (4) Source shifting: delaying delivery of water to a Project contractor, who would use water from an alternative source until the water is paid back; and (5) Exchanges: exchanging EWA assets for assets of character, such as location, seasonality, or year-type, more suitable to EWA purposes. The Memorandum of Understanding between the EWA agencies (September 30, 2004) documented the decision to extend implementing the Flexible Purchase Alternative of the EWA through December 31, 2007, the end of Stage 1.

After implementing the Flexible Purchase Alternative for a period, the EWA agencies decided to analyze continuing the EWA for a longer period of time.

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[1] The first 7 years of the Phase II implementation phase are referred to as Stage 1, which is intended to set forth the direction and build the foundation for long-term Phase III actions.

The EWA agencies had anticipated release of an EIS/EIR for the proposed Long-Term EWA in 2007. However, various environmental and program-related uncertainties caused the EWA agencies to delay completion of the EIS/EIR for the proposed Long-Term EWA. The environmental and program-related uncertainties include:

- **Bay Delta Conservation Plan**. The Bay Delta Conservation Plan (BDCP) will develop conservation strategies for State- and Federally-covered species and their habitats. The BDCP is intended to meet the requirements of State and Federal endangered species laws that apply to Project operations, and to provide the basis for State and Federal authorizations for the take of covered species (Resources Agency 2006). The BDCP is scheduled to be completed by the end of 2009. The BDCP could incorporate the EWA or EWA-like actions into the overall plan for the Delta, which would undergo environmental analysis along with the rest of the BDCP. The BDCP could eliminate the need for independent environmental review of the effects of EWA actions on covered species, or could change the types of actions needed for the EWA.

- **Delta Vision**. "Delta Vision is intended to identify a strategy for managing the Sacramento-San Joaquin Delta as a sustainable ecosystem that would continue to support environmental and economic functions that are critical to the people of California (CALFED 2007)." Phase I work will assess current conditions and practices in the Delta and develop alternative Delta management scenarios. Phase II will create a strategic plan that will identify and evaluate alternative management practices necessary to implement Delta Vision recommendations. It is uncertain what role the EWA will have in the Delta Vision, or whether the EWA as it is defined will still exist. A report on the final Delta Strategic Plan will be submitted by the Delta Vision Committee to the Governor and Legislature by December 31, 2008.

- **Pelagic Organism Decline (POD)**. Record low numbers of delta smelt and other species without a known cause have alarmed resource agencies and environmental groups. Several studies are ongoing, the results of which may affect Project operations. Section 1.5 provides background and current status of the POD. More scientific study of the POD will hopefully further the understanding of how changing Project operations affects fish, which could alter the project description for the EWA.

- **Biological Opinions (BOs)**. Reclamation, along with DWR as an applicant, has reinitiated consultation under the Federal Endangered Species Act (ESA) for BOs on the long-term operations of the CVP/SWP. The current biological opinions from USFWS (2005) and

NMFS (2004) are the subject of lawsuits (*NRDC v. Kempthorne)*. The U.S. District Court for the Eastern District of California has found the biological opinion issued by USFWS to be arbitrary and capricious in certain respects. The Court has selected remedies for this violation of the Administrative Procedures Act. The existing BO includes the EWA program; however, the contents of future BOs are uncertain.

In order to evaluate the EWA program for the long-term, the environmental conditions during that timeframe need to be generally understood. Decisions that will be made within the next few years will likely shape the long-term environmental setting. Therefore, the EWA agencies have chosen to wait for more information on the above-mentioned items before initiating a new EIS/EIR for a long-term EWA program.

1.3 Changes that Require a Supplement

NEPA and CEQA require a supplement when there are substantial changes in a proposed project or the circumstances under which the project is undertaken that are relevant to environmental concerns. A supplement is also required when new information of substantial importance becomes available and is relevant to the environmental analysis. In the case of the EWA program, the essence of the project as originally proposed has not substantially changed; however, the implementation timeframe that was originally anticipated has been extended by four years. Additionally, several years have passed since the 2004 EIS/EIR was completed and the existing environmental and regulatory setting (i.e., the environmental baseline for the purposes of the CEQA impacts analysis) is now different relative to some environmental topics, and/or new information is now available. In that regard, the hydrologic modeling used in evaluating biological/aquatic resource impacts now has additional capabilities relative to understanding the implications of certain fish actions under the EWA program. This Supplement has been prepared in light of the aforementioned changes in circumstances and new information in order to carefully and systematically evaluate if and how such changes and new information affect the analysis presented in the 2004 EIS/EIR. This Supplement, along with the 2004 EIS/EIR, provides the public, reviewing agencies, and decision-makers with a complete up-to-date analysis of the EWA program as currently proposed.

1.4 Statement of Purpose and Need/Project Objectives

The purpose and need/project objectives for the proposed action remain unchanged from the 2004 EIS/EIR and are to: 1) provide a highly flexible, immediately implementable, water management strategy that protects the at-risk native Delta-dependent fish species affected by SWP/CVP operations and facilities, 2) contribute to the recovery of these fish species, 3) allow timely water management responses to changing environmental conditions and changing fish protection needs, 4) improve water supply reliability for water users downstream from the Delta, and 5) does not result in uncompensated water cost to the Projects' water users. This water management strategy must also be consistent with the preferred program alternative selected by the CALFED agencies in the CALFED ROD.

1.5 Issues of Known Controversy

Since completion of the 2004 EIS/EIR, the POD has become an issue of known controversy, primarily because of the uncertainty in the cause of the POD and the mechanisms by which it can be reversed. The issue is summarized below, and Chapter 4 describes the issue in greater detail.

1.5.1 Background

Abundance indices calculated by the Interagency Ecological Program (IEP) between 2002 and 2004 were at record lows for delta smelt (*Hypomesus transpacificus*) and age-0 striped bass (*Morone saxatilis*), and near-record lows for longfin smelt (*Spirinchus thaleichthys*) and threadfin shad (*Dorosoma petenense*) (USGS 2007). The decline occurred despite moderate winter/spring flows, which typically results in at least modest recruitment, and substantial investments in habitat restoration and environmental water to support native fishes (DWR 2007). During the same timeframe, the San Francisco Bay Study did not show significant declines in its catches of marine/lower estuary species, indicating the problem appears to be limited to fish dependent on the upper estuary (CALFED 2007a). In response to the decline in these abundance indices, the IEP formed a POD work team to evaluate the potential causes.

The POD work team organized an interdisciplinary effort that included scientists from the DWR, CDFG, Central Valley Regional Water Quality Control Board, Reclamation, U.S. Environmental Protection Agency (USEPA), U.S. Geological Survey, California Bay-Delta Authority, San Francisco State University, and University of California at Davis. The work team put together an initial conceptual model that included three general factors that may be acting individually or collectively to lower pelagic productivity: toxins, invasive species, and water project operations. Beginning in 2005, the model was used to identify likely causes, and to assign priorities to projects in four general areas: an expansion of existing monitoring; analyses of existing data; new studies; and ongoing studies.

1.5.2 Current Status

The Pelagic Fish Action Plan (Resources Agency, DWR, & CDFG 2007) was written in response to a June 2006 request from the Legislature for the Resources Agency to report on proposed actions to address POD. The March 2007 report summarizes a total of 18 actions that are being implemented or under consideration to improve conditions in the Delta for pelagic fish species. Actions are grouped into the following categories: comprehensive ecosystem evaluation, water project, invasive species, habitat improvement, and food web actions.

The 2007 20-mm survey for juvenile delta smelt has collected record low numbers of juvenile delta smelt. A total of 137 individuals were collected, about 11.5 percent of the 1,190 collected in 2006, and only 8.2 percent of the 2000-2006 average of 1,656 (White 2007).

It is still unclear what role, if any, Project operations, toxins, and invasive species have in the decline of delta smelt.

1.5.3 Legal Proceedings

On August 31, 2007, U.S. District Court Judge Oliver Wanger issued a preliminary injunction that grants certain relief in the case of *NRDC v. Kempthorne*. This case is regarding the biological opinion issued by USFWS (2005) on long-term operations of the Projects, which Judge Wanger found to be arbitrary and capricious in certain respects. Judge Wanger has not issued a final order or judgment on this case, but the preliminary injunction includes flow targets based on remedy proposals from the parties to the lawsuits. The parties will use Judge Wanger's verbal findings to develop the details of flow and pumping requirements necessary to protect the delta smelt by October 22, 2007.

The export restrictions in the ruling will be in effect until the USFWS issues a new BO. This interim period will likely last approximately one year. It would be speculative to assume that the fish actions in the BO will be the same as those described by Judge Wanger because the BO will be based on a comprehensive review of all available information and science.

This Supplement assumes a set of fish actions (described in detail in Appendix B) that differ somewhat in magnitude and timing than those mandated by the court. In addition, the No Action/No Project Alternative includes fish actions, but not the same fish actions from the court. The analysis for this document was completed before Judge Wanger issued the preliminary injunction. Because the level of fish actions are not yet determined for the majority of the period of analysis for this Supplement (approximately December 2008 through December 2011), the EWA agencies chose to maintain the fish actions at the level already analyzed in this Supplement. These fish actions were selected based on the most recent data at the time and with the direction of

USFWS, NMFS, and CDFG to represent likely fish actions over the next few years.

1.6 Decision to be Made

Reclamation, DWR, USFWS, NMFS, and CDFG decision-makers will use this Supplement, along with the 2004 EIS/EIR, to decide on the best method for implementing the EWA from 2008 through 2011 based on the environmental consequences of each EWA alternative. Possible decision outcomes are:

- Take no action;
- Approve the Fixed Purchase Alternative, which fixes purchases to the amounts described in the EWA Operating Principles Agreement without the use of functional equivalents of some actions; or
- Approve continuation of the Flexible Purchase Alternative, which allows the EWA agencies to purchase the functional equivalent of the purchases described in the EWA Operating Principles Agreement and has a higher upper limit of EWA purchases (600,000 acre-feet) than the amount identified in the CALFED ROD.

1.7 Uses of the Document

In addition to the decision highlighted above, Reclamation, DWR, USFWS, NMFS, and CDFG will use this Supplement along with the 2004 EIS/EIR, in conjunction with the Action Specific Implementation Plan (ASIP), as the environmental analysis for a decision on whether to continue the selected EWA alternative through 2011. The ASIP is an integral component of the EIS/EIR that provides additional information to meet the requirements of the Federal ESA, State ESA and the Natural Community Conservation Planning Act (NCCPA) as described in the Multi-Species Conservation Strategy (MSCS), and it analyzes the effects of program actions on covered species.

The EWA agencies are also expected to use this Supplement along with the 2004 EIS/EIR as the environmental analysis for individual actions to implement the selected EWA alternative, including:

- Contracts for water acquisition, source shifting, or access to storage capacity (also local agencies);
- Issuance of BOs on the selected alternative;
- Issuance of NCCPA Determination on the selected alternative;

- Real-time decisions to increase upstream flows, Delta outflows, reductions/increases in pumping, consistent with existing operations rules;

- Approvals of water transfers and/or water right change petitions; and

- Approval of county groundwater permits for purposes of transfers (counties, where applicable).

When approving a specific water acquisition, the permitting agency will consider whether it was analyzed on a site-specific basis in the Supplement and 2004 EIS/EIR. If so, the agency may make a finding to that effect and rely on these two documents, unless there have been other significant changes that would trigger the need for yet more supplemental analysis and documentation. In either case, the agency would be able to tier from the analyses provided in this Supplement and 2004 EIS/EIR. If the action was not analyzed on a site-specific basis, the agency would determine whether the action is categorically exempt from CEQA, categorically excluded from NEPA, or whether additional CEQA/NEPA documents are required. It is anticipated that local agencies that must approve their own participation in an EWA transaction will use this Supplement and 2004 EIS/EIR in the same manner. Responsible agencies and cooperating agencies, such as the State Water Resources Control Board (SWRCB), are also expected to use these documents in a similar manner for approvals they must issue for projects to implement the EWA.

1.8 Structure and Content of the Supplement to the 2004 EIS/EIR

The Supplement builds on the information and analysis presented in the 2004 EIS/EIR, which includes both the Draft EIS/EIR circulated in July 2003 and the Final EIS/EIR completed in January 2004. Copies of the 2004 EIS/EIR can be viewed at:

California Bay-Delta Authority
650 Capital Mall, 5th Floor
Sacramento, CA

Additionally, electronic copies are available on-line for the Draft EIS/EIR and Final EIS/EIR:

http://www.usbr.gov/mp/EWA/DraftEIS-EIR.html

http://www.usbr.gov/mp/EWA/FinalEIS-EIR.html

The basic project description and analyses used for the Supplement are the same as those used in the 2004 EIS/EIR. As such, the Supplement to the 2004 EIS/EIR need not (according to CEQA Guidelines Section 15163), and does not, repeat or recreate the information presented in the 2004 EIS/EIR. The following text describes the overview of the structure and content of the Supplement to the 2004 EIS/EIR.

- **Chapter 1 – Introduction:** describes the background of and the basis for the Supplement to the Final EIS/EIR.
- **Chapter 2 – Project Description:** includes formulation and refinement of alternatives that were evaluated in the 2004 EIS/EIR and a summary of the No Action/No Project Alternative, Flexible Purchase Alternative and Fixed Purchase Alternative.
- **Chapter 3 – Resource Areas:** discusses the resource areas analyzed in the 2004 EIS/EIR. Each resource area section includes changes, if any, to the existing conditions (regulatory and environmental setting) from the 2004 EIS/EIR to the Supplement, and discusses whether the changes warrant additional analysis in the Supplement.
- **Chapter 4 – Fisheries and Aquatic Ecosystems:** evaluates fisheries and aquatic ecosystems including affected environment/environmental setting; assessment methods; significance criteria; alternative evaluation; mitigation measures; and cumulative effects.
- **Chapter 5 – Other Required Disclosures:** describes growth inducing impacts, cumulative impacts, consultation and coordination, irreversible and irretrievable commitments of resources, and the relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity.
- **Chapter 6 – List of Preparers and their Qualifications**

1.9 References

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Chapter 2
Alternatives, Including the Proposed Action/Proposed Project

This chapter includes an overview of the EWA program, a description of the alternatives formulation process, and descriptions of the three alternatives. For purposes of CEQA, the technical characteristics of the proposed project are described in Sections 2.1 and 2.4.

It is important to note that the basic purpose and need for, and objectives of, the EWA relative to extending the program through 2011 remain the same as originally delineated in the 2004 EIS/EIR. Also, the factors and considerations influencing the formulation of alternatives for an EWA program to be implemented from 2008 through 2011 are largely the same as those that existed when the 2004 EIS/EIR was being developed. As such, the nature and range of alternatives considered in this Supplement relative to extending the EWA through 2011 are the same as presented in the 2004 EIS/EIR.

As stated in Chapter 1, the Supplement does not need to include information already contained in the 2004 EIS/EIR; however, portions of the project description from the 2004 EIS/EIR are repeated and/or summarized below for the reader's convenience. In addition, certain sections in this chapter reflect minor changes and updates to the EWA project description that was presented in the 2004 EIS/EIR. As described below, these changes are minor and/or of a nature that do not warrant revising the 2004 EIS/EIR analysis (i.e., would not result in materially different conclusions).

- Regulatory Commitments (see Section 2.1.3). The regulatory commitments described in the 2004 EIS/EIR were agreed to by the CALFED agencies through 2007; the agencies are not proposing that these commitments be in place past 2007 and have therefore not included them in this Supplement. The lack of regulatory commitments reflects a change in the regulatory environment, but would not affect how the EWA agencies would operate the EWA or the impacts caused by the EWA program.

- BOs (see Section 2.3.1.1). The 2004 EIS/EIR described a No Action/No Project Alternative that included flow-related actions to protect fish from the1993 NMFS BO for winter-run Chinook salmon and the 1995 USFWS BO for delta smelt. These BOs have been deleted from this Supplement because they were replaced by the 2004 NMFS BO and the 2005 USFWS BO on the long-term operations of the CVP and SWP. Reclamation, with DWR as an applicant, has reinitiated consultation under the Federal ESA for these BOs. As Section 2.3.1.1 describes, it is reasonable to assume that these new BOs would include some limited fish actions, albeit fewer than the fish actions contained in the EWA program. This assumption is very similar to what was contained in the BOs governing the 2004 EIS/EIR; therefore, the different BOs will not affect the analysis of the impacts of the EWA program.

- January through March Fish Actions (see Section 2.4.1.1.5). This section is added to the Supplement because it includes additional detail regarding how the EWA agencies would take fish actions in January, February, and March. The type of fish action (export reduction) is the same as described in the 2004 EIS/EIR; however, the logic for the timing and duration of the reduction is based on new scientific information. The 2004 EIS/EIR described and evaluated pump reductions in January – March, and the new logic falls within the patterns described in the 2004 EIS/EIR. Therefore, the new text in Section 2.4.1.1.5, which would provide the EWA agencies with an updated basis for taking fish actions, would not result in a substantive change to the text included in the 2004 EIS/EIR.

- EWA Participants (see Sections 2.4.2 and 2.5.2). Sections 2.4.2 and 2.5.2 list participants that were included in the 2004 EIS/EIR, but are not included in this Supplement. The 2004 EIS/EIR described transfers both locally (effects on the specific agency from implementing the transfer), and regionally (effects on the region from many agencies implementing transfers). Deletion of an agency would eliminate the local effects, and would not change the overall project description regionally or the analysis provided in the 2004 EIS/EIR because the majority of the participants (17 out of 19) would still be involved in the EWA program. No new participants have been added to this Supplement relative to the 2004 EIS/EIR.

- Pumping to Decrease Debt (see Section 2.4.2.2.5). Pumping to decrease debt was not specifically described in the 2004 EIS/EIR although its action was included in the EWA program operations and analysis. (The action was considered part of the Joint Point of Diversion because that was one tool the EWA agencies used to decrease debt.) It is included separately in this Supplement to provide additional information regarding EWA operations. Because pumping to decrease debt was included in the analysis of the 2004 EIS/EIR, including it in the project description of this Supplement would not result in any different analysis conclusions.

2.1 EWA Program Overview

The EWA is a cooperative management program; the purpose of the EWA program is to provide protection to at-risk native fish species of the Bay-Delta estuary through environmentally beneficial changes in SWP/CVP operations at no uncompensated water cost to the Projects' water users. This approach to fish protection involves temporary modifications of Project operations to benefit fish and the acquisition of alternative sources of Project water supply, called the "EWA assets," which the EWA agencies use to replace the regular Project water supply lost by pumping reductions.

2.1.1 EWA Actions to Protect and Enhance Fish

The SWP and CVP export Project water through the Delta pumping plants. This pumping can change flow patterns within the Delta, and the pumps can entrain and kill fish at the intakes to the SWP and CVP pumping facilities when fish are moving through the Delta. The EWA agencies take actions to protect and restore Delta at-risk native fish species and provide additional benefits upstream. EWA actions in the Delta to protect fish can involve temporary pumping reductions at the Delta or closure of the DCC gates (see Section 2.1.4.2). Closing the gates at the DCC, a channel constructed to increase Sacramento River flow into the Central Delta, improves the survival of anadromous fish migrating through the Sacramento River because it helps fish migrate out to the Bay instead of traveling into the central Delta. Agency biologists use real-time data on fish abundance, flow, and fish salvage at the Delta pump intakes to develop recommendations for fish protection. Actions to provide secondary benefits include increasing instream flows in rivers upstream from the Delta and augmenting Delta outflows.

2.1.2 Asset Development

The EWA agencies take actions to protect fish and the environment while compensating for the supply effects of these actions by acquiring EWA assets and then storing and moving the assets to where they are needed to compensate for fish actions. The CALFED ROD (CALFED 2000b) and Operating Principles Agreement (CALFED 2000c) stated that the Project Agencies (Reclamation and DWR) would acquire and manage EWA assets in several ways:

- Delta Operations: altering Delta Project operations, when environmental conditions allow, to export additional water (also called variable assets);
- Water Purchases: purchasing water from willing sellers both upstream from the Delta and within the Export Service Area;

- Stored Water: purchasing stored water from the Export Service Area sources to be used as collateral for borrowing (released only when all other assets have been expended), and to function as long-term storage space after the water has been released;

- Source Shifting: delaying delivery of water to a Project contractor, who would use water from an alternative source until the water is paid back; and

- Exchanges: exchanging EWA assets for assets of character, such as location, seasonality, or year-type, more suitable to EWA purposes.

2.1.3 Regulatory Commitments

The 2004 EIS/EIR includes a description of certain regulatory commitments that would not be in effect beginning in 2008. The CALFED MSCS Conservation Agreement (CALFED 2000d) and the CALFED BOs included commitment by several CALFED agencies (USFWS, NMFS, Reclamation, Bureau of Land Management, USEPA, U.S. Army Corps of Engineers (USACE), Natural Resources Conservation Service, the Resources Agency of California, CDFG, and the DWR) that there would be no additional CVP or SWP export reductions from actions conducted to protect fish under the federal ESA, California ESA, or NCCPA beyond the regulatory baseline of fishery protection. This commitment was subject to specified conditions and legal requirements for the first 4 years of CALFED Stage 1 implementation and later extended by the EWA agencies through 2007. This commitment is based on the conditions in Section VIII-B of the MSCS Conservation Agreement and the availability of three tiers of EWA assets.

Based on current circumstances, these three tiers are no longer an accurate way to describe EWA assets. Tier 1 included baseline water, which included the biological opinions on winter-run salmon and delta smelt. Tier 2 included the EWA and a fully funded Ecosystem Restoration Program (ERP). Tier 3 consisted of assets beyond Tiers 1 and 2 that would be based upon the commitment and ability of the CALFED agencies to make additional water available should it become needed. At the time that these tiers were envisioned, the biological opinions governing operations (1993 NMFS BO for winter-run Chinook salmon and the 1995 USFWS BO for delta smelt) did not include an EWA. The biological opinions on the long-term operations of the Projects (NMFS 2004, USFWS 2005) did include an EWA, which made it difficult to differentiate between baseline water and the EWA. DWR and Reclamation have reinitiated consultation under the Federal Endangered Species Act for the BOs on the long-term operations of the Projects, and it is unclear whether the EWA will be included in the revised opinions. The discussion of tiers has been deleted to reduce confusion.

The EWA agencies have also not renewed the regulatory commitments, partially because the pelagic organism decline has caused uncertainty regarding the remedy for the species with regards to Project operations. The lack of regulatory commitments does not affect how the EWA agencies would operate the EWA.

2.2 Alternative Formulation

CEQA and the NEPA require that environmental documents identify and analyze a reasonable range of feasible alternatives that could meet the project objectives to varying degrees. Under CEQA and NEPA, the range of potential alternatives to the proposed project shall include those that could feasibly accomplish most of the basic purpose and need, and objectives of the project. In addition, CEQA requires an alternative that could avoid or substantially lessen one or more of the significant effects. NEPA and CEQA require that a reasonable range of alternatives, including a no-project/no-action alternative be analyzed.

The 2004 EIS/EIR described alternatives considered but eliminated from detailed evaluation and the development of alternatives carried forward for further evaluation. The rationale for the screening criteria and dismissal of alternatives, as well as the development process that led to the selection of the two action alternatives in the 2004 EIS/EIR, remain for this Supplement.

2.3 No Action/No Project Alternative

The No Action/No Project Alternative presented in the 2004 EIS/EIR describes the future conditions without EWA, defined as those CVP/SWP operational and environmental conditions that would reasonably be expected in the foreseeable future if the EWA program was not approved. The No Action/No Project Alternative assumes the existing regulatory and legal constraints. This alternative also describes the conditions that would occur if the EWA did not receive funding in the future.

If the EWA were not implemented, actions to protect fish and benefit the environment would occur under the existing baseline of fishery protection, but the actions would be less than would otherwise occur with the EWA. Those actions are described below.

2.3.1 Actions to Protect Fish

2.3.1.1 Flow-Related Actions

The CALFED ROD identified a baseline level of fishery protection requirements for Project operations. Existing regulatory programs established these requirements prior to implementation of the CALFED ROD, and these programs alter Project operations in ways that improve Delta water conditions for fish. The No Action/No Project Alternative includes the following environmental requirements:

- 1995 Delta Water Quality Control Plan (1995 Delta WQCP) and SWRCB's Decision 1641;
- Vernalis Adaptive Management Plan (VAMP);
- Implementation of Sections 3406(b)(1-3) of the Central Valley Project Improvement Act (CVPIA); and
- Level 2[1] Refuge Water Supplies.

The 2004 EIS/EIR included the governing biological opinions at that time (1993 NMFS BO for winter-run Chinook salmon and the 1995 USFWS BO for delta smelt), but these biological opinions are now outdated. Reclamation, with DWR as an applicant, has reinitiated consultation on the revised biological opinions, and the actions to protect fish in these new biological opinions are not yet known. The current biological opinions include the EWA, but it is unknown whether EWA will be included in the project description for the reinitiated consultation. If the EWA agencies choose the No Action/No Project Alternative, they would need to have biological opinions that did not include the EWA program. The exact contents of these biological opinions are speculative, but it is reasonable to assume that they would include some fish actions like those discussed below.

To implement these fish protection requirements, fishery and Project Agencies could take several actions described in the sections below.

2.3.1.1.1 Reducing Delta Pumping In the No Action/No Project Alternative, Project Agencies would implement pumping reductions when the fish protection requirements mandated the reduction. VAMP would require pump reductions for 31 days in April/May for salmon smolts to determine how flow, pumping, and a barrier at the head of Old River affect the survival and passage of salmon smolts through the Delta. BOs may require additional pump

[1] The Reclamation Report on Refuge Water Supply Investigations (March 1989) defined four levels of refuge water supplies: existing firm water supply (Level 1), current average annual water deliveries (Level 2), full use of existing development (Level 3), and permission for full habitat development (Level 4). CVPIA Section 3406(d) committed to providing firm water through long-term contractual agreements for Level 2 refuges.

reductions, but the timing and extent of these reductions are not known until the reinitiated consultation is complete.

In the No Action/No Project Alternative, the Projects would attempt to recover the water from reduced pumping through a variety of actions. The CVP would use a portion of the 800,000 acre-feet under CVPIA §3406(b)(2) to account for the pumping reductions. Both the SWP and CVP would use operational flexibility, as discussed in Section 2.3.2.1, to recover additional water. These sources are not likely to be sufficient to compensate for all pump reductions.

2.3.1.1.2 Closing the Delta Cross Channel Gates DCC gate closure during the winter helps reduce the chance that emigrating spring-run and winter-run Chinook salmon and steelhead smolts might travel through the central Delta and swim toward the pumps instead of taking their natural route to the Bay.

Closing the DCC gates increases the likelihood that juvenile spring-run and winter-run Chinook salmon and steelhead smolts remain in the mainstem Sacramento River, improving their likelihood of successful outmigration through the western Delta and San Francisco Bay. The closure, however, also reduces the contribution of the Sacramento River to the central Delta, which may aggravate salinity intrusion. With the DCC closed, for the same exports, more flow comes from the western Delta, which is closer to the bay and has lower water quality. The Project Agencies may reduce export pumping in response to the changes in flow direction.

The regulatory baseline dictates DCC gate closures as follows:

- Reclamation standing operating procedures call for gate closure when flow on the Sacramento River reaches 20,000 to 25,000 cubic feet per second (cfs).
- State Water Resources Control Board Decision 1641 requires the following operations of the DCC gates:
  - From November 1 through January 31 the gates will be closed for up to 45 days as requested by USFWS, NMFS, and CDFG. These closures are determined as follows:
    - If the Knight's Landing catch index (KLCI) is > 5 and ≤ 10 salmon, the DCC gates will be closed for 4 days within 24 hours. If after 4 days the KLCI still exceeds 5, the gates will remain closed for another 4 days.
    - If the KLCI is > 10 salmon, the DCC gates are to be closed until the KLCI is ≤ 5.
  - The gates will be closed continuously from February 1 through May 20.

  - From May 21 through June 15 the gates will be closed for a total of 14 days, again as requested by USFWS, NMFS, and CDFG.

2.3.1.1.3 Increasing Instream Flows Increasing flows year-round in upstream river reaches would improve habitat conditions for anadromous and resident fish populations. Reclamation and USFWS may use CVPIA §3406 (b)(2) supplies to meet these objectives; therefore, the water would be used to increase flows on CVP-controlled streams, such as the Sacramento, American, and Stanislaus Rivers and Clear Creek. The improved flows would:

- Provide improved spawning and rearing habitat for salmon and steelhead;
- Improve survival of downstream migrating Chinook salmon smolts;
- Improve habitat conditions for white sturgeon, green sturgeon, American shad, and striped bass to migrate upstream, spawn, and allow progeny to survive;
- Aid in the downstream transport of striped bass eggs and larvae;
- Improve water temperatures and increase habitat for rearing juvenile steelhead; and
- Benefit delta smelt and other estuarine species.

2.3.1.1.4 Augmenting Delta Outflows Water from the Delta flows to the San Francisco Bay, which is more saline than the Delta estuary. The water mixes in the Suisun Bay area, and the mixing zone location varies depending on the Delta outflow. Higher amounts of Delta outflow push the saltwater mixing zone farther out to the Bay, and lower flows allow the saltwater zone to move farther into the Delta. The No Action/No Project Alternative would include actions related to Delta outflow required by the SWRCB's Decision 1641.

2.3.1.2 Non-Flow-Related Actions

In the future under the No Action/No Project Alternative, a number of ongoing projects and programs (e.g., CVPIA and CALFED ERP) are expected to continue, the purpose of which is to improve the condition of species and habitats. These programs are considered a part of the No Action/No Project Alternative because their purpose is for fish protection and environmental protection and because they may create beneficial and/or adverse effects during the EWA timeframe on similar resources, in the absence of the EWA.

2.3.2 Water Management

In the No Action/No Project Alternative, it could be reasonably predicted that, in the foreseeable future, pumping reductions could result in reduced CVP and

SWP exports. The CVP and SWP could use operational flexibility within the Delta to try to make up for the water lost during pump reductions. If the Projects could not access enough water, they would then reduce their deliveries to water users. The water users would likely then implement actions to reduce or address their shortages. These two groups of water management actions are described below.

2.3.2.1 Delta Operational Flexibility

In the No Action/No Project Alternative, the Projects would be able to access water from flexibly operating the Delta export facilities through Joint Point of Diversion, relaxation of the Section 10 constraint in some months, and relaxation of the Export/Inflow (E/I) ratio. These types of flexible operations were defined prior to the EWA and would be available for the Projects to help repay their users for pump reductions (see Section 2.3.1.1.1). Only the third item, relaxing the E/I ratio, would provide additional water for the Projects. The other two options would provide additional capacity for the Projects to move water through the Delta, but they would not provide additional water to reimburse water users for lost water, except in relatively rare circumstances such as excess Delta conditions in the summer. In the No Action/No Project Alternative, these actions would be unlikely to provide enough water or capacity to replace the water lost during fish actions.

2.3.2.2 Water Users' Actions

If the EWA were not implemented and export users received reduced deliveries due to pumping reductions described in Section 2.3.1.1.1, the export users could engage in one or more of the following options: accept the shortage, increase local water supplies, idle or retire agricultural lands, transfer water from northern California via groundwater substitution or crop idling, or pursue independent water transfers.

2.4 Flexible Purchase Alternative (The Proposed Action/Proposed Project)

The Flexible Purchase Alternative allows the EWA agencies the ability to acquire up to 600,000 acre-feet of water assets (although the EWA agencies would typically acquire 200,000 to 300,000 acre-feet annually, except in years with high fish needs) to address pump reductions, fish actions, and to compensate the CVP/SWP for water otherwise lost due to those actions. These actions would include reducing Delta export pumping, closing the Delta cross channel, augmenting Delta outflow, or increasing instream flows. The EWA agencies would have the flexibility to choose from these actions to best protect at-risk fish, and would not need to solely focus on actions within the Delta. The Flexible Purchase Alternative would allow the EWA agencies to respond to changes in base condition operations while providing higher levels of fish actions than either of the other alternatives.

Asset purchases above 600,000 acre-feet would require additional environmental analysis.

2.4.1 Actions to Protect Fish and Benefit the Environment

The EWA agencies have established operating tools that allow them to protect fish. These operational tools include (1) reducing export pumping, (2) closing the DCC gates, (3) increasing instream flows, and (4) augmenting Delta outflow. These actions take place throughout the year, under various conditions. The EWA agencies use their acquired assets to meet protection objectives for at-risk fish species within the Sacramento and San Joaquin Rivers and their tributaries and the Delta.

2.4.1.1 Export Pumping Reductions

Actual EWA pump reductions would vary each year depending on fish conditions, hydrology, available EWA assets, and other factors. The potential reductions are discussed below by time of year.

2.4.1.1.1 Export Reductions in December and January Reducing exports in December and January during critical outmigration periods is intended to increase the survival of outmigrating salmonids from the Sacramento basin, including listed winter-run and spring-run Chinook, steelhead trout, and candidate late-fall and fall-run Chinook. Adult delta smelt are also migrating upstream to spawning areas at this time.

This reduction is intended to increase the survival of juvenile Chinook salmon smolts (including winter-run presmolts and spring-run yearlings) migrating through the Delta in the winter. It is scientifically supported by several years (1993 – 2002) of mark/capture data that indicate the survival of juvenile late fall-run Chinook salmon in the central Delta decreases as exports increase.

Typical actions would reduce combined pumping at Harvey O. Banks (Banks) and C.W. “Bill” Jones (Jones) Pumping Plants to 6,000 cfs for 5 days at a time, and in some years those reductions occur several times during these months. For example, in four out of the last six years, the EWA reduced pumping in December and January and used approximately 5,000 to 121,000 acre-feet of assets. During these months, the EWA agencies usually reduce pumping in conjunction with closing the DCC gates.

2.4.1.1.2 Export Reductions in February and March Reducing pumping in the critical out-migration period in February and March is intended to increase survival of out-migrating juvenile Chinook salmonids from the Sacramento basin, with a focus on ESA listed winter-run Chinook salmon and steelhead trout. Adult delta smelt also are migrating upstream to spawning areas at this time.

This reduction is intended to increase the survival of juvenile salmonid smolts migrating through the Delta in the late winter. Several years (1993 – 2002) of mark/recapture data indicate that the survival of juvenile late fall-run Chinook salmon in the central Delta decreases as exports increase. These export reductions would supplement the primary protective action of closing the DCC gates during this period. Reduced exports also decrease ESA incidental take of juvenile winter-run salmon, spawning adult delta smelt when the species are in the south/central Delta. Typical actions would reduce pumping to 6,000 cfs – 8,000 cfs for 5-10 days at a time in February through March.

2.4.1.1.3 Export Reductions in April and May Reducing Delta exports during April and May is intended to help out-migrating juvenile fall-run and spring-run Chinook salmon. As described in the No Action/No Project Alternative, the VAMP program calls for specific flow releases from the Stanislaus, Tuolumne, and Merced Rivers and specific pump reductions during 31 days, generally from mid-April to mid-May. These actions are intended to evaluate the relative effects of export and inflow to juvenile San Joaquin basin Chinook salmon survival and assist in providing protection for both anadromous and estuarine species. The CVP would use CVPIA §3406(b)(2) water to undertake the VAMP study as in the No Action/No Project Alternative; the Flexible Purchase Alternative would enable the SWP to provide the difference between what is mandated by D-1641 and what is indicated by the VAMP protocols. .

The Flexible Purchase Alternative could also include pumping reductions before April 15 to protect juvenile anadromous or resident species (including delta smelt). After May 15, the EWA agencies could request that exports continue at some reduced stable level or allow exports to ramp up gradually between May 16 and June 1. These additional days of reduced exports would provide additional protection for juvenile anadromous and resident estuarine species.

2.4.1.1.4 Export Reductions in June and July Delta pumping reductions in June could minimize entrainment of juvenile delta smelt in some years. Also, a gradual increase (ramp up) rather than a rapid increase of exports during June may be used to increase survival of both anadromous and resident estuarine species in the south/central Delta. In some years, these actions may continue into the early part of July.

Pumping reductions are intended to decrease the effects of CVP/SWP export facilities on listed resident fish in the south Delta and would enable juvenile resident estuarine and anadromous species to migrate away from the export facilities where they are less vulnerable to direct loss and/or indirect mortalities associated with export operations. Data indicate “incidental take” is greater when fish population densities are high near the export facilities or when exports increase. Additional information indicates that, generally, a gradual increase in export pumping could minimize entrainment loss of delta smelt by delaying the increase until most of them have moved to the north and west away from the influence of the pumping.

2.4.1.1.5 January through March Export Reductions (not included in 2004 EIS/EIR) During water year 2007, the Delta Smelt Working Group (Working Group) as part of the EWA recommended that fish actions be based on the flows in Old and Middle Rivers rather than a specified level of exports. USGS studies have found a relationship between negative flow (i.e., upstream flow) in Old and Middle Rivers and winter salvage of delta smelt (Resources Agency, DWR, and CDFG 2007). Old and Middle River flows are influenced by flows on the San Joaquin River, export pumping, and local diversions in the south Delta. Historically, VAMP has maintained Old and Middle River flows that are neutral or positive during part of the delta smelt spawning period to minimize entrainment of larval delta smelt (Delta Smelt Working Group 2006). However, the Working Group thinks that the VAMP starts too late in many years to be maximally protective. Therefore, the Working Group has recommended that net upstream flows in Old and Middle River not exceed -4000 cfs, with the intention of avoiding or reducing salvage. In 2007, the Projects chose to modify net Old and Middle River flows using export curtailment. The technical basis for these recommendations is based on new scientific information, but the means of implementation, e.g., export curtailment, is the same as those described in the 2004 EIS/EIR project description.

2.4.1.2 Closing the Delta Cross Channel Gates

With the Flexible Purchase Alternative, EWA agencies could take action to close the DCC gates beyond closures required under the regulatory baseline included in the No Action/No Project Alternative. EWA must compensate for water supply losses from these reductions. Additional gate closures would typically occur in November, December, January, May, or June, if additional closures were needed after the regulatory requirements of the No Action/No Project were met.

2.4.1.3 Increasing Instream Flows

Increasing instream flows is intended to improve habitat conditions in tributary rivers and the Delta for anadromous and resident fish. The Flexible Purchase Alternative would include flow increases beyond those in the No Action/No Project Alternative. Table 2-1 shows fish species that could require supplemental flows in various rivers and tributaries to meet habitat requirements for the various life history stages. The table also displays the timing of each life history stage and the rivers (those affected by EWA actions) in which each fish species can be found.

Table 2-1. Anadromous Fish Life History Stages and Locations

Fish	Run	Stage	Month	Location
Chinook Salmon	Fall	Immigrating adult	July - December	Sacramento, Feather, Yuba, American, San Joaquin, Merced
		Spawning	October - December	
		Emigrating juvenile	January - June	
	Late-fall	Immigrating adult	October - April	Sacramento, Feather, Yuba
		Spawning	December - April	
		Emigrating juvenile	May - December	
	Winter	Immigrating adult	December - July	Sacramento
		Spawning	Late April - mid-August	
		Emigrating juvenile	August - March	
	Spring	Immigrating adult	March - September	Sacramento, Feather, Yuba
		Spawning	Mid-August - October	
		Emigrating juvenile	November - June	
Steelhead	Central Valley	Immigrating adult	August - March	Sacramento, Feather, Yuba, American, San Joaquin, Merced
		Spawning	December - April	
		Emigrating juvenile	January - October	
American Shad		Immigrating adult	April - May	Sacramento, Feather, Yuba, American, San Joaquin
		Spawning	June - July	
		Emigrating juvenile	August - October	
Green Sturgeon		Immigrating adult	February - June	Sacramento
		Spawning	March - July	
		Emigrating juvenile	June - August	
White Sturgeon		Immigrating adult	February - May	Sacramento, American, San Joaquin

Source: Final Restoration Plan for the Anadromous Fish Restoration Program (AFRP Plan) (USFWS 2001)

Supplemental flows, over the existing baseline for fishery protection requirements for instream flows, provide additional water primarily to benefit salmon and steelhead adult immigration, spawning, egg incubation, rearing, and emigration of juveniles through the regulation of pulse flows, water temperature, water quality, and the maintenance of attraction and flushing flows. While not the primary objectives of the EWA, instream flows may also aid white and green sturgeon emigration, spawning, egg incubation, and rearing and American shad spawning, incubation, and rearing.

2.4.1.4 Augmenting Delta Outflows

The Flexible Purchase Alternative could include actions to augment Delta outflow in addition to outflows required by the SWRCB’s Decision 1641 and existing baseline level of fishery protection. Augmenting Delta outflow would also help to restore a westward-moving flow pattern through the Delta, which would help outmigrating fish.

In addition to taking direct actions to augment Delta outflows, other actions within the Flexible Purchase Alternative would have the secondary benefit of increasing Delta outflows. When the EWA agencies reduce Delta export pumping, outflows would increase initially as water that would have been pumped becomes Delta outflow. Carriage water (defined in Section 2.4.2.1) would also augment Delta outflow.

2.4.2 Asset Acquisition and Management

This section is organized according to the geographic areas in which the EWA Project Agencies acquire and/or manage assets for the Flexible Purchase Alternative: upstream from the Delta (Section 2.4.2.1), the Delta (Section 2.4.2.2), and the Export Service Area (Section 2.4.2.3). Figure 2-1 shows each of these areas.

The EWA Project Agencies can use any of the acquisition methods described below to purchase water. Flexibility to purchase from any of these sources is critical to helping the EWA run efficiently because it allows the Project Agencies to purchase the least expensive water available in any given year. The 2004 EIS/EIR listed agencies that may be willing to sell water to the EWA or have sold water to the EWA in past years[2], along with a general range of potentially available water volumes. This Supplement assumes the same list of agencies and range of transfers with the following exceptions: Placer County Water Agency and Tulare Lake Basin Water District would no longer transfer water to the EWA.[3]

[2] Information on past EWA transactions can be found online at http://wwwoco.water.ca.gov/calfedops/2001ops.html; http://wwwoco.water.ca.gov/calfedops/2002ops.html; http://wwwoco.water.ca.gov/calfedops/2003ops.html; http://wwwoco.water.ca.gov/calfedops/2004ops.html; http://wwwoco.water.ca.gov/calfedops/2005ops.html; or http://wwwoco.water.ca.gov/calfedops/2006ops.html.

[3] Since publication of the 2004 EIS/EIR, the EWA agencies have decided that they would not purchase water through crop idling from the Friant Division. Tulare County contains primarily Friant Division contractors; therefore, Tulare County was removed from the Export Service Area. Placer County Water Agency has indicated that they would not sell water through crop idling to the EWA agencies; therefore, Placer County was removed from the Upstream from the Delta region.

2.4.2.1 Upstream from the Delta Region

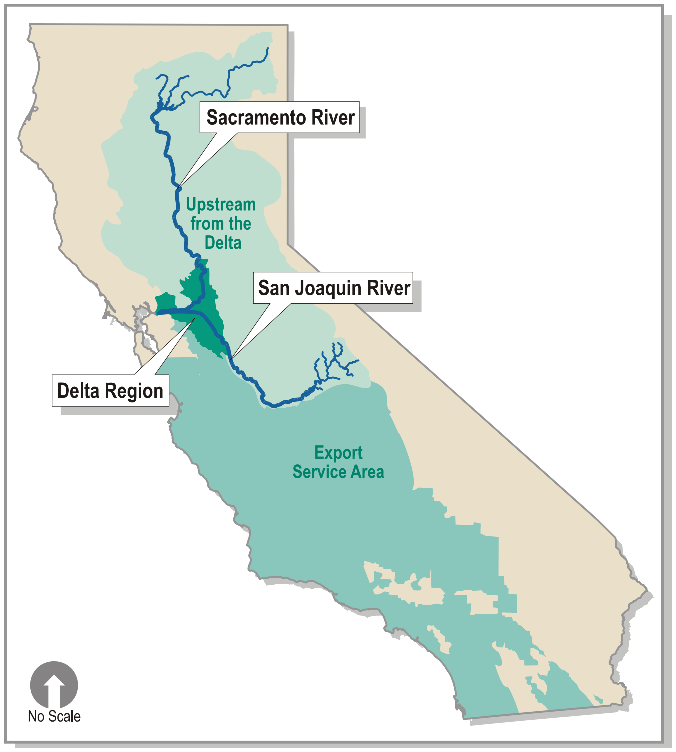

Figure 2-1. Asset Acquisition and Management Areas

As shown on Figure 2-1, the Sacramento and San Joaquin Rivers flow into the Delta; therefore, these rivers and their tributaries are designated in the analysis as the Upstream from the Delta Region. Potential asset acquisitions in the Upstream from the Delta Region include stored reservoir water, groundwater substitution, crop idling/substitution, and stored groundwater purchase. The EWA protects fish at the pumps by reducing pumping when it would help at-risk fish species, then transferring EWA assets across the Delta at other times to repay CVP and SWP users for water lost during pump reductions. Typically, EWA water would be moved through the Delta from July through September, although the Project operators could start moving EWA water in mid-June if fish were not in the area of the export pumps.

Shifting pumping to times that are less sensitive to fish would increase pumping during times when fish are absent, which sometimes requires increased Delta outflow to comply with water quality regulations in the Delta. Carriage water is defined as the additional water needed for Delta outflow to compensate for the additional exports made on behalf of a transfer to assure compliance with water quality requirements of the SWP and CVP. EWA transfers originating along the Sacramento River and its tributaries would incorporate enough carriage water to maintain water quality within the Delta at without-EWA constituent levels.

2.4.2.1.1 Stored Reservoir Water The EWA Project Agencies could acquire water by purchasing surface water stored in reservoirs owned by non-Project entities (those that are not part of the CVP or SWP). To ensure that purchasing this water would not affect downstream users, EWA agencies would limit assets to water that would not have otherwise been released downstream.

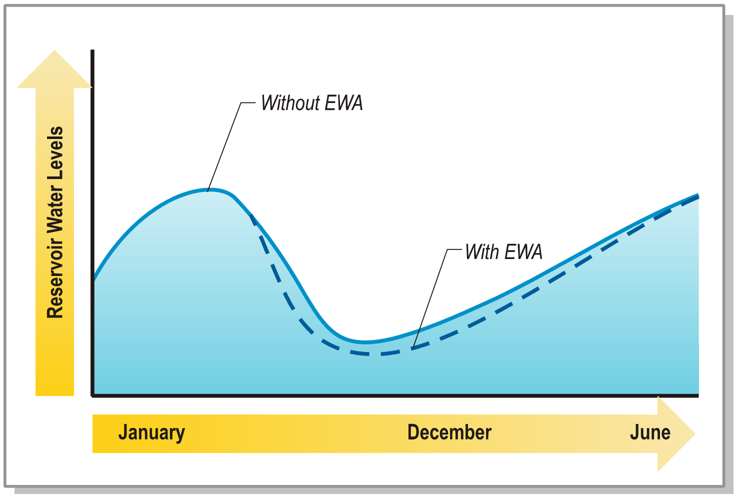

Figure 2-2. Reservoir Level Changes Due to Stored Reservoir Purchases

When the EWA purchases stored reservoir water, these reservoirs would be drawn down to lower levels than without the EWA, as shown in Figure 2-2. To refill the reservoir, a seller must prevent some flow from going downstream. Sellers must refill the storage at a time when downstream users would not have otherwise captured the water, either in downstream Project reservoirs or with Project pumps in the Delta. Stored reservoir water is released in addition to reservoir water that would be released without the EWA, thereby increasing flows in downstream waterways.

2.4.2.1.2 Groundwater Substitution Groundwater substitution transfers occur when users forego their surface water supplies and pump an equivalent amount of groundwater as an alternative supply. Because the EWA's potential groundwater substitution transfers are from agricultural users, the water from this acquisition method would be available during the irrigation season of April through October. Typically, surface water made available through groundwater substitution is stored upstream until the Delta pumps have the capacity available for EWA assets (except on the Sacramento River where water often cannot be held in Lake Shasta because of downstream temperature and flow requirements).

The Delta pumps would be unlikely to have available capacity for the EWA at the start of the irrigation season. EWA water that would have been released for irrigation would instead be held in reservoirs until later in the season, which would cause reservoir levels to be slightly higher than without the EWA while the water is held back (except on the Sacramento River).

The reservoir levels would not reverse their typical summer declines because the EWA would not add new water to the reservoir; rather, the levels would decrease more slowly (see Figure 2-3). EWA water acquired through groundwater substitution would be released later in the irrigation season, typically mid-June through September, at times when Delta pumping capacity is available. The change in reservoir elevations as the water is released would depend on the Delta conveyance capacity. If the conveyance capacity were available constantly throughout the period of mid-June through September, then the reservoir elevations would slowly return to the without-EWA levels (see Scenario 1 on Figure 2-3). If more conveyance capacity were available in July than later in the summer, then the EWA could borrow water from the storage facility and release additional water at those times that the conveyance capacity is available (see Scenario 2 on Figure 2-3). The Projects would determine if the EWA could borrow water on a case-by-case basis.

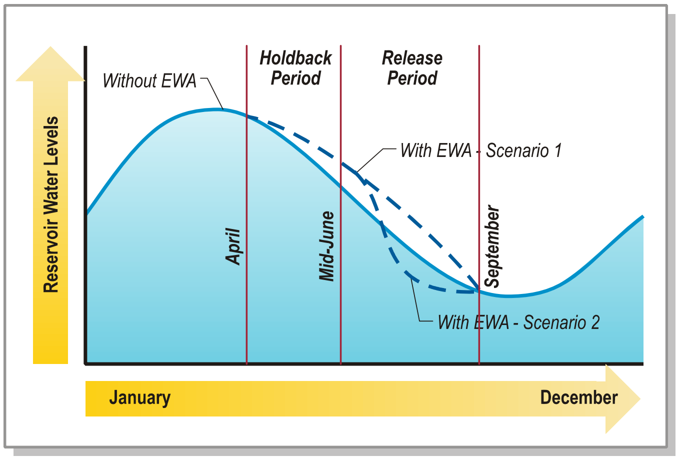

Figure 2-3. Reservoir Level Changes Due to Groundwater Substitution Transfers

2.4.2.1.3 Crop Idling or Crop Substitution Crop idling transfers come from water that would otherwise have been used for agricultural production. For crop idling acquisitions, the EWA agencies would pay farmers to idle land that they would otherwise have placed in production. Crop idling acquisitions would be retained in reservoirs upstream from the selling water agencies until they could be transferred through the Delta and pumped south. The effects on reservoir levels would be similar to that described for groundwater substitution (see Figure 2-3). Payment by the EWA agencies for water transferred would be computed based on pre-agreed consumptive use values, which may be refined as the science for generating these values improves. The EWA agencies would purchase water from idled rice crops in the Upstream from the Delta Region.

The potential also exists for the EWA agencies to purchase water through crop substitution, in which water users substitute a crop with lower water needs than the crop that they would have otherwise planted. The associated decrease in water use could be transferred to the EWA or other programs. Crop substitution would have similar but lesser effects than crop idling, so it is considered to be a part of the crop idling discussion for the remainder of the document.

To minimize socioeconomic effects on local areas, the EWA agencies would not purchase water via crop idling if more than 20 percent of recent harvested rice acreage in the county would be idled through EWA water acquisitions.

2.4.2.1.4 Stored Groundwater Purchase The EWA Project Agencies could obtain water by purchasing groundwater assets that were previously stored by the selling agency with the intent to sell a portion of those assets at a later date. This option differs from groundwater substitution in that groundwater substitution transfers would not come from water that had been previously stored.

2.4.2.2 Delta Area

The EWA Operating Principles specify methods for gaining assets in addition to those described above. These additional methods do not involve active acquisition; assets obtained by these other methods are termed “variable assets.” The EWA agencies could obtain variable assets (water or pumping capacity) through changes in Delta operations.

2.4.2.2.1 Sharing of CVPIA §3406(b)(2) and ERP Water The SWP and the EWA would share, on a 50-50 basis, water pumped by the SWP that meets the following requirements:

- Water released from storage or made available for upstream purposes under either CVPIA §3406(b)(2) or the ERP, arrives in the Delta with no further CVPIA §3406(b)(2) or ERP purposes to serve, and exceeds the export capacity of the CVP Jones Pumping Plant;
- Water that the SWP and/or EWA have demand for south of the Delta; and
- Water the SWP has capacity to pump.

This type of variable asset would result in additional water for the EWA.

2.4.2.2.2 Joint Point of Diversion The SWP could use excess capacity at its Harvey O. Banks Pumping Plant to pump water for both the CVP and the EWA, to be shared on a 50-50 basis, if the Projects meet the conditions in D-1641.

2.4.2.2.3 Relaxation of the Section 10 Constraint The USACE granted permission to the SWP to relax the Section 10 constraint (of the Rivers and Harbors Act) and increase the base diversion rate by the equivalent of 500 cfs to an average of 7,180 cfs for the months of July through September. This 500 cfs would be dedicated to pumping for the EWA, but the EWA agencies would still need to provide the assets to be pumped.

2.4.2.2.4 Relaxation of the Export/Inflow Ratio The EWA agencies would seek relaxation of the E/I ratio as appropriate to create EWA assets in the

Export Service Area. However, opportunities to relax the E/I ratio may not be as numerous as assumed in the 2004 EIS/EIR, and thus may not result in the acquisition of as much water as assumed in the CALFED ROD.

2.4.2.2.5 Pumping to Decrease Debt (not included in 2004 EIS/EIR) As described in Section 2.4.2.3.2 Borrowing Project Water, the EWA agencies would borrow water from San Luis Reservoir during pumping reductions to provide an uninterrupted supply to Project contractors. The EWA agencies would repay the water to San Luis Reservoir with variable or purchased assets. In some years, the assets might not provide enough water to repay all of the debt. Debt that was not repaid by the end of the year would be termed carryover debt. The EWA agencies could accrue up to 100,000 acre-feet of carryover debt in the SWP's share of San Luis Reservoir. The EWA agencies would be able to pump excess water in the Delta to decrease the carryover debt if there were excess water in the Delta, all Project contracts had been filled, and Article 21[4] demands had been met.

2.4.2.3 Export Service Area

The Export Service Area includes the areas served by the CVP and SWP Delta pumping facilities, encompassing agricultural and urban development in the Central Valley and central and southern coasts.

The EWA Project Agencies could acquire assets from sources within the Export Service Area. The EWA agencies would not need to arrange to move these assets through the Delta. This advantage is especially important during wet years, when Delta pumping capacity for the EWA is limited because the export pumps are fully utilized to move Project water. Assets purchased in the Export Service Area, however, are often more expensive than other assets because potential sources in the Export Service Area are more limited; water agencies usually are paying for facilities needed to capture and convey the limited supplies.

2.4.2.3.1 Water Acquisition Types The EWA Project Agencies have two potential methods for acquiring water in the Export Service Area, crop idling and stored groundwater purchase, as described below.

Crop Idling or Crop Substitution Crop idling transfers in the Export Service Area also involve agricultural water users leaving their fields idle and selling their surface water allotment to the EWA. Sellers in this area normally receive CVP or SWP water that is stored in San Luis Reservoir or pumped directly out of the Delta.

To minimize socioeconomic effects on local areas, the EWA agencies would not purchase water via crop idling if more than 20 percent of recent harvested

[4] Additional water not needed to meet current year SWP contractor deliveries or Project operational requirements can be delivered to SWP contractors under Article 21.

cotton acreage in the county would be idled through EWA or other program water acquisitions.

In the Export Service Area, the EWA agencies would receive crop idling water at O'Neill Forebay (adjacent to San Luis Reservoir) on the same schedule that would have otherwise been employed for water user deliveries. Operations in conjunction with San Luis Reservoir will be discussed in greater detail in Section 2.4.2.3.2, Borrowed Project Water.

Stored Groundwater Purchase Stored groundwater purchases in the Export Service Area would function in the same way as the upstream stored groundwater purchases (Section 2.4.2.1.4), in which entities would sell water to the EWA that they had previously stored in the ground. The EWA agencies could receive this water through two mechanisms:

- The selling agency could exchange its surface water allocation with the EWA and pump stored groundwater to satisfy local needs; or
- The selling agency could pump water out of its aquifer directly into the California Aqueduct for transfer to the EWA.

Stored groundwater is available to the EWA year-round, although the delivery would generally be during the irrigation season, usually April through September, if the water were delivered through surface water exchange.

If the EWA agencies acquire stored groundwater through a transfer of the selling agency's surface water allocation, the exchange would be made primarily at O'Neill Forebay. (In the case of Santa Clara Valley Water District, the exchange of SWP surface water would be in Bethany Reservoir.) The EWA agencies would acquire water on the same delivery schedule that the selling agency would have had without the transfer. If the selling agencies pump groundwater directly into the California Aqueduct, the seller must work cooperatively with DWR to ensure that the groundwater meets DWR's water quality requirements.

2.4.2.3.2 Asset Management The EWA requires facilities and operational arrangements in order to make its assets available when needed for accomplishing EWA objectives. The CALFED ROD defined several tools to manage assets, including the ability to borrow Project water if needed and store it for use at a time other than when the asset was acquired. Project facilities and agencies assist the EWA by conveying, storing, and loaning water when possible.

Borrowed Project Water Borrowing Project water is a management arrangement available to the EWA agencies, as long as the borrowed water could be repaid without affecting the current or following year's allocations and deliveries to Project contractors. Borrowing of Project water, specifically in San

Luis Reservoir, is intended to enhance the effectiveness and use of EWA assets. Borrowing could take place only when the borrowed water would not exacerbate water quality and supply problems associated with the San Luis low point and if the reservoir could still meet reasonable carryover storage objectives.

The EWA agencies would use borrowed Project water from the San Luis Reservoir in conjunction with Upstream-from-the-Delta transfers. If the Projects are unable to convey water through the Delta because of EWA pumping reductions, the EWA agencies could borrow water from San Luis Reservoir, provide it to Project Contractors during the reduction, then repay the water to the reservoir later by moving EWA assets from upstream reservoirs when the Delta pumps have capacity. (See Figure 2-4) EWA agencies may thus at times carry a debt to the San Luis Reservoir that would affect water elevations in the reservoir.

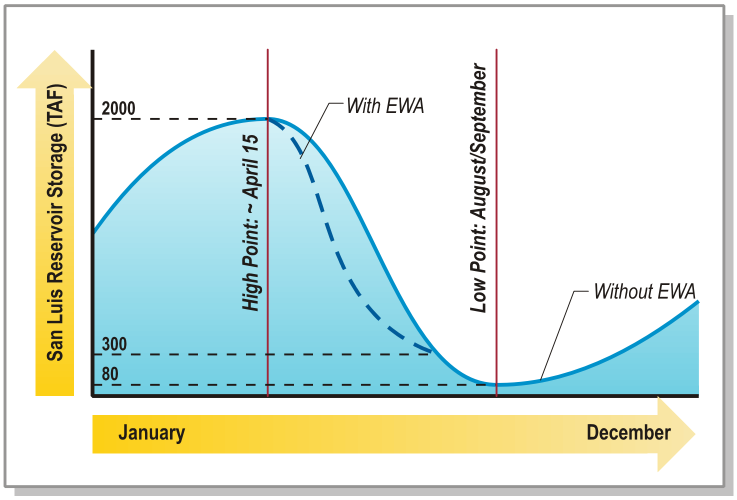

Figure 2-4. Reservoir Level Changes Due to Borrowing Water from San Luis Reservoir

In addition to borrowing Project water, as described above, the EWA agencies could also borrow Project storage if space were available. Some EWA assets are available at times when they cannot immediately be used for fish actions, such as the variable assets described above. The EWA agencies could store these assets in San Luis Reservoir (or other Project facilities such as Lake Shasta, Lake Oroville, and Folsom Lake), but they would have the lowest priority for storage (other than water stored for non-Project entities).

Groundwater Storage Groundwater storage requires the ability to percolate or inject the excess water into a groundwater basin for later extraction, or have Project water that could be transferred to the EWA as a mechanism to return the water to the EWA. Having facilities for groundwater storage of EWA assets would provide the EWA the flexibility to acquire and store water throughout the year, which would allow additional flexibility in asset acquisition.

Groundwater storage is different from the acquisition method of purchasing stored groundwater because the EWA agencies would be providing the assets to be stored (after the initial purchase of the full storage area). If the EWA agencies purchased stored groundwater, it would purchase water that the sellers had previously stored in the ground.

Stored groundwater could be returned to the EWA through two mechanisms:

- The banking entity could extract the water out of the ground and into a waterway or Project conveyance facility; or
- The entity could transfer its surface water allotment to the EWA and pump groundwater for local use.

Source Shifting Source shifting is a tool that was developed in the CALFED ROD to help make the EWA more flexible. With source shifting, the EWA agencies would hold scheduled water from a Project contractor for a fee, delivering the water at a later date. The result of this option is to delay delivery of SWP or CVP contract water.

The purpose of implementing source shifting would be to help protect the San Luis Reservoir against reaching storage volumes where the low point problem begins earlier with the EWA than it would have without the EWA. Source shifting would allow the EWA to hold water from one or more Project contractors and use it to repay debts to the San Luis Reservoir before the low point problem has begun.

At the start of source shifting operations, water surface elevations in the reservoirs or groundwater basins used as the alternate supply source by the source shifting contractor would decrease relative to non-EWA conditions. The water levels would then return to non-EWA conditions as the water was paid back, which could continue into the next year. Source shifting does lower water levels temporarily, but only within existing operating parameters. The reservoirs or groundwater aquifers would not be operated outside their standard operations.

Pre-Delivery As a permutation of source shifting, the EWA agencies could engage willing partners to receive water earlier than they would typically receive water. The EWA agencies would consider this tool if the EWA had water in storage in San Luis Reservoir during the winter that could convert to Project water as San Luis fills. To implement pre-delivery, the EWA agencies would deliver water to users in the Export Service Area that have their own storage facilities in which to store that water. The EWA would essentially be borrowing storage space from these users. This action would increase reservoir levels in surface storage facilities.

Exchanges The EWA agencies could engage willing partners to receive water earlier than their normal delivery schedule. The EWA agencies would consider using this tool if they had remaining assets at the end of June and they did not anticipate using these assets before the end of the water year. In a dry summer period, the EWA could exchange its surplus assets with an agricultural contractor with the agreement that the contractor return the water on request in the next relatively wet year; for example, a year with SWP allocations of 70 percent or higher. The agricultural contractor would then take delivery of the EWA water from July through the end of the irrigation season instead of pumping local groundwater or drawing on other sources. The exchange would reduce groundwater pumping in the first year of the exchange, and would require the contractor to reduce dependence on contract supplies in the year of the return of the water.

Similarly, the EWA agencies could exchange surplus assets with a contractor that has available surface water storage. The contractor would take deliveries of the EWA water during the same time period instead of drawing on local surface water supplies. The exchange would result in slightly higher reservoir levels throughout the winter and until the contractor returns the water to the EWA in a relatively wet year.

2.4.3 Typical Year EWA Operations

In a typical year, the EWA would purchase 200,000-300,000 acre-feet for its annual operations. In the driest years, and when assets were carried over from the prior year, the total acquisitions could be closer to 200,000 acre-feet. In near average water years, the acquisition target would be closer to 300,000 acre-feet or even higher.

In the wetter years when operational curtailments would be expected to cost more water because the base Delta pumping rate would be higher or when the EWA ends the prior year with substantial debt, water needs for fish may be in the 400,000-600,000 acre-foot range. Initial acquisition targets may be lower in those years.

2.4.4 Science and Adaptive Management

According to the CALFED ROD, "the purpose of the CALFED Science Program is to provide a comprehensive framework and develop new information and scientific interpretations necessary to implement, monitor, and evaluate the success of the CALFED Program (including all program components), and to communicate to managers and the public the state of knowledge of issues critical to achieving CALFED goals." The Science Program's evaluation efforts include two levels of independent review: a standing Independent Science Board for the entire CALFED Program, and a variety of Science Panels focused on specific programs.

Historically, the EWA had an EWA Technical Review Panel (Panel), which included distinguished experts representing scientific, economic, engineering, and socioeconomic disciplines. The Panel evaluated the EWA program every two years. The review considered the overall concept of the EWA program, EWA agencies' actions (uses of water and actions to protect fish), and the technical and biological basis for actions that took place. The original Panel was disbanded after completion of the 2004 annual review, but was re-formed for the first bi-annual review in 2006. Under the Flexible Purchase Alternative, the Science Program would continue to organize EWA workshops and review the biological parameters of the EWA program. The members of the Panel (or other qualified experts) would participate in these workshops. The EWA agencies would, to the extent practicable, incorporate future recommendations into the manner in which they make purchases and take fish actions.

Adaptive management is a key component of the EWA and Science Programs. Adaptive management treats actions as partnerships between scientists and managers by designing those actions as experiments with a level of risk commensurate with the status of those species involved, and bringing science to bear in evaluating the feasibility of those experiments. New information and scientific interpretations would be developed through adaptive management, as the programs progress, and would be used to confirm or modify problem definitions, conceptual models, research, and implementation actions (CALFED 2000b).

Adaptive management provides a process to change EWA fish actions or asset acquisitions depending on the recommendations of the Science Panel. The Panel prepares a report after reviewing the EWA program each water year. These reports can be found at
http://science.calwater.ca.gov/workshop/past_workshops.shtml.

2.5 Fixed Purchase Alternative

In the Fixed Purchase Alternative, the EWA agencies could take the same types of fish actions identified in the No-Action/No Project and Flexible Purchase Alternatives, but the assets available would limit the magnitude of the actions. This alternative limits the EWA agencies to purchases of the 185,000 acre-feet identified in the CALFED ROD (35,000 acre-feet upstream from the Delta and 150,000 acre-feet in the Export Service Area) and would not use functional equivalency to adjust purchase location. Water purchases would be limited to the 185,000 acre-feet per year regardless of water year type. In this alternative, the volumes that the EWA agencies would purchase from each region would remain constant every year. The Fixed Purchase Alternative has the benefits of variable assets, source shifting, and groundwater storage as described in the ROD. In this alternative, the EWA agencies would acquire variable assets at the same rate as in the Flexible Purchase Alternative.

If pumping would be likely to put at risk the continued existence of a species listed as endangered or threatened under the ESA, the Project Agencies would curtail pumping even if purchases already totaled 185,000 acre-feet and all assets were used. However, the EWA agencies would need supplemental environmental documentation before they could acquire more water to compensate water users for these actions.

2.5.1 Actions to Protect Fish and the Environment

Under the Fixed Purchase Alternative, the EWA agencies could take the following actions to protect fish and the environment: (1) reduce export pumping, (2) close the DCC gates, (3) increase instream flows, and (4) augment Delta outflow. Section 2.3.1 describes these actions as part of the No Action/No Project Alternative; the Fixed Purchase Alternative would include increased amounts of the same actions. Section 2.4.1 further describes the types of EWA actions, including the timing.

Because the Fixed Purchase Alternative limits the EWA agencies' asset acquisitions, the EWA agencies must prioritize fish actions and in many years only undertake the highest priority actions. The Fixed Purchase Alternative would focus on actions within the Delta; the primary action would likely be to reduce export pumping to help fish in the vicinity of the pumps. The Fixed Purchase Alternative includes less flexibility to engage in upstream actions; in most years, the assets available in this alternative would be entirely consumed by repayments for water not exported during pump reductions. The EWA agencies would determine the frequency of pump reductions according to the fish behavior in that year and would take actions when they would most benefit the fish. In some years, the fish may not spend time near the pumps; therefore, the EWA agencies would not need to reduce pumping as often during such periods. In those years, the Fixed Purchase Alternative has the potential to provide the other benefits listed above.

2.5.2 Asset Acquisition and Management

The 2004 EIS/EIR lists agencies that may be willing to sell water to the EWA or have sold water to the EWA in past years[5], along with a general range of potentially available water volumes. This Supplement assumes the same list of agencies and range of transfers, with the following exceptions: Placer County Water Agency and Tulare Lake Basin Water Storage District would not transfer water to the EWA.

2.5.3 Science and Adaptive Management

Section 2.4.5 describes the CALFED Science Program, its role in reviewing the success of the EWA program, and a summary of past recommendations. It also

[5] Information on past EWA transactions can be found online at http://wwwoco.water.ca.gov/calfedops/2001ops.html; http://wwwoco.water.ca.gov/calfedops/2002ops.html; http://wwwoco.water.ca.gov/calfedops/2003ops.html; http://wwwoco.water.ca.gov/calfedops/2004ops.html; http://wwwoco.water.ca.gov/calfedops/2005ops.html; or http://wwwoco.water.ca.gov/calfedops/2006ops.html.

describes the Adaptive Management process as it applies to the EWA. This same review and adaptive management process would apply to the Fixed Purchase Alternative. The Fixed Purchase Alternative, however, would have less flexibility to modify its actions should the Science Program's experts recommend changes. Alterations in actions under the Fixed Purchase Alternative would primarily include changes in timing because the amount of water available for actions is constrained.

2.6 Identification of the Environmentally Preferred Alternative

As described in the upcoming resource chapters, the Fixed Purchase Alternative and the Flexible Purchase Alternative have similar effects on fisheries. The primary environmental delineator is the benefit produced by each alternative. The Flexible Purchase Alternative would include higher levels of asset acquisition, which would allow the EWA agencies to take more actions to benefit fish. The Fixed Purchase Alternative would include less asset acquisition; therefore, the EWA agencies would have to prioritize actions to protect fish in the Delta and could take fewer actions to benefit fish. These differences in the environmental benefits of the Flexible Purchase Alternative and the Fixed Purchase Alternative were identified in the 2004 EIS/EIR, which assumed implementation of the EWA through 2007, and such differences would essentially be the same relative to implementing the EWA in 2008 through 2011.

Because the Flexible Purchase Alternative includes increased asset acquisitions, the EWA agencies could take more actions to benefit fish and would likely not need additional assets beyond the 600,000 acre-feet very often. The Fixed Purchase Alternative would have an increased likelihood of needing assets beyond 185,000 acre-feet to protect the continued existence of a species listed as endangered or threatened under the ESA, which may result in uncompensated actions to protect fish. Both alternatives increase water supply reliability over the No Action/No Project Alternative, but the Fixed Purchase Alternative would not be as reliable because of the increased potential of uncompensated actions.

The Flexible Purchase Alternative is the environmentally preferred alternative because of the increased benefits it would provide. The benefits to aiding in the recovery of at-risk native fish species populations are described in more detail in the upcoming resource chapters.

2.7 References

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Chapter 3
Resource Areas

This chapter includes a description of the resource areas identified in the 2004 EIS/EIR as being potentially affected by the EWA program. As stated in Chapter 1, the Supplement does not need to include information already contained in the 2004 EIS/EIR. Therefore, this chapter will describe any substantive changes to the environmental and regulatory setting since the 2004 EIS/EIR, evaluate whether those changes warrant additional analysis, and, where appropriate, provide such additional analysis.

Appendix A contains a list of impacts, mitigation measures, and beneficial impacts included in the 2004 EIS/EIR that are also applicable to this Supplement. The Delta fisheries sections of the tables are deleted and are superseded with the fisheries information in this Supplement. Additionally, Placer and Tulare Counties are deleted from the tables because they would not be a participant in the EWA program evaluated in this Supplement.

3.1 Resource Areas with no Environmental or Regulatory Setting Changes

The following resources have either: 1.) no changes; or 2.) changes to the environmental or regulatory setting that are not specific enough to distinguish them from the description in the 2004 EIS/EIR: water supply, groundwater, geology and soils, visual, cultural, flood control, and Indian Trust Assets. Because the project description for the EWA is still essentially the same as originally proposed, the baseline condition for these resources have not substantially changed, and there is no new important information regarding these resources, no additional analysis beyond that already provided in the 2004 EIS/EIR is necessary for this Supplement.

3.2 Resource Areas with Environmental or Regulatory Setting Changes

This section describes resource areas that have substantive changes to the environmental and/or regulatory setting since the 2004 EIS/EIR: water quality, air quality, fisheries and aquatic ecosystems, vegetation and wildlife, agricultural economics, agricultural social issues, agricultural land use, environmental justice, recreation, and power.

3.2.1 Water Quality

Regulatory Setting

No substantive changes in the regulatory setting have occurred since the completion of the 2004 EIS/EIR.

Environmental Setting

The environmental setting for the water quality analysis includes water quality data for the reservoirs and rivers that are affected by EWA agency actions. The water quality within these reservoirs and rivers has likely changed to an extent since the completion of the 2004 EIS/EIR. The 2004 EIS/EIR contained a list of the 303(d) listed waterbodies; Table 3-1 includes an updated list of the constituents of concern for impaired waterbodies.

Table 3-1. Constituents of Concern for 303(d) Listed Waterbodies

Name	Constituent	Potential Sources	Estimated Area Affected	Approved TMDL (Proposed TMDL)
Lake Shasta	Cadmium	Resource extraction	20 acres	(2020)
	Copper	Resource extraction	20 acres	(2020)
	Zinc	Resource extraction	20 acres	(2020)
Sacramento River	Cadmium	Resource extraction	15 miles	2002
	Copper	Resource extraction	15 miles	2002
	Zinc	Resource extraction	15 miles	2002
	Diazinon	Agriculture	16 miles	2003
	Unknown toxicity	Source unknown	82 miles	(2019)
	Mercury	Resource extraction	16 miles	(2019)
Lower Feather River	Diazinon	Agriculture	42 miles	2003
	Chlorpyrifos	Source unknown	42 miles	(2019)
	Group A pesticides	Agriculture	42 miles	(2011)
	Mercury	Resource extraction	42 miles	(2009)
	Unknown Toxicity	Source unknown	42 miles	(2019)
Lower American River	Mercury	Resource extraction	27 miles	(2008)
	Unknown toxicity	Source unknown	27 miles	(2019)
Lake Natoma	Mercury	Source unknown	485 acres	(2019)
Lower Merced River	Chlorpyrifos	Agriculture	50 miles	(2008)
	Diazinon	Agriculture	50 miles	(2008)
	Group A pesticides	Agriculture	50 miles	(2011)
	Mercury	Source unknown	50 miles	(2019)

Table 3-1. Constituents of Concern for 303(d) Listed Waterbodies

Name	Constituent	Potential sources	Estimated Area Affected	Approved TMDL (Proposed TMDL)
San Joaquin River	Chlorpyrifos	Agriculture	145 miles	2005
	Diazinon	Agriculture	142 miles	2005
	Selenium	Agriculture	37 miles	2002
	Boron	Agriculture	145 miles	(2006)
	DDT	Agriculture	145 miles	(2011)
	EC	Agriculture	145 miles	(2006)
	Group A pesticides	Agriculture	145 miles	(2011)
	Mercury	Resource extraction	57 miles	(2020)
	Selenium	Agriculture	3 miles	(2019)
	Unknown toxicity	Source unknown	145 miles	(2019)
Sacramento - San Joaquin Delta Waterways	Chlorpyrifos	Agriculture/Urban Runoff/Storm Sewers	43,614 acres	(2019)
	DDT	Agriculture	43,614 acres	(2011)
	Diazinon	Agriculture/Urban Runoff/Storm Sewers	43,614 acres	(2019)
	Dioxin	Point source	1,603 acres	(2019)
	EC	Agriculture	20,819 acres	(2019)
	Exotic species	Source unknown	43,614 acres	(2019)
	Furan compounds	Contaminated sediments	1,603 acres	(2019)
	Group A pesticides	Agriculture	43,614 acres	(2011)
	Mercury	Resource extraction	43,614 acres	(2006)
	Pathogens	Urban runoff/storm Sewers; recreational and tourism activities	1,603 acres	(2008)
	PCBs	Source unknown	8,398 acres	(2019)
	Unknown toxicity	Source unknown	43,614 acres	(2019)

Source: RWQCB 2006.

Conclusion

The updated 303(d) list shows inclusion of Lake Natoma for mercury relative to the listing in the 2004 EIS/EIR. Other waterbodies are substantially similar, with only minor changes to the estimated area affected. The water quality of each waterbody under the baseline condition was considered in the analysis; however, the significance criteria specified effects on water quality were based on changes to reservoir storage, river flow, and water temperature. These parameters would not have changed in the modeling output for the baseline condition or the action alternatives.

Additionally, several operating parameters would be maintained that affected the water quality analysis in the 2004 EIS/EIR:

1) The standards that govern water quality in the Delta would continue.

2) Carriage water, defined as the additional water needed for Delta outflow to compensate for the additional exports made on behalf of a transfer to assure compliance with water quality requirements of the SWP and CVP, would be included in the transfers.

3) Pumping of EWA assets would remain in July, August, and September, the effects of which were evaluated in the 2004 EIS/EIR.

Because there are no substantive changes to the project description and modeled baseline condition, and no new important information regarding this issue, no additional water quality analysis is warranted in this Supplement.

3.2.2 Air Quality

Regulatory Setting

New regulatory standards established since the 2004 EIS/EIR affect the basis from which emissions from agricultural sources can be analyzed. In the 2004 EIS/EIR, the regulatory setting stated agricultural irrigation pumps were exempt from air quality permit requirements. Senate Bill 700 and Rule 4550, described below, augment existing air pollution control requirements to include regulation of agricultural sources. In addition, updated ambient air quality standards lower the concentration of $PM_{2.5}$ at which actions would be significant.

Senate Bill 700 Senate Bill (SB) 700 amends air pollution control requirements in the California Health and Safety Code to include requirements for agricultural sources of air pollution (CAPCOA 2004). SB 700 adds requirements to state law in six main areas; four of the areas relate to the EWA:

1) Defines “agricultural source:” a source of air pollution or a group of sources used in the production of crops including internal combustion engines,

2) Removes the permit exemption: local air districts can require permits for agricultural sources of pollutant emissions;

3) Establishes specific permitting and exemption requirements: specifies varying permit requirements for agricultural sources in five categories; and

4) Requires emission control regulations in areas that do not attain National Ambient Air Quality Standards (NAAQS) for PM_{10}: air districts must adopt and implement best available control measures and best available retrofit control technology to reduce emissions from agricultural practices.

Rule 4550 Conservation Management Practices Several Air Pollution Control Districts (APCDs) and Air Quality Management Districts (AQMDs) have regulations regarding fugitive dust, although the majority of the regulations exempt agricultural operations. The San Joaquin Valley APCD adopted a regulation that targets agricultural operations. Rule 4550 Conservation Management Practices, adopted in August 2004, limits fugitive dust emissions from agricultural operation sites within the San Joaquin Valley: Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare, and western portion of Kern Counties (SJVAPCD 2004). Rule 4550 requires agricultural owners/operators to implement a conservation management practice (CMP) for each identified category, such as land preparation, harvest, and unpaved roads. Example CMPs include conservation tillage, night harvesting (moisture levels are higher and winds are lighter at night, which helps contain particulate matter emissions from tillage), and applying mulch.

$PM_{2.5}$ In October 2006, the Environmental Protection Agency passed a rule lowering the NAAQS 24-hour concentration for $PM_{2.5}$ from 65 $\mu g/m^3$ to 35 $\mu g/m^3$. This new standard should be used to determine a project's air quality impacts.

Environmental Setting

The environmental setting in the 2004 EIS/EIR included ozone and PM_{10} concentrations between 1995 and 1999 for counties with EWA actions that could affect air quality. The average concentrations vary slightly in recent years (e.g., 2001 – 2005) compared to those in the 2004 EIS/EIR; however, the overall trend relative to the state standard (i.e., above or below the standard) is the same. Therefore the analysis in the 2004 EIS/EIR, which incorporates whether the county is in attainment for ozone and PM_{10}, remains valid.

Conclusion

Agricultural Regulations New regulations include provisions for agricultural emissions that did not exist at the time of the 2004 EIS/EIR. The new regulations were not factored into the analysis in the 2004 EIS/EIR; however, the 2004 EIS/EIR analyzes the impacts associated with changes in agricultural emissions even without these regulatory requirements. The impact determination related to groundwater substitution and crop idling was significant (less than significant with mitigation). This determination was based on project-related emissions within counties with a nonttainment status. Incorporation of the regulations into the analysis would not change the outcome; rather, the regulations support the inclusion of agricultural emissions in the analysis.

$PM_{2.5}$ The analysis in the 2004 EIS/EIR used mass emissions rather than concentrations in evaluating the significance of impacts. Crop idling would produce $PM_{2.5}$; however, the 2004 EIS/EIR concluded the impact would be less than significant with mitigation. Mitigation included complying with the local

APCD's or AQMD's regulations, which would now include the updated $PM_{2.5}$ regulation.

The regulatory and environmental changes that have occurred since the publication of the 2004 EIS/EIR do not warrant additional analysis for project-related impacts on air quality.

3.2.3 Fisheries and Aquatic Ecosystems

Substantial regulatory and environmental setting changes have occurred within the Delta. Because of the lengthiness and complexity of the changes, Chapter 4 is used to present the information.

3.2.4 Vegetation and Wildlife

Regulatory Setting

New regulatory standards established since the 2004 EIS/EIR affect the basis from which impacts on wetlands can be analyzed. Since the 2004 EIS/EIR, the USEPA jointly with USACE issued a memorandum providing guidance on implementing the U.S. Supreme Court's June 19, 2006 decision in the consolidated cases Rapanos v. United States and Carabell v. United States. The Clean Water Act (CWA) makes it unlawful to discharge dredged or fill material into navigable waters without a permit. Navigable waters are defined in 33 U. S. C. §§1311(a), 1342(a), as "the waters of the United States including the territorial seas" which the USACE has interpreted to mean traditional navigable waters and other waters such as tributaries and adjacent wetlands. Two landowners in Michigan challenged CWA rulings on their projects. These challenges made their way to the U.S. Supreme Court where a split decision was rendered. This 4-1-4 split decision resulted in the USEPA and USACE devising new guidance for implementing the ruling and determining what waters fall under CWA jurisdiction.

Environmental Setting

The environmental setting in the 2004 EIS/EIR discussed wetlands based upon MSCS habitat categories such as nontidal freshwater permanent emergent, natural seasonal wetland, and managed seasonal wetland. Because EWA actions vary from year to year, hence the specific project area affected changes from year to year, the environmental setting was discussed at a broad scale and has not changed significantly since the 2004 EIS/EIR.

Conclusion

The environmental setting wetland categories (nontidal freshwater permanent emergent, etc.) are based upon the MSCS and not upon CWA jurisdiction. Because EWA actions vary from year to year, hence the area affected changes from year to year, CWA jurisdictional determinations are not made until it is determined what specific actions are being taken and where. The recent Rapanos ruling and subsequent USEPA and USACE guidance may alter whether or not some wetlands previously considered under the 2004 EIS/EIR are now jurisdictional or not and require mitigation if affected by EWA actions.

Although the new USEPA/USACE guidance was not factored into the analysis in the 2004 EIS/EIR, the impact determination related to groundwater substitution and crop idling was significant (less than significant with mitigation). Incorporation of the new guidance into the analysis would not change the outcome. Wetlands would still be significantly affected by groundwater substitution and crop idling; however, the overall extent of affected wetlands may change.

The regulatory changes that have occurred since the publication of the 2004 EIS/EIR do not warrant additional analysis for project-related impacts on wetlands.

3.2.5 Regional and Agricultural Economics

Regulatory Setting

No substantive regulatory setting changes have occurred since the completion of the 2004 EIS/EIR.

Environmental Setting

Economic conditions have changed slightly since the 2004 EIS/EIR. This section presents recent economic data (years 2005, 2006, or 2007 depending on most recent data available) and describes how EWA actions' effects could differ from those in the 2004 EIS/EIR. The data presented is intended to serve as indicators of how the economy is similar or different to that described in the 2004 EIS/EIR; therefore, data from the 2004 EIS/EIR is not repeated.

Upstream from the Delta Region The 2004 EIS/EIR described the environmental setting with various economic parameters, including industry earnings, employment, and employee compensation. Since publication of the 2004 EIS/EIR, Placer County Water Agency has indicated that they would not sell water through crop idling to the EWA agencies; therefore, Placer County was removed from the Upstream from the Delta Region.

Table 3-2 shows 2005 economic parameters for the Upstream from the Delta Region. From 1999-2005, total personal income increased about 34 percent, or $3.8 billion, in the region, with individual county increases ranging from 23 to 37 percent. Increases in non-farm income contributed most to the increases in total personal income; individual county increases ranged from 28 to 48 percent. Per capita income increased in all counties from about $2,500 to $5,100. Total industry earnings also increased in all counties, ranging from 29 to 48 percent. Total employment increased 8 to 10 percent in Butte, Sutter, and Yolo Counties, and remained relatively the same in Glenn and Colusa Counties. Total population in the region increased about 13 percent from 1999 to 2005. With the exception of Yolo County, the unemployment rate in all other Upstream from the Delta Region counties decreased from 2000 to 2006. In 2006, unemployment rates were 6.2 percent in Butte County, 12.6 percent in Colusa County, 8.0 percent in Glenn County, 8.9 percent in Sutter County, and 5.2 percent in Yolo County (California Department of Finance 2007).

Table 3-2. 2005 Economic Activity Upstream from the Delta Region ($1,000)

County	Personal Income[1]				Total Industry Earnings[3]	Total Employment[4] (jobs)	Total Population (persons)
	Total	Non-Farm	Farm	Per Capita (dollars)[2]			
Butte	$5,811,300	$5,712,708	$98,592	$27,136	$3,668,593	107,218	214,153
Colusa	$533,501	$475,145	$58,356	$25,559	$400,183	10,996	20,873
Glenn	$624,555	$574,804	$49,751	$22,561	$384,217	12,126	27,683
Sutter	$2,451,884	$2,398,649	$53,235	$27,548	$1,414,109	43,138	89,005
Yolo	$5,745,453	$5,680,285	$65,168	$31,041	$5,542,022	118,348	185,091
Total	$15,166,693	$14,841,591	$325,102		$11,409,124	291,826	536,805

Source: BEA REIS 2007

[1]Personal income is the income that is received by persons from participation in production, from both government and business transfer payments, and from government interest

[2]Per capita personal income is measure of income is calculated as the total personal income of the residents of an area divided by the population of the area. Per capita personal income is often used as an indicator of the economic well-being of the residents of an area.

[3]Total industry earnings include all farm and non-farm earnings.

[4]Total employment includes all industry sector employment estimates of both full and part-time jobs.

Table 3-3 shows agricultural revenues and production costs in the Upstream from the Delta Region. Compared to 1999 values in the 2004 EIS/EIR, the total region's cash receipts have increased about 10 percent. Total cash receipts in Colusa, Sutter, and Yolo Counties decreased, but increases in Butte and Glenn Counties offset the decreases to result in a net increase for the region. Government payments decreased in all counties, ranging from 34 to 46 percent. Production expenses increased about 4 to 10 percent in all counties expect Colusa, where expenses remained similar. Realized net income increased in Butte and Glenn Counties and decreased in Colusa, Sutter, and Yolo Counties, which is consistent with the changes in total cash receipts.

Table 3-3. 2005 Agricultural Revenues and Production Costs, Upstream from the Delta Region ($1,000)

County	Gross Farm Income[1]					Total Production Expenses[2]	Realized Net Income[3]	Total Farm Labor and Proprietors Income[4]
	Total Cash Receipts			Other Income				
	Livestock, Production	Crops	Total	Govern-ment Payments	Total Other Income			
Butte	$14,102	$370,045	$384,147	$23,825	$53,305	$308,047	$129,405	$102,816
Colusa	$9,196	$264,733	$273,929	$35,468	$63,555	$300,735	$36,749	$62,637
Glenn	$69,458	$202,066	$271,524	$22,451	$53,075	$275,414	$49,185	$51,837
Sutter	$9,029	$281,740	$290,769	$31,252	$75,481	$343,917	$22,333	$57,739
Yolo	$19,468	$354,263	$334,795	$15,831	$54,196	$394,167	$14,292	$70,972
Total	$121,253	$1,472,847	$1,555,164	$128,827	$299,612	$1,622,280	$251,964	$346,001

Source: BEA REIS 2007

[1]Gross farm income consists of estimates for the following items: cash receipts from marketing of crops and livestock; income from other farm-related activities, including recreational services and the sale of forest products; government payments to farmers; value of food and fuel produced and consumed on farms; gross rental value of farm dwellings; and the value of the net change in the physical volume of farm inventories of crops and livestock.

[2]Production expenses consist of: purchases of feed, livestock, seed, fertilizer and lime, and petroleum products; hired farm labor expenses (including contract labor); and all other production expenses (e.g. depreciation, interest, rent and taxes, and repair and operation of machinery).

[3]Production expenses and gross farm income excluding inventory change are used to calculate realized net income of all farms (gross farm income, excluding inventory change, minus production expenses equals realized net income).

[4]Bureau of Economic Analysis estimate of farm proprietors' income is estimated from modifying realized net income to exclude the income of corporate farms and salaries paid to corporate officers.

Table 3-4 shows the top 10 commodities in each county of the Upstream from the Delta Region in terms of value of agricultural production. There has been very little change in the 2005 top 10 commodities in each county relative to the 2000 county lists presented in the 2004 EIS/EIR. Rice was the top commodity for value of production in 2000 for Butte and Glenn, but is second in 2005. The top ranked commodities for Colusa, Sutter, and Yolo have remained the same. The production values differed for each commodity relative to year 2000, but this reflects changes in market prices, crop yields, acreage planted, and production costs.

Table 3-4. 2005 Leading Commodities for Value of Production in the Upstream from the Delta Region

Rank	Yolo	Value ($1,000)	Sutter	Value ($1,000)	Glenn	Value ($1,000)	Butte	Value ($1,000)	Colusa	Value ($1,000)
1.	Tomatoes	68,260	Rice	98,520	Almonds, All	134,541	Almonds	187,391	Rice	124,963
2.	Grapes, Wine	41,967	Walnuts	52,318	Rice, Milling	76,558	Rice	86,085	Almond Meats	121,968
3.	Hay, Alfalfa	36,242	Peaches	27,883	Milk, Market	47,761	Walnuts	76,691	Tomatoes, Processing	42,818
4.	Almonds	30,976	Plums, Dried	18,945	Walnuts, English	24,676	Nursery Stock	11,099	Cattle and Calves	13,257
5.	Rice	28,248	Almonds	12,052	Cattle and Calves	20,109	Peaches, Clingstone	10,107	Walnuts, English	11,693
6.	Walnuts	21,748	Nursery Products	11,058	Plums, Dried	14,342	Cattle and Calves	8,999	Seed, Rice	7,785
7.	Seed Crops	21,413	Cattle and Calves	10,248	Hay, Alfalfa	7,974	Plums, Dried	7,310	Seed, Onion	6,84
8.	Organic Crops	13,914	Tomatoes	9,328	Grapes	7,822	Kiwifruit	6,741	Hay, Alfalfa	5,051
9.	Cattle and Calves	12,412	Melons	8,411	Olives	7,353	Fruit and Nut Crops	4,708	Seed, Cucumber	4,710
10.	Wheat	7,238	Hay, Alfalfa	5,228	Corn, Grain	5,297	Field Crops	4,665	Beans, Dry	3,833

Source: USDA NASS 2006b

Table 3-5 shows the average rice acreage in the Upstream from the Delta Region from 2001 to 2005. As identified in the 2004 EIS/EIR, the EWA agencies would only acquire water through idling 20 percent of the available rice acreage in a county. The EWA agencies would follow the same standards identified in the 2004 EIS/EIR to determine a 20 percent value. The 5-year average acreages in Table 5 are relatively similar to the 1995 through 1999 average acreages presented in the 2004 EIS/EIR. Average acreage increased within 6 percent for Glenn and Sutter Counties and stayed relatively the same in Butte and Colusa Counties. The 5-year average rice acreage in Yolo County increased from 28,822 acres to 35,758 acres, mainly because of an increase in rice planted in 2003 and 2004. Idling the maximum rice acreage in the Upstream from the Delta Region under 2001 to 2005 average acreages would yield about 296,000 acre-feet. The EWA agencies would not idle the maximum amount in a given year.

Table 3-5. 2001 to 2005 Average Rice Acreage in the Upstream from the Delta Region

County	Average Total Acres	20 Percent of Total Acreage
Butte	94,920	18,984
Colusa	131,886	26,377
Glenn	88,461	17,692
Sutter	98,133	19,627
Yolo	35,758	7,152

Source: USDA NASS 2002 to 2006a

The environmental setting section in the 2004 EIS/EIR did not present specific costs of rice production; however, a crop budget was used in the economic model to determine regional effects. University of California Crop Extension (UCCE) published a 2007 rice budget for the Sacramento Valley; the 2004 EIS/EIR used data from a 2001 rice budget. As reported in the UCCE crop budgets, total production costs for rice increased about $300 per acre from 2001 to 2007. This increase was largely due to a $230 increase in operating costs for cultural and harvesting activities. One notable difference in the rice production costs is the change in the price of labor and the price of fuel. Labor costs increased about $6.00 per hour from 2001 to 2007 and fuel increased about $1.30 per gallon (UCCE 2001, UCCE 2007).

Export Service Area Since publication of the 2004 EIS/EIR, the EWA agencies have decided that they would not purchase water through crop idling from the Friant Division. Tulare County contains primarily Friant Division contractors; therefore, Tulare County was removed from the Export Service Area.

Table 3-6 shows 2005 economic parameters for the Export Service Area. Total personal income in the region increased about $13 billion. Both farm and nonfarm income increased in all counties. Per capita income increased from $4,800 to $5,800 relative to 1999 values. Total industry earnings in the region increased in the range of $1 to $5 billion. Total employment in the region increased 10 percent and population increased 16 percent. The unemployment rate in all Export Service Area counties decreased from 2000 to 2006. In 2006, unemployment rates were 8.0 percent in Fresno County, 7.6 percent in Kern County, and 8.5 percent in Kings County (California Department of Finance 2007).

Table 3-6. 2005 Economic Activity in the Export Service Area, ($1,000)

County	Personal Income				Total Industry Earnings[1]	Total Employment[2]	Total Population
	Total	Nonfarm	Farm	Per Capita (dollars)		(jobs)	(persons)
Fresno	$22,796,108	$22,144,020	$652,088	$25,961	$17,355,171	436,751	878,089
Kern	$18,924,066	$18,027,615	$896,451	$24,999	$14,772,999	349,868	756,981
Kings	$3,089,692	$2,930,168	$159,524	$21,536	$2,426,767	56,778	143,467
Total	$44,809,866	$43,101,803	$1,708,063		$34,554,937	843,397	1,778,537

Source: BEA REIS 2007
Refer to Table 3-2 definitions of terms

Table 3-7 shows agricultural revenues and production costs in the Export Service Area. The total region's cash receipts increased over $2 billion from the values in the 2004 EIS/EIR. Production expenses increased 6 to 13 percent in each county. Realized net income increased over $1 billion from the 2004 EIS/EIR values, largely because of the increase in total cash receipts.

Table 3-7. 2005 Agricultural Revenues and Production Costs, Export Service Area ($1,000)

County	Total Cash Receipts			Other Income		Total Production Expenses	Realized Net Income	Total Farm Labor and Proprietors Income
	Total	Livestock, Production	Crops	Govt. Payments	Total Other Income			
Fresno	$3,642,381	$828,724	$2,813,657	$70,578	$188,029	$3,252,330	$578,080	$692,773
Kern	$3,101,007	$496,212	$2,604,795	$61,143	$115,730	$2,271,119	$945,618	$943,837
Kings	$975,092	$546,179	$428,913	$42,256	$73,248	$792,869	$255,471	$171,738
Total	$7,718,480	$1,871,115	$5,847,365	$173,977	$377,007	$6,316,318	$1,779,169	$1,808,348

Source: BEA REIS 2007
Refer to Table 3-3 for further definitions of terms

Table 3-8 shows the top 10 commodities in each county of the Export Service Area in terms of value of agricultural production. Since 2000, the region has increased production of high value tree and vine crops, including almonds, grapes, and citrus. The value of production for cotton dropped in ranking from second in 2000 to sixth in 2005 in Fresno County and from second to ninth in Kern County. Cotton remained second in Kings County, but the overall value of production decreased.

Table 3-8. 2005 Leading Commodities for Value of Production in the Export Service Area

Rank	Fresno	Value ($1,000)	Kern	Value ($1,000)	Kings	Value ($1,000)
1.	Grapes	554,551	Almonds and By-Products	594,378	Milk, All	455,897
2.	Almonds	469,820	Grapes, All	536,571	Cotton, All	249,741
3.	Milk	334,383	Milk, All	421,564	Cattle and Calves	178,295
4.	Tomatoes	328,077	Citrus, All	354,700	Pistachios	84,348
5.	Cattle and Calves	319,686	Pistachios	314,352	Alfalfa	54,140
6.	Cotton	284,854	Carrots, All	209,162	Tomatoes, Processing	49,469
7.	Poultry	280,060	Cattle and Calves	200,966	Silage, Corn	45,242
8.	Peaches	183,678	Hay, Alfalfa	160,059	Peaches, All	36,047
9.	Nectarines	173,946	Cotton and Cottonseed	140,519	Almonds	28,550
10.	Oranges	157,239	Potatoes, All	96,342	Walnuts	26,960

Source: USDA NASS 2006b

Table 3-9 shows the average cotton acreage in the Export Service Area from 2001 to 2005. As identified in the 2004 EIS/EIR, the EWA agencies would only acquire water through idling 20 percent of the available cotton acreage in a county. The EWA agencies would follow the same standards identified in the 2004 EIS/EIR to determine a 20 percent value. The 5-year average acreages in Table 3-9 are substantially lower than the 1995 through 1999 average cotton acreages presented in the 2004 EIS/EIR. Average cotton acreage decreased 30 percent in Fresno County, 43 percent in Kern County, and 17 percent in Kings County. These acreage decreases are reflective of the region’s increasing trend toward permanent tree and vine crops. Therefore, based on the 20 percent limit, much less cotton acreage is eligible for idling relative to the acreages in the 2004 EIS/EIR. Idling the maximum amount of cotton acreage in the Export Service Area would yield about 263,000 acre-feet of water.

Table 3-9. 2001 to 2005 Average Cotton Acreage in the Export Service Area

County	Average Total Acres	20 Percent of Total Acreage
Fresno	246,012	49,202
Kings	139,561	27,912
Kern	185,256	37,051

Source: USDA NASS 2002 to 2006a

The environmental setting section in the 2004 EIS/EIR did not present specific costs of cotton production; however, a crop budget was used in the economic model to determine regional effects. UCCE published a 2003 cotton budget for the San Joaquin Valley; the 2004 EIS/EIR used data from a 1999 cotton budget. Cotton production costs increased about $120 per acre from 1999 to 2003. Operating costs increases for labor and materials account for about half of the total cost increases.

Water Transfer Prices The 2004 EIS/EIR conducted an analysis on the effects of EWA participation on prices and supplies of water transfers in California's transfer market. This section presents updated water transfer data. Although still somewhat new, the water transfer market has developed more through increased transactions and participants since the 2004 EIS/EIR. Environmental water transfers have increased in recent years through purchases through EWA and WAP programs and instream flow regulations. The total quantity of water transferred is largely dependent on hydrologic conditions. Total statewide temporary water transfers, including environmental, agricultural, and urban, have ranged from 800,000 acre-feet in 1998 (a wet hydrologic year) to about 1,700,000 acre-feet in 2001 (a dry hydrologic year).

Table 3-10 shows EWA water acquisitions each year from 2001 through 2005, the seller, and the average price of water acquired. The price paid for EWA water transfers varied by year and buyer. Average prices also varied by location of source, such as Upstream from the Delta or the Export Service Area. For example, in 2001, the price paid ranged from $138 to $370 per acre-foot in the Export Service Area and $75 to $100 in the Upstream from the Delta Region. In 2002, the EWA agencies purchased water at an average price of $75 Upstream of the Delta and $181 per acre-foot in the Export Service Area. In 2003, the EWA agencies purchased water at an average price of $84 Upstream of the

Table 3-10. EWA Water Acquisitions by Region, 2001 to 2004 and Average Price Paid

Year	Yuba County Water Agency TAF	Other Sacra-mento Valley TAF	Kern County Water Agency TAF	CVP Water Provided TAF	Other TAF	Total EWA Water Acquired TAF	Average Price Paid $/AF [1]
2001	50	30	20	72	164	336	$179
2002	135	7	97	0	0	240	$118
2003	65	5	125	0	20	215	$142
2004	100	20	35	0	0	155	$123
2005	5	0	90	0	59	154	$143

Source: DWR 2007
[1]Includes value of CVP water in 2001 and option fees in 2003 and 2004 (DWR 2001 to 2004)

Delta and $169 per acre foot in the Export Service Area. In 2004, the EWA agencies purchased water at $87 and $190, respectively; and in 2005, the EWA agencies purchased water at $43 per acre foot Upstream of the Delta and an average price of $146 per acre foot in the Export Service Area.

Table 3-11 shows the average real price of temporary water transfers for all transfers by type of buyer and origin of seller from various sources. Until 2001, the average price of refuge water supplies were lower than municipal and industrial (M&I) supplies and similar to all other buyers. From 2001 to 2004, the EWA agencies paid more on average for their supplies than other buyers. In general, transfers bought from the south coast have cost more than supplies bought from the San Joaquin valley, and the south coast transfers have cost more on average than all transfers. The one exception, in 2004, was caused by a single, unusually low-priced south coast transfer.

Table 3-11. Real Price (2004 dollars) of Temporary Transfers [1,2]

Year	All Transfers	By Type of Buyer				By Origin of Seller	
		EWA	Refuge [3]	M&I	All Other Buyers	From San Joaquin Valley	From South Coast
1992	$128			$135	$91	$144	$157
1993	$139			$138	$55	$91	$171
1994	$77			$149	$51	$55	$154
1995	$133		$38	$202	$50	$47	$202
1996	$112		$38	$172	$42	$49	$198
1997	$50		$44	$43	$47	$50	$194
1998	$62		$46	$95	$28	$24	$191
1999	$74		$61	$170	$41	$49	$162
2000	$111		$53	$184	$82	$79	$197
2001	$121	$180	$92	$134	$68	$122	$122
2002	$103	$113	$82	$96	$15	$101	$112
2003	$131	$133	$103	$96	$164	$131	$161
2004	$92	$102	$111	$55	$64	$101	$55

Sources: DWR 2007, Reclamation 2005a, Reclamation 2005b, Stratecon 1992 to 2004

[1]Data do not include intra-CVP transfers, SWP turnback water, or prices for temporary transfers lasting more than 10 years.

[2]Real prices are estimated from nominal prices and the gross national product implicit price deflator. Prices are adjusted to year 2004 dollars.

[3]Refuge transactions were place in the water year where most of the water was used.

Conclusion

Crop Idling Effects The analysis in this supplemental document compares recent available economic data to the data presented in the 2004 EIS/EIR to evaluate if any substantial changes to the economic effects in the 2004 EIS/EIR would occur as a result of the new data.

The regional and agricultural economic analysis estimated potential crop idling effects using UCCE crop budgets, County Agricultural Commissioners crop reports, and IMPLAN regional multipliers. The crop budgets provided information to estimate the direct agricultural effects of crop idling. These effects include the decreases in expenditures in regional economic sectors as a result of farmers not purchasing material, fuel, labor, equipment or other supplies needed to produce rice or cotton. The analysis used price and yield data in the County Agricultural Commissioners crop reports to determine crop revenues. Farmers' revenues would be lost by participating in crop idling; however, farmers would receive water transfers revenue, which would presumably make them better off. The EWA agencies would need to negotiate water transfer prices so that farmers would be willing to participate. The crop reports also provided crop acreage data to determine 5-year averages for county rice and cotton acreage. The EWA agencies would continue to limit crop idling to 20 percent of the county's rice or cotton acreage.

The analysis used IMPLAN regional multipliers to determine the indirect and induced effects of crop idling. Indirect effects are caused by changes in expenditures in regional industries that produce inputs for crop production. Induced effects are caused by changes in expenditures of household income. Regional multipliers capture the trade linkages between regional industries and allow for the estimates of indirect and induced effects. In general, the multipliers do not change much from year to year. A change in multipliers reflects a change in technology, a change in relative prices of inputs, or a change in purchasing patterns of inputs from local to imports. Agricultural production has not experienced any major changes since the 2004 EIS/EIR; therefore, multipliers for the related industry sectors would not have substantially changed.

The 2004 EIS/EIR included a county level and local level analysis of crop idling effects. The crop budgets and reports, and regional multipliers were used to estimate economic effects on a regional level, which was defined as individual county economies. The 2004 EIS/EIR presented effects as a percentage of the total county economy. The analysis in the 2004 EIS/EIR also included a qualitative analysis to describe potential effects at the local level, or smaller towns, communities, or local industries. Use of economic data from large regions as a baseline tends to mask the effects of land idling on individual counties or small rural communities. An effect that appears very small relative to an entire economy may seem quite adverse within the most affected areas. Economic effects of crop idling tend to be concentrated within small subgroups of the regional economy; for example, certain agricultural interests in certain locales within a county.

Omitting Placer and Tulare Counties as potential crop idling counties would reduce the total regional economic effects of crop idling because it decreases the amount of rice and cotton acreage eligible for idling. Therefore, total effects in the Upstream of the Delta Region and Export Service Area would be less than those described in the 2004 EIS/EIR.

Based on the updates to the economic baseline, acreages, and production costs, the effects described in the 2004 EIS/EIR would not be expected to substantially change. Therefore, additional regional and agricultural economics analysis is not warranted. The following sections describe this conclusion in more detail for each region.

Upstream of the Delta Region Based on the above data, the county economies in the Upstream from the Delta Region have grown in industry earnings, personal income, and employment. This results in a larger baseline economy from which to compare the effects of crop idling. For example, if crop idling effects remained the same as the 2004 EIS/EIR, the regional effects on a percentage level would decrease under current conditions.

Average county rice acreage has remained stable from 2001 to 2005 relative to 1995 to 1999 averages. Therefore, 20 percent of rice acreage used in the 2004 EIS/EIR analysis would not substantially change under current conditions. Under 2001 to 2005 conditions, idling 20 percent of rice acreage would yield about 296,000 acre feet of water. The EWA agencies would not need the maximum amount of water from rice idling in a single year. In a typical year, the EWA would purchase 200,000-300,000 acre-feet for its annual operations through all types of water acquisitions. Crop idling would be the lowest priority asset acquisition in the Upstream from the Delta Region.

The direct effects of crop idling would be different relative to the 2004 EIS/EIR because of the changes in production costs. Rice production costs have increased since the 2004 EIS/EIR; therefore, direct effects could be slightly larger because farmers would not be paying higher prices for seed, fuel, labor, and other supplies. These direct effects would trickle through other sectors in the economy and result in indirect and induced effects. Because regional multipliers would not have changed substantially, the scale of indirect and induced effects would be similar to the 2004 EIS/EIR. In summary, total economic effects (direct, indirect, and induced) would be larger than the 2004 EIS/EIR, but not to a degree that would substantially affect the county economy, especially considering the increases in the county baseline economies. In other words, the percentage effects of crop idling relative to the county economy would be similar under current conditions compared with those identified in the 2004 EIS/EIR.

The analysis of local effects would remain the same as the 2004 EIS/EIR, in which some potential effects of rice idling could be felt more at a local level.

Export Service Area Based on the above data, the county economies in the Export Service Area have grown in industry earnings, personal income, and employment. This results in a larger baseline economy from which to compare the effects of crop idling.

Average county cotton acreage has decreased about 30 percent from 2001 to 2005 relative to 1995 to 1999 averages. Therefore, 20 percent of cotton acreage used in the 2004 EIS/EIR analysis would be substantially less under current conditions. Fewer acres eligible for idling would result in fewer economic effects.

Under 2001 to 2005 conditions, the maximum idling action of 20 percent of the region's cotton acreage would produce about 263,000 acre-feet of water. In wet and above normal water years, the EWA agencies would try to acquire most of the water needed for fish actions through crop idling in the Export Service Area. During these years, economic effects would be greater than in drier years when the EWA agencies can target other acquisition types in the Upstream from the Delta Region.

The direct effects of crop idling would be different relative to the 2004 EIS/EIR because of the changes in production costs. Cotton production costs have increased since the 2004 EIS/EIR; therefore, direct effects could be slightly larger because farmers would not be paying higher prices for seed, fuel, labor, and other supplies. These direct effects would trickle through other sectors in the economy and result in indirect and induced effects. Because regional multipliers would not have changed substantially, the scale of indirect and induced effects would be similar to the 2004 EIS/EIR.

In summary, the percentage effects of crop idling relative to the regional economy would likely be slightly smaller under current conditions than the effects in the 2004 EIS/EIR because the regional economies have grown and maximum cotton acreages eligible for idling have decreased.

The analysis of local effects would remain the same as the 2004 EIS/EIR, in which some potential effects of cotton idling could be felt more at a local level. Because average cotton acreage has decreased in the region relative to the 2004 EIS/EIR, businesses fully dependent on cotton production may experience more adverse economic effects from cotton idling.

Water Transfer Market Effects Based on recent data on the water transfer market, the conclusions in the 2004 EIS/EIR on EWA effects on water transfer prices and supplies would remain the same. The 2004 EIS/EIR concluded EWA purchases are not expected to have a substantial effect on water prices for other users and that other factors have more influence on the price of water transfers than EWA purchases. Hydrologic conditions change the supply of water available for transfers, which would shift the price of water. The difference in supply of water in a wet and dry year amounts to millions of acre-feet. Dry hydrologic conditions probably had an upward influence on price in 2001. Water that originated in the South Coast Region, San Joaquin Valley or Bay

Area was more expensive than other water sources and strongly influences the price of transfers. Agricultural prices could also affect supply of water transfers. Small changes in agricultural prices can have a large effect on water transfer supply because net returns in farming are very responsive to agricultural prices. These factors are not controlled by participants in the market.

In most years, the EWA agencies would not purchase the maximum amount of water allowed by environmental documentation. If the EWA purchased up to its potential maximum, the EWA could account for a larger share of the water transfer market. If the EWA participated in established markets during these years, the EWA could influence water prices in those markets. Recent data from the water transfers market supports these conclusions; therefore, no additional analysis is warranted.

3.2.6 Agricultural Social Issues

Regulatory Setting

No regulatory changes have occurred since the completion of the 2004 EIS/EIR.

Environmental Setting

The environmental setting in the 2004 EIS/EIR reported population, median income, per capita income, poverty rate, unemployment rate, average number unemployed, average number of farms, average farm acreage, and number of farm laborers from sources that ranged generally from 1999-2002. Table 3-12 shows updated county per capita income and average crop acreage (used as indicators for changes to the environmental setting).

Table 3-12. Change in Per Capita Income and Average Crop Acreage

County	2001-2005 Per Capita Income (dollars)[1]	1995-1999 Per Capita Income (dollars)[1]	2001-2005 Average Rice/ Cotton Acreage	1995-1999 Average Rice/ Cotton Acreage
Butte	$27,136	$22,012	94,920	95,000
Colusa	$25,559	$23,085	131,886	132,300
Glenn	$22,561	$18,015	88,461	83,750
Sutter	$27,548	$24,223	98,133	96,700
Yolo	$31,041	$27,037	35,758	23,850
Fresno	$25,961	$21,146	246,042	352,500
Kings	$24,999	$15,732	139,561	222,500
Kern	$21,536	$19,886	182,256	246,500

[1] *Source: BEA REIS 2007; USDA NASS 2002 to 2006a*

Although not presented in the environmental setting section in the 2004 EIS/EIR, the agricultural social analysis collected 20 years of farm labor employment data (1980 – 1999) to identify farm labor trends. Recent 2005 farm employment data in Butte, Colusa, Glenn, Sutter, Kern and King Counties are similar to the historic observations. Farm employment in 2005 in Yolo County was 2,551 workers, which is a decrease relative to all 1980 to 1999 data. Farm employment in Fresno County was 23,559 workers, which is also lower than all 1980 to 1999 data.

Conclusion

The analysis regarding farm labor employment used 20 years of farm labor employment data (1980 – 1999) to identify farm labor trends. Including additional years of data would not change the standard deviation of the labor trends.

Based on updated environmental setting data, farm labor displaced by EWA crop idling actions would remain similar to or be less than the values in the 2004 EIS/EIR. The EWA agencies would continue to limit crop idling to 20 percent of rice or cotton acreage in the county. Labor requirements for rice production have not changed since the 2004 EIS/EIR (UCCE 2001 and UCCE 2007) and labor requirements for cotton have increased slightly from 6.9 full time labor equivalents per 1000 acres to 7.3 full time labor equivalents per 1000 acres (UCCE 1999 and UCCE 2003). Because average rice acreage has not shifted substantially and full-time labor equivalents are the same, effects from maximum rice idling actions would be similar to those in the 2004 EIS/EIR. Average cotton acreage in the Export Service Area from 2001 to 2005 has decreased relative to the 1995 to 1999 average used in the 2004 EIS/EIR analysis. Maximum cotton acreage eligible for idling in 2005 would be less than analyzed in the 2004 EIS/EIR; therefore, maximum idling actions would displace fewer farmworker jobs. On a per acre basis, job displacement would be slightly larger than identified in the 2004 EIS/EIR, but maximum effects would still be well within historic variations of farm labor employment.

With recent farm labor and crop acreage data, the amount of project-related displaced laborers would continue to be within historical fluctuations. Therefore, the availability of additional data does not warrant new agricultural social issues analysis in this Supplement.

3.2.7 Agricultural Land Use

Regulatory Setting

No regulatory changes have occurred since the completion of the 2004 EIS/EIR.

Environmental Setting

The 2004 EIS/EIR included land use categories and land use conversions in 1998 and 2000 from the Farmland Mapping and Monitoring Program (FMMP). Tables 3-13 – 3-17 include updated figures by county for changes from 2002 to 2004. The EWA program did not contribute to any of these land use conversions.

Table 3-13. Yolo County 2002-04 Acreage Changes

Land Use Category	Total Acreage Inventoried		Acres Lost	Acres Gained	Total Acreage Changed	Net Acreage Changed
	2002[1]	2004	(-)	(+)		
Prime Farmland	261,648	259,637	2,602	591	3,193	-2,011
Farmland of Statewide Importance	18,007	18,123	154	270	424	116
Unique Farmland	54,586	53,157	2,180	751	2,931	-1,429
Farmland of Local Importance	67,546	66,619	2,313	1,386	3,699	-927
IMPORTANT FARMLAND SUBTOTAL	401,787	397,536	7,249	2,998	10,247	-4,251
Grazing Land	143,263	145,227	343	2,307	2,650	1,964
AGRICULTURAL LAND SUBTOTAL	545,050	542,763	7,592	5,305	12,897	-2,287
Urban and Built-up Land	27,216	28,511	65	1,360	1,425	1,295
Other Land	73,365	74,357	874	1,866	2,740	992
Water Area	7,821	7,821	0	0	0	0
TOTAL AREA INVENTORIED	653,452	653,452	8,531	8,531	17,062	0

Source: FMMP 2004.

Table 3-14. Butte County 2002-04 Acreage Changes

Land Use Category	Total Acreage Inventoried		Acres Lost	Acres Gained	Total Acreage Changed	Net Acreage Changed
	2002[1]	2004	(-)	(+)		
Irrigated Farmland	247,007	245,475	3,017	1,485	4,502	-1,532
Nonirrigated Farmland	6,648	5,448	1,288	88	1,376	-1,200
INTERIM FARMLAND SUBTOTAL	253,655	250,923	4,305	1,573	5,878	-2,732
Grazing Land	263,653	261,946	3,431	1,724	5,155	-1,707
AGRICULTURAL LAND SUBTOTAL	517,308	512,869	7,736	3,297	11,033	-4,439
Urban and Built-up Land	42,340	43,819	0	1,479	1,479	1,479
Other Land	336,618	339,578	1,191	4,151	5,342	2,960
Water Area	21,643	21,643	0	0	0	0
TOTAL AREA INVENTORIED	917,909	917,909	8,927	8,927	17,854	0

Source: FMMP 2004a

Table 3-15. Colusa County 2002-04 Acreage Changes

Land Use Category	Total Acreage Inventoried		Acres Lost	Acres Gained	Total Acreage Changed	Net Acreage Changed
	2002[1]	2004	(-)	(+)		
Prime Farmland	201,346	201,642	1,190	1,486	2,676	296
Farmland of Statewide Importance	1,826	2,152	3	329	332	326
Unique Farmland	126,916	124,796	2,704	584	3,288	-2,120
Farmland of Local Importance	234,186	232,758	2,338	910	3,248	-1,428
IMPORTANT FARMLAND SUBTOTAL	564,274	561,348	6,235	3,309	9,544	-2,926
Grazing Land	9,408	9,151	258	1	259	-257
AGRICULTURAL LAND SUBTOTAL	573,682	570,499	6,493	3,310	9,803	-3,183
Urban and Built-up Land	4,431	4,624	0	193	193	193
Other Land	160,439	163,429	201	3,191	3,392	2,990
Water Area	1,838	1,838	0	0	0	0
TOTAL AREA INVENTORIED	740,390	740,390	6,694	6,694	13,388	0

Source: FMMP 2004b

Table 3-16. Glenn County 2002-04 Acreage Changes

Land Use Category	Total Acreage Inventoried		Acres Lost	Acres Gained	Total Acreage Changed	Net Acreage Changed
	2002[1]	2004	(-)	(+)		
Prime Farmland	163,628	162,670	1,736	778	2,514	-958
Farmland of Statewide Importance	88,891	88,374	858	341	1,199	-517
Unique Farmland	16,539	16,589	404	454	858	50
Farmland of Local Importance	77,613	78,721	1,545	2,653	4,198	1,108
IMPORTANT FARMLAND SUBTOTAL	346,671	346,671	4,543	4,226	8,769	-317
Grazing Land	232,411	231,716	833	138	971	-695
AGRICULTURAL LAND SUBTOTAL	579,082	578,070	5,376	4,364	9,740	-1,012
Urban and Built-up Land	5,942	6,080	47	185	232	138
Other Land	258,346	259,220	267	1,141	1,408	874
Water Area	5,759	5,759	0	0	0	0
TOTAL AREA INVENTORIED	849,129	849,129	5,690	5,690	11,380	0

Source: FMMP 2004c

Table 3-17. Sutter County 2002-04 Acreage Changes

Land Use Category	Total Acreage Inventoried		Acres Lost	Acres Gained	Total Acreage Changed	Net Acreage Changed
	2002[1]	2004	(-)	(+)		
Prime Farmland	167,436	166,203	1,509	276	1,785	-1,233
Farmland of Statewide Importance	108,750	107,743	1,169	162	1,331	-1,007
Unique Farmland	19,482	19,480	267	265	532	-2
Farmland of Local Importance	0	0	0	0	0	0
IMPORTANT FARMLAND SUBTOTAL	295,668	293,426	2,945	703	3,648	-2,242
Grazing Land	50,321	50,637	617	933	1,550	316
AGRICULTURAL LAND SUBTOTAL	345,989	344,063	3,562	1,636	5,198	-1,926
Urban and Built-up Land	11,847	12,581	9	743	752	734
Other Land	29,722	30,914	574	1,766	2,340	1,192
Water Area	1,883	1,883	0	0	0	0
TOTAL AREA INVENTORIED	389,441	389,441	4,145	4,145	8,290	0

Source: FMMP 2004d

Conclusion

The 2004 EIS/EIR presented total rice/cotton acreage by county and the acreage proposed for idling. Tables 3-5 and 3-9 show updated values for the average acreage by county. The 5-year average acreages in Table 3-5 are relatively similar to the 1995 through 1999 average acreages presented in the 2004 EIS/EIR. Average acreage changes are within 6 percent for Butte, Colusa, Glenn, and Sutter Counties. The 5-year average rice acreage in Yolo County increased from 28,822 acres to 35,758 acres. The 2001 to 2005 rice acreage in the Upstream from the Delta Region does not substantially vary from those presented in the 2004 EIS/EIR.

Crop idling would be a temporary effect to land use. Farmers could resume planting on the field in the following year. Crop idling under the EWA would not result in any permanent changes to land use. The 2004 EIS/EIR stated that if crop idling would change the classification of farmland to levels less than Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP and Prime Farmland under the Williamson Act, the EWA agencies would not purchase water from that parcel. Therefore, although the county land use conversions and the 20 percent of total rice/cotton acreage have changed, the changes should not affect the analysis outcome. A new analysis incorporating fully updated environmental setting data is therefore not warranted.

3.2.8 Recreation

Regulatory Setting

No regulatory changes have occurred since the completion of the 2004 EIS/EIR.

Environmental Setting

Recreation facilities at Diamond Valley Lake had not been opened at the time of the 2004 EIS/EIR. The following text describes the recreational environmental setting for Diamond Valley Lake.

Diamond Valley Lake, between Temecula and Hemet, is 4.5 miles long and over 2 miles wide and is owned by the Metropolitan Water District (MWD). The lake began filling in November 1999 and was filled in early 2002. Diamond Valley Lake has a capacity of 800,000 acre-feet and provides opportunities for fishing, boating, biking, hiking, swimming in designated areas, and camping. Because Diamond Valley Lake is primarily a drinking water source, swimming and other body contact activities are prohibited in certain areas. Only clean-burning engines are allowed on the lake. Boat rentals are available, and shoreline fishing is accessible along a 1.5 mile stretch northwest of the east marina boat ramp. The East Marina boat ramp is useable down to a water surface elevation of 1,666 feet mean sea level (msl). Future facilities at Diamond Valley Lake may include special event areas, separate swimming areas, and several museums. Surrounding Diamond Lake is the Southwestern Riverside County Multi-Species Reserve of over 13,500 acres, with opportunities for hiking, horse-back riding, photography and wildlife viewing.

Conclusion

The 2004 EIS/EIR did not analyze effects on recreation facilities at Diamond Valley Lake because no facilities existed at that time. The additional environmental setting information available for this Supplement makes analysis possible; therefore, impact analysis is warranted.

Impact Analysis

Impact statement: *EWA agency management of MWD water under the Flexible or Fixed Purchase Alternatives via source shifting could decrease water surface elevations at Diamond Valley Lake.*

If MWD participated in source shifting, they would agree to delayed delivery of SWP water during which they would draw from other sources. In addition to Diamond Valley Lake, MWD has many options for source shifting, including:

- Lake Mathews, Lake Perris, and Castaic Lake. MWD could delay delivery of SWP water and draw its supplies instead from these storage facilities and accept the SWP water deliveries at a later date.

- Semitropic and Arvin Edison. During wet years, MWD could reduce the deliveries that SWP would have diverted to storage on MWD's behalf. MWD could then have its SWP water delivered to Semitropic and Arvin Edison at a later date.
- Hayfield (upstream aqueduct groundwater storage on the Colorado River). MWD could delay delivery of Colorado River water to Hayfield; the water would be delivered at a later date.
- Change blend. MWD generally maximizes water sources and quality by blending Colorado River and SWP water 50:50. MWD could change the blend to provide water for source shifting.

It is unlikely that MWD would source shift from any one source. Because of the size of Diamond Valley Lake, 800,000 acre-feet, and the probability that MWD would use all resources in their water management, the reduction in water deliveries caused by source shifting under the Flexible or Fixed Purchase Alternatives would not substantially reduce the water level in the reservoir. Source shifting participants' reservoirs would not be operated outside their standard operations. Therefore, water dependent recreational activities at Diamond Valley Lake would not be adversely affected. This action would have a less-than-significant effect on recreation at Diamond Valley Lake.

3.2.9 Power

Regulatory Setting

As described in the 2004 EIS/EIR, the Western Area Power Administration's (Western) mission was to, "sell and deliver electricity that is excess to Project use (power required for CVP operations)." Western has since broadened its mission to include First Preference Customers[1] in addition to CVP operational needs.

Environmental Setting

The average annual energy use of the major pumping plants has likely varied since this data was presented in the 2004 EIS/EIR. However, the information was used as background information for comparative purposes and not in the analysis. Slight changes in average annual energy use do not have the potential to change the analysis; therefore, updated energy use information is not presented.

[1] First Preference Customers are customers wholly in Trinity, Calaveras, or Tuolumne counties, California, as specified under the Trinity River Division Act (69 Stat. 719) and the New Melones provisions of the Flood Control Act of 1962 (76 Stat. 1173, 1191-1192). In both cases, the customers of the counties are entitled to 25 percent of the additional CVP energy resulting from the operational integration of their specific unit/division into the CVP.

Conclusion

The change in the regulatory setting affects the priority of Western's power customers, but not the annual energy produced. The power analysis in the 2004 EIS/EIR evaluated the effects of the alternatives on energy production; the significance criteria did not include changes in power customers. Because the regulatory setting change would not alter energy production, there would be no change in the impact analysis outcome. Therefore, the less-than-significant effects (with mitigation) in the 2004 EIS/EIR remain unchanged and no further power analysis is warranted.

3.2.10 Environmental Justice

Regulatory Setting

No regulatory changes have occurred since the completion of the 2004 EIS/EIR.

Environmental Setting

The environmental setting in the 2004 EIS/EIR reported ethnicity, poverty and employment data from sources that ranged generally from 1999-2002. Tables 3-18 and 3-19 show updated demographic data for ethnicities, unemployment, and poverty rates (used as indicators for changes to the environmental setting).

Table 3-18. Ethnicities Percentages of County Populations (2005)

County	Caucasian (%)	African-American (%)	American Indian/ Alaska Native (%)	Asian (%)	Native Hawaiian/ Pacific Islander (%)	Hispanic (%)
Butte	89.2	1.6	1.9	4.1	0.2	11.8
Colusa	93.5	1.0	2.4	1.7	0.7	49.1
Glenn	92.5	0.9	2.2	2.9	0.1	32.5
Sutter	80.9	2.3	1.6	12.5	0.2	25.7
Yolo	80.7	2.6	1.4	11.7	0.4	27.5
Fresno	81.4	5.7	1.9	8.8	0.2	46.1
Kern	85.8	6.2	1.7	3.9	0.3	44.1
Kings	84.3	8.5	2.0	3.3	0.3	47.0

U.S. Census Bureau, 2007, State and County QuickFacts

Table 3-19. County Demographics

County	2006 Unemployment Rate(1)	2004 Poverty Rate(2)
Butte	6.2%	15.2%
Colusa	12.6%	11.7%
Glenn	8.0%	14.4%
Sutter	8.9%	12.1%
Yolo	5.2%	11.2%
Fresno	8.0%	19.8%
Kern	7.6%	17.8%
Kings	8.5%	17.6%

1 – California Department of Finance 2007

2 - U.S. Census Bureau 2007, State and County QuickFacts

Conclusion

The percentages of Caucasians and Hispanics have increased in most counties and poverty rates have decreased relative to 1999 conditions. Recent (2005) farm labor employment, which remains largely Hispanic, is similar to 1999 levels in the 2004 EIS/EIR, except for Yolo and Fresno Counties. Farm employment in 2005 in Yolo County was 2,551 workers, which is a decrease relative to all 1980 to 1999 data. Farm employment in Fresno County was 23,559 workers, which is also lower than all 1980 to 1999 data. The farm labor effects of EWA rice idling actions would be similar to effects presented in the 2004 EIS/EIR because 5-year average rice acreages and labor requirements for rice production are similar to values in the 2004 EIS/EIR. Therefore, the environmental justice effects would not change from the 2004 EIS/EIR. The farm labor effects of EWA cotton idling actions would be less than effects presented in the 2004 EIS/EIR because 5-year average cotton acreages have decreased. In Fresno, Kern, and Kings Counties, total average cotton acreage has decreased in the range 120,000 to 192,000 acres from 1995 to 1999 averages. Even though labor requirements per acre have increased slightly, maximum idling actions of 20 percent of cotton acreage would still result in fewer farm worker losses than in the 2004 EIS/EIR. Therefore, because farm employment data has not substantially changed and cotton idling would displace fewer farm workers, the environmental justice effects would be less than the 2004 EIS/EIR.

3.2.11 Climate Change

The Intergovernmental Panel on Climate Change (IPCC) defines climate and climate change as follows (IPCC 2007, Annex 1). Climate can be defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities (such as temperature, precipitation, and wind) over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer.

Several factors contributed to the decision to not quantitatively analyze the potential implications of climate change for the action alternatives in the Supplement to the 2004 EIS/EIR:

- Uncertainties associated with projected global economic and technological developments that would translate into future global greenhouse gas emissions (IPCC 2001a),
- Uncertainties associated with earth system modeling of biogeochemical cycles that would integrate anthropogenic greenhouse gas emissions into natural cycles, translating emissions scenarios into greenhouse gas accumulation scenarios for the atmosphere (IPCC 2001a),
- Uncertainties of how to translate climatic process paradigms into climate models, leading to a diverse collection of coupled atmosphere-ocean general circulation models that simulate and project different climatic response to commonly assumed atmospheric greenhouse gas scenarios (IPCC 2001a).

Globally, and in spite of these uncertainties, there is consensus among reported climate projections that surface air temperatures would increase in response to underlying scenarios, ranging from 1.1°C to 6.4°C by Year 2100 (IPCC 2007, Table SPM 3). However, at a regional level and in terms of precipitation response over California, projections not only vary in magnitude, but they also vary in direction with some projections indicating more precipitation and others predicting less precipitation (Dettinger 2005).

Another factor for why potential climate change implications were not quantitatively analyzed within this Supplement is the absence of tools and methods necessary to translate the distributions of emissions projection, atmospheric greenhouse gas accumulation, and climate response information into Central Valley hydroclimatic impacts and implications for SWP and CVP operations under assumed No-Action and Action-Alternative conditions. DWR and Reclamation are investing in the development of tools and methods that would enable such an analysis. To this end, the agencies have formed a Climate Change Work Team tasked with the goal of producing qualitative and quantitative information to managers on potential effects and risks of climate change to California’s water resources.

The mission of the Work Team is to coordinate with other state and federal agencies on the incorporation of climate change science into California’s water resources planning and management. The Work Team will provide and regularly update information for decision-makers on potential impacts and risks of climate change, flexibility of existing facilities to cope with climate change, and available mitigation measures. Current activities are focused on developing tools and methodologies to enable quantitative analysis in EIS/EIR effects disclosure. However, at the time of preparing this Supplement, those tools and methods remained unavailable. As a result, this Supplement includes only qualitative discussion on what potential future climate change might imply for baseline SWP and CVP operations, and what it might imply for continuing the EWA through 2011.

3.2.11.1 Potential Implications for Baseline Operation of the SWP and CVP

On July 9, 2006, DWR released a report on climate change and its potential impact on California's water resources. Entitled "Progress on Incorporating Climate Change into Management of California's Water Resources" (DWR 2006), the report summarizes recent research into changes in precipitation, air temperatures, snow levels, rainfall and snowmelt runoff, and the attendant impact on water supply in California into future years. The report was prepared in response to an Executive Order by the Governor in June 2005.

In relation to Climate Change Work Team development of tools and methods as discussed in the previous section, the report illustrates how scenario-based climate change impacts assessment can be performed using CALSIM II. However, the results of the DWR report do not address the matter of translating climate projection uncertainty into SWP/CVP operations uncertainty, which would be necessary for quantitative discussion of what climate change may imply for the proposed action in this Supplement.

The report explicitly cautions that all results presented are preliminary, incorporate several assumptions, reflect a limited number of climate change scenarios, and do not address the likelihood of each scenario. Therefore, these results are not sufficient by themselves to make policy decisions. That said, the report offered several findings, reiterated in the following sections, on SWP/CVP operations and Sacramento-San Joaquin Delta conditions as they would be affected under the four climate change scenarios analyzed.

Hydrology and SWP/CVP Operations

This following section is from Section 2.2.3 of the report "Progress on Incorporating Climate Change into Management of California's Water Resources" (DWR 2006). It provides a brief background on the origins of assumed climate change scenarios and qualitative discussion on what these changes might mean for Central Valley water resources.

Theories concerning climate change and global warming existed as early as the late 1800s. By the late 1900s that understanding of the earth's atmosphere had advanced to the point where many climate scientists began to accept that the *earth's climate is changing. Today, many climate scientists agree that some warming has occurred over the past century and will continue through this century.*

The United Nations Intergovernmental Panel on Climate Change predicts that changes in the earth's climate will continue through the 21st century and that the rate of change may increase significantly in the future because of human activity (IPCC, 2001b) [IPCC 2001b in this chapter]. Many researchers studying California's climate believe that changes in the earth's climate have already affected California and will continue to do so in the future.

Climate change may seriously affect the State's water resources. Temperature increases could affect water demand and aquatic ecosystems. Changes in the timing and amount of precipitation and runoff could occur. Sea level rise could adversely affect the Sacramento-San Joaquin River Delta and coastal areas of the State. Some of the projected effects of climate change on California's water resources and the consequences of those effects are summarized in Table 3-20.

Climate change is identified in the 2005 update of the California Water Plan (Bulletin 160-05) as a key consideration in planning for the State's future water management (DWR, 2005a) [DWR 2005 in this Chapter]. The 2005 Water Plan update qualitatively describes the effects that climate change may have on the State's water supply. It also describes efforts that should be taken to quantitatively evaluate climate change effects for the next Water Plan update.

Table 3-20. Potential Effects of Climate Change on California's Water Resources and Expected Consequences

Potential Water Resource Impact	Expected Consequence
Reduction of the State's average annual snowpack	• *Potential loss of 5 million acre-feet or more of average annual water storage in the State's snowpack* • *Increased challenges for reservoir management and balancing the competing concerns of flood protection and water supply*
Changes in the timing, intensity, location, amount, and variability of precipitation	• *Potential increased storm intensity and increased potential for flooding* • *Possible increased potential for droughts*
Long-term changes in watershed vegetation and increased incidence of wildfires	• *Changes in the intensity and timing of runoff* • *Possible increased incidence of flooding and increased sedimentation*
Sea level rise	• *Inundation of coastal marshes and estuaries* • *Increased salinity intrusion into the Sacramento-San Joaquin River Delta* • *Increased potential for Delta levee failure* • *Increased potential for salinity intrusion into coastal aquifers (groundwater)* • *Increased potential for flooding near the mouths*

Potential Water Resource Impact	Expected Consequence
	of rivers due to backwater effects
Increased water temperatures	• *Possible critical effects on listed and endangered aquatic species* • *Increased environmental water demand for temperature control* • *Possible increased problems with foreign invasive species in aquatic ecosystems* • *Potential adverse changes in water quality, including the reduction of dissolved oxygen levels*
Changes in urban and agricultural water demand	*Changes in demand patterns and evapotranspiration rates*

The following is from the DWR report's Executive Summary on findings from Chapter 4 "Impacts of Climate Change on the State Water Project and Central Valley Project" (DWR 2006):

- *In three of the four climate scenarios simulated, there were significant shortages predicted in CVP north-of-Delta reservoirs during droughts. In future studies, operational changes are necessary to avoid these shortages. At this time, it is not clear whether the necessary changes in operations will be insignificant or substantial.*

- *Estimated changes in annual average SWP south-of-Delta Table A*[2] *deliveries ranged from a slight increase of about 1 percent for a wetter scenario to about a 10 percent reduction for one of the drier climate change scenarios.*

- *Estimated increases in winter runoff and lower Table A allocations resulted in slightly higher annual average Article 21*[3] *deliveries in the three drier climate change scenarios. However, the boosts in Article 21 did not offset losses to Table A. The wetter scenario with higher Table A allocations resulted in fewer Article 21 delivery opportunities and slightly lower annual average Article 21 deliveries.*

- *Estimated changes in annual average CVP south-of-Delta deliveries ranged from increases of about 2.5 percent for a wetter scenario and decreases of as much as 10 percent for drier climate change scenarios. The CVP results of the drier climate change scenarios are in question due to the north-of-Delta shortages mentioned above. These shortages will have to be addressed in future climate change studies.*

[2] Table A is a tool for apportioning available supply and cost obligations under the SWP contract.
[3] Additional water not needed to meet current year SWP contractor deliveries or Project operational requirements can be delivered to SWP contractors under Article 21.

- *For both the SWP and CVP, estimated carryover storage was adversely impacted in the drier climate change scenarios and somewhat increased in the wetter climate change scenario.*

Delta Water Levels and Quality Sea level rise would conceptually affect water project operations by increasing the need for operations to repulse salt water intruding into the Delta. Such effects were not examined during preparation of the DWR report (DWR 2006) due to lack of existing tools for that type of analysis (current Work Team activities involve collaborations to develop these necessary tools). The report does discuss surrogates that provide indication of increased operation challenges associated with repulsing saltwater intrusion caused by sea level rise. Results from the surrogate information along with other estimated Delta impacts are summarized in the following excerpt from the DWR report's Executive Summary of Chapter 5 "Impacts of Climate Change on the Sacramento-San Joaquin Delta" (DWR 2006):

- *For the four climate change scenarios, Delta inflows typically increase during the late winter and early spring and decrease during the summer and fall. On average, Delta exports are reduced with the largest reductions occurring during the summer and fall. Inflows and exports are most sensitive to climate change during extremely wet or extremely dry periods.*

- *Flexibility in the system to modify reservoir operations and Delta exports for the climate change scenarios at present sea level results in minor impacts to compliance with chloride standards at Municipal and Industrial intakes.*

- *A one foot rise in sea level without any changes to the system operations would result in estimated chloride concentrations below the 250 mg/l threshold 90 percent of the time at Old River at Rock Slough. In real time, operational adjustments will take place so these effects will translate into water supply impacts to the SWP and CVP. As stated above these impacts to water supply cannot be quantified at this time. Maintaining chloride concentrations below the 150 mg/l threshold was also more challenging during critical and dry years. These results indicate the need to develop a tool to quantify the additional water supplies that would need to be dedicated to repulse sea water in order to maintain Delta water quality under sea level rise conditions.*

- *There was complete compliance with the chloride standards at the SWP and CVP for the climate change at present sea level scenarios. Chloride concentrations remained below threshold values for the sea level rise and combined climate change and sea level rise scenarios.*

- *Chloride mass loadings at the municipal and industrial intakes are typically reduced for the climate change only scenarios due to lower* *export rates. Increased intrusion of salt water from the ocean for the sea level rise and combined climate change and sea level rise scenarios lead to increased chloride mass loadings at the municipal and industrial intakes.*

- *For a one foot rise in sea level, maximum daily water levels exceeded the minimum levee crest elevation on Sherman Island twice during the 16-year analysis period. Water levels did not exceed the minimum crest elevation for present sea level conditions.*

3.2.11.2 Implications for the EWA Alternatives

This Supplement analyzes alternatives through 2011. Climate change would likely involve a much longer time period before having the potential to affect SWP and CVP operations. Between now and 2011, it is unlikely that the Project operations will experience changes resulting from climate change. Therefore, climate change is not likely to affect the analysis of the EWA alternatives. Additionally, the EWA alternatives would not be expected to affect climate change because of the short duration of the project and because the EWA alternatives would not produce pollutants harmful to the earth's atmosphere.

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Chapter 4
Fisheries and Aquatic Ecosystems

This chapter updates the information contained in the 2004 EIS/EIR to include more recent information pertinent to fisheries and aquatic resources in the Delta. Information on geographic areas outside of the Delta was not updated, because changes to the regulatory and environmental settings only affect the Delta Region. This chapter describes the fisheries and aquatic ecosystems within the Delta region, and presents changes to the affected environment/environmental setting in the Delta region since the 2004 EIS/EIR, including regulatory requirements. It also describes changes in understanding of the use of the Delta by fish species of management interest. Particular changes of note with respect to the 2004 EIS/EIR are the Pelagic Organism Decline (POD), recognized in 2005 as something more profound than short-term population variability (described in Section 4.1.2.2.1), and the listing of the southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) as threatened in 2006. Additionally, petitions to change the status of delta smelt from threatened to endangered and to list longfin smelt as endangered have been filed with both the state and federal governments (Center for Biological Diversity et al. 2006 and 2007, Bay Institute et al. 2007a, 2007b). These petitions are currently under review by USFWS and DFG. This chapter focuses on information that is different from the 2004 EIS/EIR, as well as associated information from the Delta region to provide background for the reader.

4.1 Affected Environment/Existing Conditions

The Delta region includes the areas extending from Freeport on the Sacramento River and from Vernalis on the San Joaquin River downstream to Collinsville and Honker and Suisun Bays (Figure 4-1). The sloughs, channels, and connecting waterways along the San Joaquin River and Sacramento River are considered part of the Delta region. The Delta is a network of channels through which water, nutrients, and aquatic food resources are transported and mixed by tidal action. Pumps and siphons divert water directly from the Delta for irrigation and municipal and industrial use or into CVP and SWP facilities. River inflow, Delta Cross Channel operations, and diversions (including agricultural and municipal diversions, and export pumping) affect Delta species through changes in habitat conditions (e.g., salinity intrusion), and mortality attributable to entrainment and exposure to unsuitable habitat conditions and increased risk of predation. A more detailed description of the physical configuration of the Delta is provided in Section 9.1.2 of the 2004 EIS/EIR. The following sections include an overview of the fish species of primary management concern and factors affecting their distribution and abundance, and a summary of the affected environment/environmental setting.

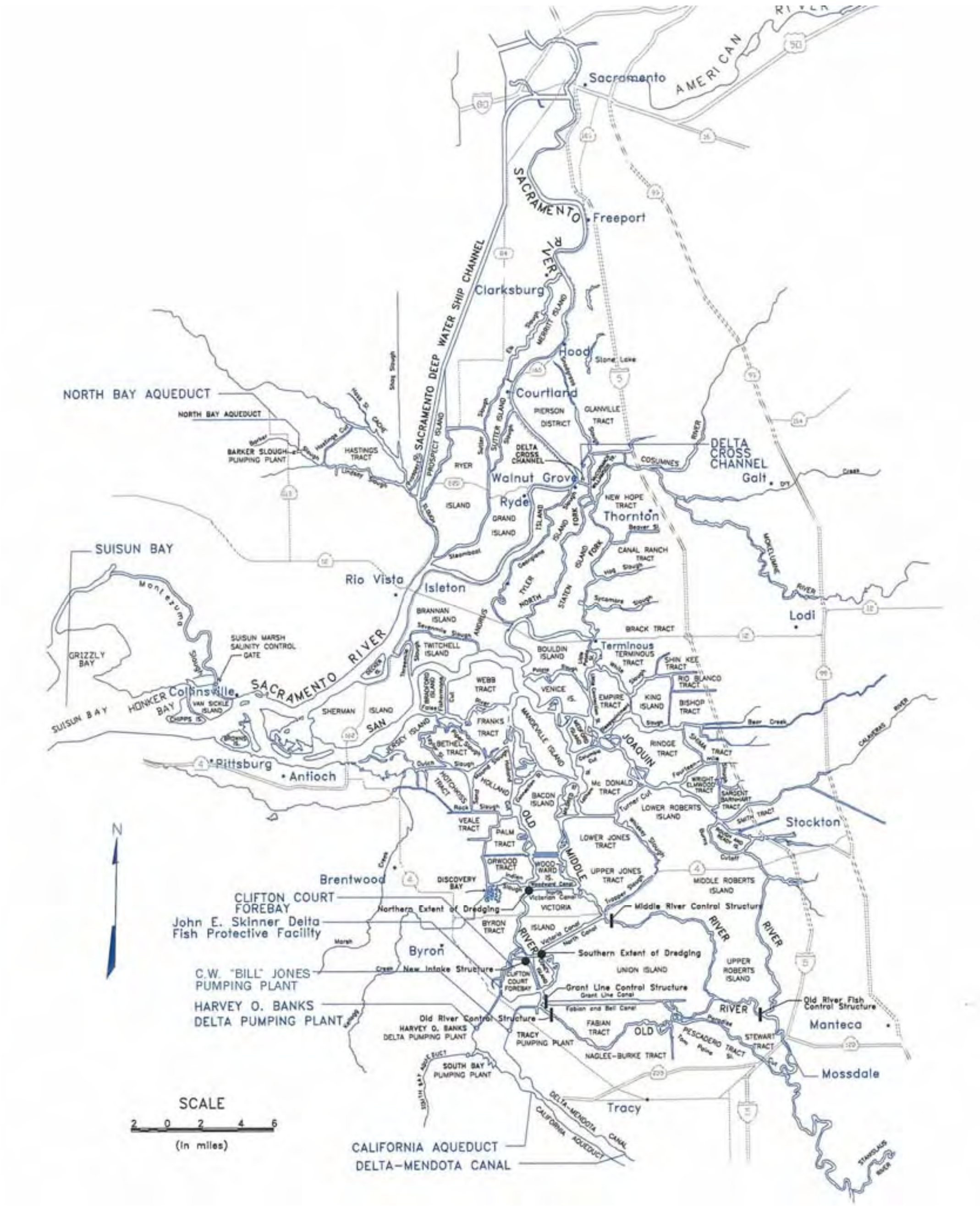

Figure 4-1 Sacramento-San Joaquin Delta

4.1.1 Regulatory Setting

Descriptions of the fishery resources found within the area of analysis borrow heavily from other recent, pertinent discussions including the NMFS and the USFWS BOs on the long-term operations of the CVP and SWP (NMFS 2004, USFWS 2005). These sources provide comprehensive discussions of life histories of listed species and the influences of factors affecting these resources.

In the analysis of potential effects on fishery resources, special emphasis is placed on evaluating impacts to the species of primary management concern to facilitate compliance with the State and Federal Endangered Species Acts (ESAs), and to be consistent with State and Federal restoration/recovery plans and Federal BOs. This focus is consistent with the following:

1) CALFED's 2000 Ecosystem Restoration Program Plan (ERPP) and Multi-Species Conservation Strategy (MSCS);
2) The programmatic determinations for the CALFED program, which includes CDFG's Natural Community Conservation Planning Act (NCCPA) approval and the programmatic BOs issued by NMFS and the USFWS;
3) USFWS's 2001 Final Anadromous Fish Restoration Program (AFRP) (USFWS 2001), which identifies specific actions to protect anadromous salmonids;
4) CDFG's 1996 Steelhead Restoration and Management Plan for California, which identifies specific actions to protect steelhead (McEwan and Jackson 1996);
5) CDFG's Restoring Central Valley Streams, A Plan for Action (CDFG 1993a), which identifies specific actions to protect salmonids;
6) DWR and DFG's Pelagic Fish Action Plan (DWR and CDFG 2007), which identifies actions to be taken to protect pelagic species and research activities to be undertaken to further understanding of POD;
7) USFWS's and NMFS's BOs on the long-term operations of the Projects (USFWS 2005, NMFS 2004);
8) USFWS's 1995 Recovery plan for Sacramento-San Joaquin Delta native fishes (USFWS 1995);
9) NMFS's 1997 Recovery plan for winter-run Chinook salmon (NMFS 1997); and
10) SWRCB Decision 1641 (D-1641) which sets flow and water quality requirements within the Delta (SWRCB 2001).

Improvement of habitat conditions for these species of priority management concern is also likely to protect or enhance conditions for other fish resources, including native resident species.

The BOs on the long-term operations of the Projects (USFWS 2005, NMFS 2004) were issued after completion of the 2004 EIS/EIR. These BOs established non-discretionary terms and conditions to implement reasonable and prudent measures as part of the Section 7 consultation. The agencies have reinitiated consultation on these BOs, and it is not known how these terms and conditions might change. For purposes of this analysis it is assumed that the current terms and conditions will be carried forward into the future. The projects must be operated according to these terms and conditions to be authorized for incidental take of endangered species under the ESA. These reasonable and prudent measures include a variety of elements that are intended to minimize take of these species. These include establishment of incidental take limits, real time biological and incidental take monitoring, screen improvements, Delta Cross Channel operations, and studies to better understand the adverse effects associated with CVP and SWP operations. Exceedance of incidental take limits requires reinitiation of formal consultation with NMFS and USFWS.

The southern DPS of green sturgeon was listed as threatened under the federal ESA in 2006 (NMFS 2006). The primary factors responsible for the decline of the DPS were destruction, modification or curtailment of habitat and inadequacy of existing regulatory mechanisms. This listing requires federal agencies to consult with NMFS if they conduct actions that may affect the listed species or result in the destruction or adverse modification of proposed critical habitat. Critical habitat has not been designated for this DPS at this time; however, the species is known to occur within the project area.

The petitions to change the status of delta smelt from threatened to endangered were sparked by the sharp decline in delta smelt abundance (Center for Biological Diversity et al. 2006 and 2007) The change in status from threatened to endangered would have little practical effect on this analysis, as the same protections would apply as those that currently exist.

The petitions to list longfin smelt (Bay Institute et al. 2007a, 2007b) are in the review process and no decision has been made with respect to the petitions. Should these petitions for listing under ESA and CESA be granted, the listing would require consultation with USFWS and CDFG regarding projects that might jeopardize these species.

Legal proceedings (NRDC, et al. vs. Kempthorne, et al. and others) are currently underway regarding operations in the Delta and the effect of these operations on fisheries resources. These rulings may substantially affect these operations, but the nature of these effects and their interaction with the EWA program cannot be determined at this time.

Portions of the estuary have been identified as critical habitat under the ESA for spring-run and winter-run Chinook salmon, Central Valley steelhead (NMFS 2005a), and delta smelt. The estuary has also been described as Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and

Management Act (MSA) for commercially important fish species such as Chinook salmon, starry flounder (*Platichthys stellatus*), and northern anchovy (*Engraulis mordax*).

4.1.2 Environmental Setting

4.1.2.1 Fisheries Resources

The Delta sustains a broad range of ecologically, commercially, and recreationally important fisheries. This area includes one of the largest recreational fisheries in California, and one of the largest commercial fisheries of the Pacific Coast. These fisheries are of substantial cultural, scientific, and social value. The Delta supports one or more life stages of a diverse assemblage of anadromous, freshwater, euryhaline, and saltwater species (SFEP 1992, Moyle 2002). It provides spawning and/or nursery habitat for more than 40 fish species (Table 4-1), including delta smelt, Sacramento splittail, American shad, white sturgeon, and striped bass, and provides a migration corridor and seasonal rearing habitat for Chinook salmon and steelhead. Species such as green sturgeon utilize the Delta as a migratory corridor, juvenile nursery habitat, and adult foraging habitat. Longfin smelt spawn in the Delta and rear in Suisun and San Pablo Bays. The fisheries and aquatic habitats of the Delta have been well studied and documented. However, some factors and dynamics affecting the population of many species are incompletely understood. As indicated in Table 4-1 five fish species utilizing the Delta are listed under the Federal and State ESAs.

Table 4-1. Fishes of the Sacramento-San Joaquin Delta

Common Name	Scientific Name	Life History	Status
Pacific lamprey*	*Lampetra tridentate*	A	declining
River lamprey*	*Lampetra ayersi*	A	SC
White sturgeon*	*Acipenser transmontanus*	A	Declining, fishery
Green sturgeon*	*Acipenser medirostris*	A	SC, FT
American shad	*Alosa sapidissima*	A	fishery
Threadfin shad	*Dorosoma petenense*	A	common
Steelhead*	*Oncorhynchus mykiss*	A	SC, FT, fishery
Chinook salmon*	*Oncorhynchus tshawytscha*	A	fishery, EFH
Sacramento fall-run			fishery, EFH
Late-fall-run			SC, fishery, EFH
Winter-run			FE, SE
Spring-run			ST, FT, fishery, EFH
Longfin smelt*	*Spirinchus thaleichthys*	A-R	SC
Delta smelt*	*Hypomesus transpacificus*	R	FT, ST
Wakasagi	*Hypomesus nipponensis*	R	invading
Hitch*	*Lavinia exilicauda*	R	unknown
Sacramento blackfish*	*Orthodon microlepidotus*	R	unknown
Sacramento splittail*	*Pogonichthys macrolepidotus*	R	SC

Common Name	Scientific Name	Life History	Status
Hardhead*	*Mylopharodon conocephalus*	N	SC
Sacramento pikeminnow*	*Ptychocheilus grandis*	R	common
Fathead minnow	*Pimephales promelas*	N	rare
Golden shiner	*Notemigonus chrysoleucas*	R	uncommon
Common carp	*Cyprinus carpio*	R	common
Goldfish	*Carassius auratus*	R	uncommon
Sacramento sucker*	*Catostomus occidentalis*	R	common
Black bullhead	*Ameiurus melas*	R	common
Brown bullhead	*Ameiurus nebulosus*	R	uncommon
Yellow bullhead	*Ameiurus natalis*	R	rare
White catfish	*Ameiurus catus*	R	abundant
Channel catfish	*Ictalurus punctatus*	R	common
Blue catfish	*Ictalurus furcatus*	R	rare
Western mosquitofish	*Gambusia affinis*	R	abundant
Rainwater killifish	*Lucania parva*	R	rare
Striped bass	*Morone saxatilis*	R-A	abundant
Inland silverside	*Menidia beryllina*	R	abundant
Bluegill	*Lepomis macrochirus*	R	common
Redear sunfish	*Lepomis microlophus*	R	uncommon
Green sunfish	*Lepomis cyanellus*	R	uncommon
Warmouth	*Lepomis gulosus*	R	uncommon
White crappie	*Pomoxis annularis*	R	common
Black crappie	*Pomoxis nigromaculatus*	R	uncommon
Largemouth bass	*Micropterus salmoides*	R	common
Smallmouth bass	*Micropterus dolomieui*	R	uncommon
Bigscale logperch	*Percina macrolepida*	R	common
Yellow perch	*Perca flavescens*	N	rare
Tule perch*	*Hysterocarpus traski*	R	common
Threespine stickleback*	*Gasterosteus aculeatus*	R	common
Yellowfin goby	*Acanthogobius flavimanus*	R	common
Chameleon goby	*Tridentiger trigonocephalus*	R	invading
Staghorn sculpin*	*Leptocottus armatus*	M	common
Prickly sculpin*	*Cottus asper*	R	abundant
Starry flounder*	*Platichthys stellatus*	M	common, EFH
Northern anchovy*	*Engraulis mordax*	M	uncommon, fishery, EFH

Modified from USFWS 1995, DWR and Reclamation 2005.

Notes:
An asterisk (*) indicates a native species
A = anadromous
R = resident
N = non-resident visitor
M = marine
SC = species of special concern
FT = Federal threatened
ST = State threatened
FE = Federal endangered
SE = State endangered
FP = Federal proposed

Species of primary management concern were identified based upon their ecological, commercial, and recreational significance (Table 4-2). Fish species listed under the Federal and State ESAs are both ecologically and institutionally important; some listed species are also recreationally and commercially important. Federal and State listed species within the area of analysis are:

- Winter-run Chinook salmon (*Oncorhynchus tshawytscha*);
- Central Valley spring-run Chinook salmon (*O. tshawytscha)*;
- Central Valley steelhead *(O. mykiss)*;
- Delta smelt (*Hypomesus transpacificus)*; and
- The southern DPS of North American green sturgeon (*Acipenser medirostris*).

Fall and late-fall run Chinook salmon are candidate species under the Federal ESA. Recreationally or commercially important species include American shad (*Alosa sapidissima*) and striped bass (*Morone saxatilis*). Several species were also identified due to their ecological significance and sensitivity to flow and temperature: Pacific lamprey (*Lampetra tridentata*), white sturgeon (*Acipenser transmontanus*), Sacramento splittail (*Pogonichthys macrolepidotus*), hardhead (*Mylopharodon conocephalus*), and longfin smelt (*Spirinchus thaleichthys*).

Table 4-2. Fish Species of Special Management Concern in the Delta

Status	Species	Location (Area of analysis)	Primary Management Consideration
Listed	Winter-run Chinook salmon	Delta and Areas Upstream	FE, SE, Commercial
	Spring-run Chinook salmon	Delta and Areas Upstream	FT, ST, Commercial, Recreation
	CV Steelhead	Delta and Areas Upstream	FT, Recreation
	Delta smelt	Delta and Areas Upstream	ST, FT
	Green sturgeon	Delta and Areas Upstream	FT, Recreation
Recreational	Fall/late-fall Chinook salmon	Delta and Areas Upstream	FC, Commercial, Recreation, EFH
	Striped bass	Delta and Areas Upstream	Recreation
	American shad	Delta and Areas Upstream	Recreation
	White sturgeon	Delta and Areas Upstream	Ecological, Recreation
Ecological	Hardhead	Delta and Areas Upstream	Ecological
	Pacific lamprey	Delta and Areas Upstream	Ecological
	Sacramento splittail	Delta and Areas Upstream	Ecological
	Longfin smelt	Delta and Downstream Areas	Ecological, petition for listing filed

Notes:
FC = Federal Candidate Species
FE = Federal Endangered
FT = Federal Threatened
SE = State Endangered
ST = State Threatened

4.1.2.2 Population Trends

Many Delta fishes have been in decline since the 1970s, including species that use the Delta for only a part of their life history. Delta smelt are entirely dependent upon the Delta. They generally have a one-year life span, feed on zooplankton, and have low fecundity (USFWS 2004). Historically widespread, delta smelt are now found at low abundance levels and occur in a much more restricted range within the Delta. Abundance fluctuated historically, but after 1981, delta smelt began a decline resulting in a ten-fold reduction in numbers and has remained at extremely low levels over the past 20 years. The last four years have seen some of the lowest indices of abundance ever recorded, as determined by the fall midwater trawl. In June 2007, low abundance of delta smelt resulted in the Banks Pumping Plant (PP) being shut down for 10 days and substantial reductions at the Jones PP to reduce entrainment of this species. Other Delta-dependent species, such as striped bass (young of year) and longfin smelt, have also exhibited declining populations.

Evaluating potential impacts on fishery resources requires an understanding of fish species' life histories and life stage-specific environmental requirements. Life history descriptions of these species are included in the ASIP (Appendix C).

4.1.2.2.1 Pelagic Organism Decline. The precipitous declines in Delta species sparked an investigation into the reasons for the widespread declines noted. From this, the POD issue emerged, which has become of overwhelming concern in the Delta. This term refers to the recent (2002- present) decline of pelagic fishes within the San Francisco estuary (Armor et al. 2005, IEP 2005a, DWR and CDFG 2007, Sommer 2007). The decline was viewed as a possible change in the estuary's ability to support pelagic species and appeared to be a "step-change"[1] from the preceding long-term decline. The identification of this decline was announced by agency scientists in early 2005. Four fish species are of primary concern: delta smelt, longfin smelt, striped bass (young of year), and threadfin shad. From 2002 to present, despite moderate hydrologic conditions in the estuary which would have been expected to result in moderate increases in population sizes, the populations of these species experienced sharp declines, as indicated by the results of the annual fall midwater trawl survey and confirmed through other sampling programs. Populations of each of the four species have been at or near all-time record lows since 2002. This change has persisted for a sufficiently long period to conclude that it is the result of something other than the pattern of widely variable population levels observed historically or part of the long-term decline previously observed. However, there is some disagreement whether this step decline is truly different than the long-term decline (IEP Review Panel 2005).

Because these four species share a pelagic life history type, residing primarily in open water and feeding upon zooplankton and other fishes in the water column,

[1] A sudden change from one sustained level to another sustained level.

and fish species with different life history patterns or in other parts of the bay have not shown similar declines over this same period, it was believed that the decline in these four species may stem from the same cause or suite of causes (DWR and CDFG 2007, Sommer 2007). To date, research has failed to identify a single factor responsible for the decline of all species or even that of a single species (Sommer 2007, Chotkowski pers. comm. 2007, Bennett 2005). POD researchers currently believe that important factors responsible for the decline may be different for each species, and that even for a single species these factors may differ between seasons and by hydrologic condition (wet and dry years) (Sommer 2007, DWR and CDFG 2007). These factors may operate cumulatively to cause the observed population declines. The POD Management Team has hypothesized that the three factors most likely to be responsible for the decline are the effects of exotic species, toxins, and water operations (DWR and CDFG 2007). The individual importance of these three potential factors is the topic of ongoing research. Many of the Interagency Ecological Program (IEP) studies to evaluate the causes of the POD have focused on these factors (IEP 2005a, DWR and DFG 2007). According to the 2005 IEP POD Synthesis (Armor et al. 2005) and the 2007 Pelagic Fish Action Plan (DWR and CDFG 2007), these three potential causal factors are likely to work in direct and indirect ways through “top down,” “bottom up,” and habitat pathways. Top down pathways reduce the populations of pelagic species through direct mortality caused by predation, entrainment, or other factors. Bottom up pathways reduce the populations of pelagic species by reducing the productivity of the ecosystem at the lower levels of the food web by reducing the amount of food available for the pelagic fish species, or through competition, which reduces the availability of the food produced. Habitat pathways are changes in the amount or quality of habitat available (Sommer 2007). These pathways are not entirely separate or distinct. For example, a change in salinity (one habitat parameter) might not affect striped bass directly, but might reduce the population of one of its prey items. Declines in the population of the prey items may then cause a subsequent reduction in striped bass survival. In this example, a change in habitat resulted in a bottom up effect on the striped bass population.

Exotic Species. Many POD studies have been focused on the effects of introduced species. The San Francisco estuary is one of the most biologically invaded estuaries in the world. Non-native species have been introduced intentionally and unintentionally. Striped bass and threadfin shad, both POD species, were intentionally introduced. Many other introduced species are considered undesirable and some of these species are believed to adversely affect the ecosystem within the estuary. Suisun Bay and marsh have historically provided critical rearing habitat for all of the POD fish species. The productivity of this area is believed to have been reduced by the introduction of the overbite clam (*Corbula amurensis*) in the early to mid-1980s. Since the introduction of the clam, there has been a significant reduction of the phytoplankton, thereby affecting the productivity of the estuary with a corresponding reduction in zooplankton and pelagic fish production (Kimmerer 2002). Kimmerer (2002) observed that historic relationships between delta outflow and the populations of longfin smelt and striped bass have shifted since the introduction of this clam. This relationship has changed even more during the POD years (Sommer 2007). However, the distribution of *Corbula* during the POD years is similar to what it was in the 1987-1992 drought. Additionally, there has been no major decline in phytoplankton biomass or a system wide decrease in zooplankton biomass during the POD years. However, there may be a more localized decline in zooplankton biomass within Suisun Bay (DWR and CDFG 2007).

The estuary also has experienced successive waves of invasive copepod species. Copepods are zooplankton that form the food-base for many pelagic fishes. The most recently introduced copepod, *Limnoithona tetraspina*, displaced the previously dominant copepod species (*Psuedodiaptomus forbesi*) in the early 1990s. The abundance of other copepods has decreased continuously since its introduction. *Limnoithona* is believed to be a less suitable food item than the previous species (Sommer 2007). Because of this, the food supply for pelagic fish may be of lesser quality than it was previously. There has been indication of such effects, as declines in delta smelt growth and striped bass condition factor have been observed in Suisun Bay relative to other areas in some years.

Toxins. Anthropogenic and environmental toxins could also have an adverse effect on fish populations (DWR and CDFG 2007). While initial histopathology data on striped bass and delta smelt indicated high frequencies of liver lesions and other signs of disease indicative of toxic insults (Armor et al. 2005), subsequent bioassay studies have shown little effect on POD species (Sommer 2007, Chotkowski pers. comm. 2007). It is unclear at this time, what the effect of toxins might be on POD species (DWR and CDFG 2007, Chotkowski pers. comm. 2007). Two toxins have received special attention, pyrethroid pesticides and *Microcystis* hepatotoxins. Studies are ongoing for both, but neither has been directly linked to POD at this time.

Pyrethroid pesticides have received special attention in POD studies due to their increased use in recent years and their high toxicity to aquatic organisms. Pyrethroid use has increased over the past decade after organophosphate insecticide use declined due to increased regulation and concerns over human health effects. Although pyrethroids are readily adsorbed onto sediment, they can be mobilized during high flow events and are highly toxic to zooplankton and fish (Werner et al. 2006). Research on the effects of pyrethroids is ongoing. While it has been shown that these pesticides have the capacity to impact pelagic fish populations, a direct link to POD has yet to be demonstrated (Armor et al. 2005).

Microcystis is a colonial cyanobacteria that produces hepatotoxins that can affect both fish and humans. Blooms of *Microcystis* have become larger and more widespread in recent years under summertime conditions. Reduced streamflow in the Delta is thought to promote the growth of *Microcystis* (Lehman 2006). Linkages between *Microcystis* blooms and Delta fisheries are still under investigation. They have not been identified as a primary cause of the POD (Herbold et al. 2006).

Water Operations. Water exports indirectly affect pelagic fish by changing the hydrology and salinity of the estuary. They also directly affect fish through entrainment. Hydrologic changes caused by water exports include changes in flow magnitude and direction, especially in the South Delta, movement of water from the Sacramento River into and through the central Delta, and changes in the amount of low salinity habitat available for fish dependent upon this type of habitat. Assessment of the indirect effects of exports has largely been focused on the position of the 2 ppt salinity isopleth (i.e., the “X2” value) and the relative abundance of low salinity habitat upon which POD species, especially delta smelt (USFWS 2004, NMFS 2005b). In recent years, efforts have been made to shift water diversions away from the spring, when diversions are believed to have the greatest impacts on fish in the Delta. However, during these years, the total amount of water exported from the Delta annually has increased substantially. The most notable changes have included a slight increase in flow down the Sacramento River since 2001, a reduction in peak San Joaquin River outflows since 1999, and increased exports during June through December (DWR and CDFG 2007). Between 2001 and 2002, an increase in the salvage of delta smelt, longfin smelt, and threadfin shad was correlated with a decrease in fall mid-water trawl indices of these species (Armor et al. 2005, DWR and CDFG 2007). UC Davis researchers proposed that increased winter exports are entraining early spawning delta smelt. The early spawners tend to be the largest and most robust individuals. Increased entrainment of the most robust members of the delta smelt population may be weakening the population in concert with other factors (Bennett 2005, DWR and CDFG 2007).

Salvage rates have been used as an index of the relative impacts of entrainment on pelagic fish populations. Salvage is not a direct measurement of entrainment effects, since the number of fish salvaged is only a small fraction of the fish lost to entrainment and fish smaller than about 20 mm are not adequately represented in salvage. It also does not account directly for fish lost to predation before they reach the pumps, or fish that have been displaced from more favorable to less favorable habitats by the changes in current patterns caused by the pumps. It is accepted, however, that salvage provides an index of the number of fish entrained into the pumps. To the extent that salvage and these other sources of loss are proportionate to pumping, the salvage index provides a useful tool to assess the relative magnitude of these losses. In order to understand the effects of exports and entrainment on pelagic fish populations, POD researchers are studying correlations between decreasing fall midwater trawl indices, stock-recruitment relationships, and increasing exports. Some models have indicated that exports explain less than two percent of the variability in population sizes as determined from the fall midwater trawl data (Chotkowski pers. comm. 2007). These models, however, are still in development.

Habitat Quality. Fall habitat quality has also been hypothesized to be related to fish abundance. Feyrer et al. (in press) point to an overall reduction in habitat quality coincident with long-term declines in delta smelt, striped bass, and threadfin shad. The specific factors relating to fish abundance were water clarity (Secchi disk depth) and specific conductance (related to salinity) for delta smelt and striped bass, and specific conductance and temperature for threadfin shad. These factors were selected for analysis because this information was collected consistently in association with the fall midwater trawl sampling program. However, specific mechanisms linking physical habitat quality to the abundance of these species remain unclear and tools for evaluating this hypothesis are still under development. Additionally, numerous other water quality and habitat parameters that were not evaluated could also coincide with changes in the abundance of these species.

Uncertainties. While there has been a substantial amount of research into the potential causes of POD, the amount of scientific uncertainty associated with the cause and effect relationships is large. None of these hypotheses, including those from the POD management team, have received widespread acceptance from the scientific community or even the principal investigators conducting POD studies (Sommer 2007, Chotkowski pers. comm. 2007). None of the POD hypotheses have been published in peer reviewed literature. The IEP Review Panel (2005) suggested that IEP solicit increased participation and peer review by the academic community as POD concepts and hypotheses are developed. This step is being taken. Thoroughly testing these hypotheses will require years of additional research. It is likely that several of these potential causal factors contribute cumulatively to the POD, with different factors operating at different times of year or under different hydrologic conditions and on different species and lifestages. The specific mechanisms and the magnitude of the effects of each element remain to be determined. Further refinement, modeling, and testing is ongoing, and it is unclear when and if these mechanisms can be verified.

Because of the urgency of the POD crisis, particularly with regard to delta smelt, management actions are being undertaken to try to maintain these species, even in the face of these uncertainties.

4.1.2.3 Factors Affecting Other Fish Species

The potential causal factors described above for POD also apply to other Delta fish species. In general, the factors influencing fish populations in the Delta include changes in hydrologic patterns, habitat modification, contaminant input, entrainment, and introduction of non-native species (Moyle et al. 1995). Collectively, these changes have reduced habitat availability and quality and have contributed to an overall downward trend in survival of Delta-dependent fisheries (Moyle 2002). The EWA program affects water management, and specifically the timing and magnitude of inflows and exports at the CVP and SWP pumping facilities. These factors are described in more detail below.

4.1.2.3.1 Upstream from the Delta. Construction and operations of the large Central Valley reservoirs, including Shasta, Oroville, New Bullards Bar, Folsom, New Melones, New Don Pedro, New Exchequer, Millerton, and others, have altered the timing and magnitude of river flows into the Delta. Historical annual runoff into the Bay-Delta ranged from 19 to 29 million acre-feet (SFEP 1992). Now, upstream users, cities, farmers, and water projects divert about half of the historical flow. The water projects store water during the winter and spring months for release later in the year, which reduces the natural flow in April, May, and June and increases the flow in late summer and fall.

Modified Delta inflow affects timing and location of salinity gradients, considered an important influence on habitat quality and quantity for a number of species (Baxter et al. 1999). Water project operations can affect the location of the salinity gradient (X2 location) by reducing Delta inflows during the late winter and spring or increasing Delta inflows during the summer months. A number of studies have focused on effects of the X2 location on estuarine habitat during the late winter and spring (Kimmerer 2002). Inflows are increased in the summer months to support higher pumping, with only enough additional inflow above the incremental increase in pumping rate to prevent salinity from intruding upstream. The added inflow increment or “carriage water,” is not intended to reduce salinity compared to the no-transfer condition, but to maintain the salinity.

Reduced inflow during the winter and spring have lead to higher water salinity in areas such as Suisun Bay and the western Delta, which are important nursery areas for many estuarine fish species during spring. Elevated salinity levels reduce growth and survival rates for young stages of Delta fish. Salinity levels are often particularly high during spring, when drainage discharged into the Delta, including drainage water flowing down the San Joaquin River, increase salinity in Delta channels. The net result is a substantial reduction in habitat quality for fish. Decreased Delta inflows in late fall and winter may result in reductions in fall habitat quality which may result in adverse impacts to fish, as describe previously (Feyrer et al. in press).

4.1.2.3.2 CVP and SWP Facilities. CVP and SWP exports can influence the magnitude of flows into the Delta and the outflow from the Delta into Suisun Bay. Along with Delta inflow, Delta outflow is an important regulator of habitat quality and availability, and fish distribution, survival, and abundance. Delta inflow and outflow are important for species residing primarily in the Delta and upper estuary (e.g., delta smelt and longfin smelt) (USFWS 1995), and juveniles of anadromous species (e.g., Chinook salmon, steelhead, and green sturgeon) that rear in the Delta prior to ocean entry. CVP and SWP operations can increase fish entrainment, redirect fish into areas with higher risks of mortality, and degrade essential habitat conditions.

Operation of State Water Project Facilities. SWP facilities in the south Delta include Clifton Court Forebay, Skinner Fish Facility, Banks PP, and the intake channel to the pumping plant. Delta water enters the SWP at Clifton Court Forebay. The forebay stores water until the off-peak use period when most pumping at the Banks PP occurs. Water flows from the Forebay, through the primary intake channel of the Skinner Fish Facility where fish screens (louvers) divert fish into the salvage facilities. The fish facility also reduces the amount of floating debris conveyed to the pumps.

Clifton Court Forebay. Clifton Court Forebay is used to store water during high tide that is moved through the Banks PP during the subsequent low tide. It has a maximum capacity of 31,000 acre-feet. When the gates are open at high tide, inflow can be as high as 12,000 cubic feet per second (cfs). Fish entering Clifton Court Forebay may be exposed to predation and angling pressure in the forebay (pre-screening losses). CDFG views predation on fish entrained into the forebay as a concern insofar as it exceeds natural predation rates in Delta channels.

Juvenile salmon, juvenile striped bass, and other species entrained into the forebay are exposed to high levels of predation before they can be salvaged at the Skinner Fish Facility (Gingras 1997). Based on studies of marked juvenile salmon released at the radial gates, mortality estimates of juvenile fall-run Chinook salmon traversing the forebay range from 63 to 98 percent. Survival of young striped bass in Clifton Court Forebay is also low (6 percent). Predation in Clifton Court Forebay is caused by both fish and birds, but striped bass are considered the primary predator (Gingras 1997, Churchwell et al. 2005).

Skinner Fish Facility. The Skinner Fish Facility removes a portion of the fish greater than about 20 millimeters (mm) long from water diverted into Clifton Court Forebay from the Delta and pumped at Banks PP. Salvaged fish are transported in trucks to one of several Delta release sites. Historically, survival of species that are more sensitive to handling, such as delta smelt, was believed to be low (DWR and Reclamation 1994 as cited in DWR and Reclamation 1996), although recent improvements have improved survival of delta smelt during salvage operations (Morinaka pers. comm. 2007). Effects of annual herbicide spraying to reduce nuisance aquatic plants may also be a factor in the decreased ability of fish to survive handling during salvage. Approaches are being investigated to reduce loss associated with salvage. A direct loss model has been developed by DWR and CDFG to estimate losses based on operations at the SWP south Delta facilities. This model can be used to estimate the effect of changes in operations on salmon and striped bass.

DWR conducts daily fish monitoring and fish salvage operations at the SWP Skinner Fish Facility. Total fish salvage is estimated using data on the species composition and numbers of fish collected in each subsample, in combination with information on screen efficiency, the percentage of time and volume subsampled, and estimates of pre-salvage predation mortality and losses. These estimates show high seasonal and interannual variability in fish losses. Information on the seasonal and interannual variability in salvage for various species, in combination with results of daily operations and monitoring, serve as one of the important focuses for application of EWA assets in an effort to help reduce loss of various fish species at the export facilities.

The majority of juvenile Chinook salmon (primarily fall-run Chinook salmon fry) are observed in salvage operations during the late winter and early spring (February through May). Yearling spring-run and fall-run salmon, late-fall-run salmon smolts, and pre-smolt winter-run juvenile salmon are also observed during the late fall and winter (November through January). Steelhead are primarily observed in salvage during the late winter early spring months (February through April) but juveniles and adults are observed from December through July. Striped bass are salvaged at all times, with the majority of juvenile striped bass occurring during the summer months (May through July). Delta smelt are observed in the salvage operations during the fall, winter, and early spring. Longfin smelt are primarily salvaged during the spring (March through May) as juveniles. Sacramento splittail are salvaged throughout the year, although the majority of splittail (young-of-the-year) occur during the spring and early summer (March through July). Green sturgeon are found in low numbers in the salvage operations throughout the year with the highest density occurring in August. A variety of other resident and migratory fish species are also collected as part of both SWP and CVP salvage operations.

Fish that are not bypassed by the salvage facility may survive passage through the pumps and enter the aqueduct. Fish, including striped bass and freshwater species, may rear in the canals and downstream reservoirs. These fish support recreational fisheries along the aqueduct and in downstream reservoirs. They are lost to Delta populations, however.

New studies are in progress to better understand fish losses associated with operation of the Skinner Fish Facility. These studies include an evaluation of predation and mortality at each phase of the salvage operations (collection, handling, and transport and release). Assessment of acute mortality and injury to delta smelt and the assessment of fish predation during the salvage phases and at release sites are two ongoing studies (IEP 2005a).

South Delta Barriers. The South Delta Temporary Barriers Project involves seasonally installing, operating, and removing four temporary rock barriers. These are at the head of Old River, at the lower end of Old River, near the Federal pumping facilities, in Grant Line canal, and in Middle River just upstream of Trapper Slough. The purpose of these barriers is to increase water levels and improve circulation during export operations to allow continuation of local diversions and improve fishery conditions for up-migrating adult salmon and out-migrating smolt (DWR and Reclamation 2005). Some barriers have not been installed in some years because of varying hydrologic and hydrodynamic conditions, and concerns about endangered species.

During the fall, the barrier on Old River (Head of Old River Barrier) is installed to increase flow in the San Joaquin River to maintain adequate dissolved oxygen concentrations for adult salmon migrating upstream (Hayes 1995 as cited in DWR and Reclamation 1996). This barrier is installed in the spring (except in high flow years) to reduce the number of migrating salmon that enter Old River and subsequently SWP, CVP, and agricultural diversions (DWR and Reclamation 2005).

The presence of the temporary barriers alters the patterns and volume of flow in south Delta channels. In particular, installation of the Head of Old River Barrier decreases San Joaquin River inflow to Old River and the Grant Line Canal, causing the SWP and CVP pumps to pull more water from the central Delta via Columbia Cut and Turner Cut (Resource Management International, Inc. [RMI] 1995 as cited in DWR and Reclamation 1996). Changes in the south Delta flow patterns affect the distribution and abundance of delta smelt and other fishes in the south Delta as well as affecting direct losses to the export facilities. The barriers may also alter survival of fall-run Chinook salmon smolt emigrating from the San Joaquin River (Reclamation and SJRGA 2001) and the spawning migration of adult salmon. The barriers also increase aquatic weed abundance by ponding water above the barrier, which creates habitat for introduced fish species like largemouth bass and green sunfish (Oppenheim pers. comm. 2007). Since the barriers provide additional cover for fish predators, predation loss of juvenile fish at the barriers is likely increased. In addition, the barriers alter emigration of steelhead smolt from the San Joaquin River.

The structural component (Stage 1) of the preferred alternative of the SDIP includes installing permanent operable gates on Old River, Grantline Canal, Middle River, and at Old River where it splits from the San Joaquin River. The purpose of the permanent operable gates is the same as the temporary barriers, but these operable gates would provide greater flexibility relative to the previous temporary barriers and allow for gates to be opened or closed based on short-term needs. Stage 1 of the SDIP is included in the cumulative analysis.

Operation of the Central Valley Project Facilities. Reclamation operates CVP facilities in the Delta, including the Jones Pumping Plant, Tracy Fish Collection Facility, and Delta Cross Channel.

Jones Pumping Plant. The Jones PP is located adjacent to Clifton Court Forebay. The plant pumps water directly from the Old and Middle rivers to the Delta-Mendota Canal. Pumping capacity is 4,600 cfs, although the pumping plant is operated at 4,200 cfs capacity until the California Aqueduct – Delta Mendota Canal Intertie is completed (see Section 5.2). The Jones PP is usually operated continuously, although it historically operated only during the spring and summer to meet agricultural demands. It is operated in concert with the SWP Banks facility to meet the regulatory standards governing protection of water quality standards within the Delta.

Tracy Fish Collection Facility. Fish salvage facilities at the Jones PP use behavioral barriers that are composed of a system of primary and secondary louvers (Brown and Greene 1992 as cited in DWR and Reclamation 1996; DWR and Reclamation 2005) that direct fish to holding tanks. Salvaged fish are periodically transferred by truck to a release point in the Delta. One release site is on the Sacramento River near Horseshoe Bend and the other on the San Joaquin River immediately upstream of the Antioch Bridge (Reclamation 2004).

When compatible with export operations, and technically feasible, the louvers are operated with the objective of achieving water approach velocities: for striped bass of approximately 1 foot per second (ft/s) from May 15 through October 31, and for salmon of approximately 3 ft/s from November 1 through May 14 (Reclamation 2004). However, recent studies indicate that approach velocities are often in excess of these requirements due to tides, debris and temporary barriers (DeMoyer 2007).

Screening facilities allow for many fish longer than ~38 mm to be salvaged and returned to the estuary, but considerable mortality of these fish is believed to occur, and small fish are not screened effectively (Brown et al 1996 as cited in Kimmerer 2002). Bowen (2005) estimated the Tracy Fish Collection Facility to have a 13.4 percent screening efficiency for delta smelt.

The Tracy Fish Collection Facility (TFCF) began a series of ongoing studies starting in the early 1990s to improve understanding of factors associated with efficiency of salvage operations at the TFCF. Studies to date have found that debris loading of the primary screens, day and night time frames, tidal stage and water column velocity are related to successful salvage of several important species at the secondary louvers (Bowen et al. 1998).

Delta Cross Channel and Georgiana Slough. The Sacramento River provided 85 percent (median; range 69 to 95 percent) and the San Joaquin River 11 percent (4 to 25 percent) of annual total flow into the Delta during 1956 to 2000. Export flow rate from the south Delta usually exceeds flow in the San Joaquin River, with the result that the Sacramento River must provide the balance. This requires a net flow either southward or eastward, through the Delta toward the export pumps (Kimmerer 2002). This water is conveyed via the DCC near Walnut Grove. The DCC conveys Sacramento River water into eastern Delta channels (including the north and south forks of the Mokelumne River) to supply the southern Delta with water for export via CVP and SWP pumps. Two radial gates regulate flow through the DCC. Georgiana Slough is a natural, unregulated channel about one mile downstream of the DCC that also conveys Sacramento River water to the interior Delta.

Studies have demonstrated that juvenile Chinook salmon and other species are diverted from the Sacramento River to the central Delta through either the DCC or Georgiana Slough (Kjelson et al. 1989 as cited in DWR and Reclamation 1996, NMFS 2004, DWR and Reclamation 2005). Fish migrating through the central Delta are subjected to longer, less direct, migration routes and are exposed to greater risks of predation and entrainment, elevated water temperatures and overall inferior water quality. A large number of small, unscreened diversions occur along the route through the central Delta.

Many of the diversions in the Delta are unscreened and can entrain larval and juvenile fish while cumulatively reducing Delta inflow. Over 2,000 unscreened diversions have been documented in California's Central Valley (Herren and Kawasaki 2001). These diversions have the capacity to divert about one-quarter of the freshwater inflow into the Delta and many are known to entrain significant numbers of larval and juvenile fish (Nobriga et al. 2002, DWR and Reclamation 2005). Recent work by DWR at Horseshoe Bend on the Sacramento River demonstrated the value of screening agricultural diversions and found that losses to diversions are related to fish habitat use and diel[2] behavior (Nobriga et al. 2002). Entrainment into the Horseshoe Bend intake occurred episodically or in cycles and impacts to different species were staggered, suggesting that the entrainment was more related to the presence of fish at the intake. The findings suggest that location and size of the diversion relative to size of the channel are major factors in the risk of entrainment (Nobriga et al. 2002). Screening was found to reduce entrainment relative to unscreened conditions by over 90 percent at the Horseshoe Bend diversion (Nobriga et al. 2002).

Fish that avoid entrainment in these diversions may pass into the southern Delta, where they are vulnerable to the effects of the SWP or CVP export facilities. A significant relationship exists between the proportion of flow diverted into the interior Delta and the proportion of winter-run Chinook salmon lost at the export facilities (NMFS 2004).

The hydraulic capacities of the DCC and Georgiana Slough physically limit the amount of Sacramento River water that can be conveyed toward the pumping plants in the south Delta. This limitation can result in insufficient flows to meet pumping demand, which results in water being drawn from the lower San Joaquin River area of the Delta. When this "reverse flow" condition occurs, pumping causes Sacramento River water to flow around the west end of Sherman Island and then eastward up the San Joaquin, Old, and Middle rivers. This condition occurs in most years during the summer months. It is most problematic when it occurs during the spring, which frequently happens in years with low Delta inflows (dry years) and high levels of export at the SWP and CVP pumps.

There have been concerns regarding the effects of reverse flows on fish populations and their food supply (DWR and Reclamation 1994 as cited in DWR and Reclamation 1996, Bennett 2005, Sommer 2007, Chotkowski pers. comm. 2007). These concerns have focused mainly on planktonic egg and larval

[2] A 24-hour period that includes a day and the following night.

stages of species. Even when these species do not spawn to a significant extent in the southern Delta, eggs or larvae may be transported into the area by reversed flows in Middle and Old rivers. As discussed previously, these early life stages are generally entrained, since they are too small to be effectively screened from export waters. The effects of reverse flows on downstream migrating juvenile Chinook salmon and steelhead have also been identified as an area of concern by resource agencies (NMFS 2004b). There is also a relationship between reverse flows and the number of delta smelt, striped bass and longfin smelt entrained at the pumps (Sommer 2007), but this relationship explains only a small fraction of the variation of fall abundance as indicated by the fall midwater trawl samples (Chotkowski pers. comm. 2007).

4.1.2.3.3 Other Facilities. Other major facilities in the Delta that may affect fish include the Contra Costa Canal, the North Bay Aqueduct, the Pittsburg and Antioch power plants, and the Montezuma Slough Salinity Control Structure. EWA does not affect the operation of these facilities.

4.1.2.4 Delta Hydrodynamics

The EWA Program would affect inflows to and exports from the Delta, which could affect Delta hydrodynamics and habitat quality as well as entrainment at the SWP and CVP. The EWA Program has little potential to affect other factors affecting fish, such as contaminants, exotic species, or entrainment at the numerous unscreened diversions. Several parameters have been used to estimate the effects of inflow and outflow on habitat conditions and fisheries. These include Delta outflow, Export to Inflow (E/I) ratios, the location of X2, and entrainment. These parameters were modeled as described in Appendix B. The modeled values of these parameters under Baseline Conditions are presented in the following sections. Modeled values, rather than actual historic values, are presented to provide a direct comparison (model results to model results) between Baseline Conditions and the action alternatives in the impact assessment. Using actual historic values for these parameters could introduce model artifacts into the evaluation, as the model will not necessarily reproduce historic values. Thus using historic values could potentially result in misidentification of impacts where none occur or in missing impacts that are present.

Delta Outflow. Water development has greatly altered the volume and seasonal pattern of flows into and through the Estuary. Each year, diversions reduce the volume of fresh water that otherwise would flow through the Estuary. The volume of the Estuary's fresh water supply has been increasingly depleted each year. This is due to upstream diversions, in-Delta use, and Delta exports which have grown from about 1.5 million acre-feet (MAF) to nearly 6 MAF, with total diversions throughout the system of about 16 MAF. Delta outflow is an important factor influencing fish habitat and fish populations, as described in Section 4.2.2.1.

For Baseline conditions, the median (value occurring 50 percent of the time) outflow ranged from 4,802 cfs in September to 17,671 cfs in March. In comparison, flows during wetter conditions (occurring 25 percent of the time) ranged from 5,090 cfs in September to 27,170 cfs in March. While in drier conditions (occurring 75 percent of the time) flows ranged from 4,330 cfs in September to 13,008 cfs in March (Table 4-3). Table 4-3, along with many tables throughout the remainder of the section, show the percent of the time a value is greater than or equal to the table value (a.k.a exceedance) to characterize the data. A value that occurs 1 percent of the time indicates that the outflow is great and very rarely exceeded (a very wet year). A value that occurs 99 percent of the time indicates that the outflow is low and almost always exceeded (a very dry year).

Table 4-3. Sacramento San Joaquin Delta Outflow under Existing Conditions

Percent of Time Greater Than or Equal To		Oct (cfs)	Nov (cfs)	Dec (cfs)	Jan (cfs)	Feb (cfs)	Mar (cfs)	Apr (cfs)	May (cfs)	Jun (cfs)	Jul (cfs)	Aug (cfs)	Sep (cfs)
Low Occurrence High Value ↓	1	16,736	14,280	25,519	26,586	49,745	49,613	35,551	40,300	46,748	19,574	6,417	7,960
	10	9,765	6,625	9,873	17,872	34,913	33,349	27,396	29,420	23,477	10,903	6,302	5,639
	25	7,361	6,422	7,365	11,039	26,523	27,170	23,465	22,890	13,401	10,236	6,119	5,090
Median	50	6,124	6,215	6,427	8,000	15,022	17,671	16,010	14,336	10,097	8,567	5,756	4,802
↑ High Occurrence Low Value	75	5,731	5,985	5,977	6,544	10,972	13,008	12,734	9,178	7,505	6,650	4,727	4,330
	90	4,517	4,949	5,105	5,868	9,252	9,162	10,053	7,166	6,512	5,143	3,828	4,160
	99	4,063	4,758	4,726	5,679	8,265	7,479	8,120	5,340	5,160	4,965	3,712	4,029

Export/Inflow Ratio. By regulation, the ratio of the combined SWP/CVP export volume to the total inflow to the Delta (E/I ratio) cannot exceed 65 percent from July through January, or 35 percent from February through June. Exports are calculated as a 3-day average and inflow as a 14-day average, unless the CVP or SWP are making storage withdrawals for export, in which case inflow is also a 3-day average. Exceptions to the 35 percent requirement are allowed in February under some circumstances. These standards would be met under all alternatives. Lower E/I ratios would be beneficial to fish (NMFS 2005b, USFWS 2004), in that a smaller proportion of the total flow is being diverted, and thus presumably a smaller proportion of the fish are subjected to the adverse effects of the pumps. Statistical relationships between E/I and biological productivity or population indices have not been developed. Furthermore, substantially different conditions could be present in the Delta at the same E/I ratio (e.g. 1,000 cfs exports with 10,000 cfs inflow versus 10,000 cfs exports with 100,000 cfs inflow). In discussions with biologists knowledgeable regarding Delta operations (Poage and White pers. comm. 2007), no biologically meaningful thresholds or specific amount of change in E/I could be identified as significance criteria. For these reasons, changes in E/I ratios were not used in the evaluation of Project alternatives Flexibility in the E/I standard is provided in the Bay-Delta Water Quality Control Plan and pumping above the E/I standard is a tool for the EWA to obtain water. This tool has not been used in recent years. Flexing the E/I is not represented in any modeling runs used for this analysis.

Under Baseline conditions, the E/I ratios approach regulatory limits most frequently in March and September, where the maximum allowable ratio occurs about three quarters of the time. The median values fall between 44 to 63 percent during July through January and from 10 to 23 percent in the February through June period (Table 4-4).

Table 4-4. Frequency of Occurrence of Export/Inflow Ratios Under Existing Conditions

Percent of Time Greater Than or Equal To		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Low Occurrence High Value ↓	1	65%	64%	65%	64%	45%	35%	31%	32%	35%	54%	62%	65%
	10	64%	61%	61%	61%	42%	35%	27%	28%	35%	49%	61%	65%
	25	60%	58%	57%	56%	35%	35%	25%	23%	35%	47%	60%	65%
Median	50	54%	50%	52%	42%	23%	23%	22%	19%	31%	44%	58%	63%
↑ High Occurrence Low Value	75	47%	39%	32%	21%	15%	13%	14%	15%	23%	35%	49%	51%
	90	42%	28%	14%	10%	9%	10%	10%	12%	16%	20%	27%	46%
	99	26%	14%	9%	6%	5%	3%	6%	7%	9%	9%	12%	38%

X2 Location. Salinity is an important habitat factor in the Estuary. Estuarine species characteristically have optimal salinity ranges, and their survival may be affected by the amount of habitat available within the species' optimal salinity range (Kimmerer 2002). This is described in further detail in Section 4.2.2.2. Because the salinity field in the Estuary is largely controlled by freshwater outflows, the level of outflow may determine the available area of optimal salinity habitat for different species (Hieb and Baxter 1993; Unger 1994 as cited in DWR and Reclamation 1996, Kimmerer 2002, DWR and Reclamation 2005).

Under D-1641 Water Quality Objectives, the location of X2 is regulated to be west of certain compliance points from February through June. The SWP and CVP are operated to comply with these criteria.

The estimates of X2 location (Table 4-5) show that under Baseline Conditions, X2 would be located between river kilometer (rkm) 64 and rkm 88, as measured upstream from the Golden Gate. X2 is generally furthest west in February through April and furthest east in August and September. X2 is generally further west in wetter conditions and further east in drier conditions.

Table 4-5. Estimated Average Location of X2 (River Kilometer) by Water Year Type and Month Existing Conditions

Averages	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	79.9	81.0	78.4	73.4	65.1	64.6	66.4	67.2	70.0	75.3	82.3	83.6
Above Normal	82.7	81.9	80.8	76.9	67.8	66.8	67.0	70.0	74.0	76.6	82.8	84.4
Below Normal	81.2	82.2	80.9	79.1	70.7	70.6	71.3	72.2	76.7	78.7	82.9	85.1
Dry	82.3	82.9	82.5	80.7	75.3	73.9	73.8	76.5	79.4	81.5	85.1	86.0
Critical	83.6	83.4	83.4	82.3	76.9	77.3	76.5	81.6	82.1	84.4	87.6	86.9
1922-1994 WY Avg	81.6	82.1	80.9	78.0	70.6	70.1	70.6	72.8	75.8	78.9	83.9	85.0

4.1.2.5 Entrainment

As described previously, export operations of the SWP and CVP affect fish survival within the Delta, both directly and indirectly (USFWS 2005). The number of fish lost is assumed to be proportional to the numbers entrained as indicated by salvage. This is described in detail in Section 4.2.2.3.

Table 4-6 presents the estimated annual average entrainment index calculated for the Baseline Condition for all years and for wetter and drier hydrologic conditions. These numbers serve as a basis for comparison to evaluate the effect of the action alternatives on fish salvage. More fish are generally entrained in wetter conditions than in drier conditions, which is consistent with the amount of water diverted during these two hydrologic conditions. The largest decreases in the entrainment index between wetter and drier hydrologic conditions occur for striped bass, American shad and splittail. The entrainment index for longfin

Table 4-6. Simulated Annual Average Entrainment Indices for Combined Banks (SWP) and Jones (CVP) Exports under Existing Conditions

Fish Species	All Years	Wetter Years	Drier Years
Delta smelt	102,273	106,719	98,910
Delta Smelt - Pre-spawning and adults[1]	4,977	5,618	4,493
Delta Smelt - juveniles[2]	94,977	97,869	92,790
Striped bass	3,529,692	4,343,624	2,914,280
Longfin smelt	49,206	21,569	70,103
Threadfin shad	5,100,522	4,766,910	5,352,766
Fall-Run Chinook[3]	90,559	124,213	65,113
Late Fall-Run Chinook[3]	1,706	2,639	1,000
Winter-Run Chinook[3]	13,468	12,872	13,919
Spring-Run Chinook[3]	56,655	91,269	30,482
Steelhead[3]	30,095	34,403	26,837
Splittail	562,082	1,291,982	10,206
American shad	1,175,686	1,665,095	805,645

Notes:
[1]January – March
[2]April – June
[3]Entrainment indices based on loss ratios instead of only salvage numbers

smelt and threadfin shad is considerably greater in drier conditions than in wetter conditions. Drier conditions result in these species being in closer proximity to the pumps.

4.2 Environmental Consequences/Environmental Impacts

4.2.1 Consideration of Scientific Uncertainties in Determining the Evaluation Approach

Scientific uncertainties stem from an incomplete understanding of cause and effects and our ability to measure physical changes and species responses. Tools to analyze potential actions on aquatic life in the Delta are limited by our understanding of the biological and physical mechanisms that affect the species present. Of necessity, the tools available to represent physical conditions in the Delta simplify complex relationships and limit the kinds of conditions that can be represented. Many models and analytical approaches have been advanced over the years and most have been found wanting to some degree. The earlier models represented regressions of observed physical conditions and biological variables, such as the response of striped bass to salinity. Such models have been applied for management of Delta species and found to be poor indicators of potential future conditions (IEP Review Panel 2005).

As understanding of physical conditions, including Delta hydraulics, have improved, flow and water quality models have improved. However, flow models and water quality models dependent upon them represent oversimplifications of more complex processes. Tools for interpretation of flow and water quality model results used to assess the effects of potential actions on aquatic species tend to focus on individual aspects of the physical environment. More detailed and complex modeling tools for biota are being developed, but are too early in the developmental process to provide reliable results. There also is some controversy as to the true importance and representativeness of several of the biological indices, including those derived from historical monitoring programs that have been used to derive empirical relationships and measure population trends (IEP Review Panel 2005, Sommer 2007).

The current state of knowledge limits the ability to assess the interactions of biological and physical factors at the community and food web level of the Delta. This limitation affects the accuracy of the predicted changes to the physical environment and the potential effects on biological populations. The uncertainties regarding the mechanisms of food web- interactions restrict our understanding of the factors causing adverse changes in Delta biota. This is especially apparent in the literature addressing the ongoing long-term decline of native Delta species and introduced recreational species and the contribution of invasive exotic species toward this decline. The IEP POD Review Panel Report (IEP 2005) states:

Key pieces of basic information appear to be lacking on the habitat requirements and early life stages of pelagic species of interest. For example, there is very little information on where the eggs of delta smelt can be found in the system. Likewise, there are few reliable estimates of vital rates (e.g. stage-specific growth and mortality rates) required to adequately model spatially explicit population dynamics of pelagic species under different scenarios.

The data analyses and dynamic models lack the sophistication to match the complexity of the dynamics in the hydrological and population/community dynamics of the Bay-Delta system.

There are clearly differences of opinion between scientists as to the use of analytical approaches and the data needed for more complete analyses.

Relationships involving key indices such as X2 and Delta outflow are based primarily on single factors or ratios that are empirically derived to indicate favorable or less favorable conditions for fish. These indices allow for the use of physical models to provide indications of the effect of potential actions by the comparison of results derived from hydraulics and water quality, especially salinity. These indices include X2, Export/Inflow relationships, and Delta outflows. Such indices provide valuable insight into how changes in physical factors may adversely or favorably affect Delta species, but do not provide a comprehensive analysis of the synergistic interactions of variables that are important to understanding community and ecosystem effects.

4.2.2 Assessment Approach

Results of hydrologic modeling (described in Appendix B) provide monthly information that is used to evaluate the potential effects of EWA operations on conditions that affect fish species inhabiting the Bay-Delta estuary. The following modeling parameters were selected to be part of this analysis:

- Delta outflow;
- Change in location of the 2 parts per thousand (ppt) salinity isohaline (X2); and
- Entrainment of fish at CVP and SWP Delta facilities.

Potential effects to fish and aquatic habitat were assessed through a comparative analysis of hydrologic conditions. Changes in these hydrologic parameters are indicative of potential effects on fish species and aquatic ecosystems in the Delta. NMFS has determined that there are no species requiring Essential Fish Habitat (EFH) consultation within the Delta under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) related to the EWA Program (NMFS 2004).

4.2.2.1 Delta Outflow

Delta outflow is the amount of water leaving the western Delta and flowing into Suisun Bay. It is related to seasonal runoff and releases from upstream reservoirs reaching the Delta, as well as in-Delta diversions and CVP/SWP exports. Delta outflow is a general indication of habitat conditions in the Delta. Historically, there were relationships between Delta outflow and striped bass and longfin smelt populations (Kimmerer 2002). These relationships have changed over the years as conditions in the Delta have changed, but these former relationships indicate the potential importance of Delta outflow to Delta fishes. Seasonal flows influence the transport of eggs and young organisms through the Delta and into San Francisco Bay. Flows during the months of April, May, and June play an especially important role in determining the reproductive success, survival, and emigration success of many estuarine and migratory species including salmon, striped bass, American shad, delta smelt, longfin smelt, splittail, and others (Stevens and Miller 1983; Stevens et al. 1985; Herbold 1994; Meng and Moyle 1995 as cited in DWR and Reclamation 1996).

Additionally, Delta outflow is a primary driver of other hydrologic parameters within the Delta that affect habitat quality. These parameters include the location of X2 (discussed below) and fall habitat quality[3] (Feyrer et al., in press, see Section 4.1.2.2.1). D-1641 contains Delta outflow compliance criteria[4] under the water quality objectives for fish and wildlife beneficial uses ranging from 3,000 to 8,000 cfs, depending on month and water year type (Table 4-7, SWRCB 2001).

Table 4-7. Delta Outflow Requirements under D-1641[1]

Water Year Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	4,500[2]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	8,000	4,000	3,000	4,000	4,500	4,500
Above Normal	4,500[2]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	8,000	4,000	3,000	4,000	4,500	4,500
Below Normal	4,500[2]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	6,500	4,000	3,000	4,000	4,500	4,500
Dry	4,500[2]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	5,000	3,500	3,000	4,000	4,500	4,500
Critical	4,500[2]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	7,100[3]	4,000	3,000	3,000	3,000	3,500	3,500

Notes:
[1]Based on Net Delta Outflow Index
[2]Increased to 6,000 cfs if the eight rivers index for December exceeds 800 TAF
[3]Calculated as a 3-day running average and dependent on EC at Collinsville and the Eight Rivers Index and the Sacramento River Index in May.

[3] Specific mechanisms linking physical habitat quality to the abundance of these species remain unclear and tools for evaluating this hypothesis are still under development.
[4] D-1641 defines the Net Delta Outflow Index as Delta Inflow minus Delta Consumptive Use minus Delta Exports (Fig 3, SWRCB 2000)

This requirement is based on a 3-day running average, whereas the model uses a monthly time step and is not capable of examining a 3-day period. Modeling limitations do not allow evaluation of compliance with the standard using the modeled results, as the monthly average may not be a good estimator of the average over any 3-day period.

Approach. To evaluate potential effects on Delta fish resources, monthly Delta outflow under the action alternatives were determined and compared to monthly Delta outflow under Baseline Conditions over the period of record evaluated. Emphasis is given to the months December through July, which are of greatest import to most of the evaluation species (Sommer 2007). Other periods of the year are also evaluated, however, based on emerging theories about factors affecting pelagic species in other seasons (see Section 4.1.2.2.1).

Effects on Delta fishery resources were considered adverse if monthly Delta outflows decreased under the action alternatives, relative to Baseline Conditions[5], during one or more months of the evaluation period. Significance criteria for this evaluation are provided in Section 4.2.3.1.

4.2.2.2 Location of X2

The location of suitable habitat for delta smelt and other Delta species has been affected by changes in the hydrodynamics of Delta waterways resulting from water diversions that have shifted the position of X2 upstream of the confluence of the Sacramento and San Joaquin Rivers (USFWS 2005). Historically, the location of X2 has varied from San Pablo Bay (rkm 50) during high Delta outflow to Rio Vista (rkm 100) during low Delta outflow. In recent years, it has typically been located from approximately Honker Bay to Sherman Island (rkm 70 to 85). X2 is controlled directly by the volume of Delta outflow, although changes in X2 lag behind changes in outflow. Minor modifications in outflow do not greatly alter the X2 location. The location of X2 downstream of the confluence of the Sacramento and San Joaquin Rivers is closely associated with the natural logarithm of Delta outflow between 1959 and 1988 (USFWS 2005).

X2 is commonly used as an index of the location of the Low Salinity Zone. The Low Salinity Zone is an area of the Estuary characterized by higher levels of particulates, higher abundances of several types of organisms, and maximal turbidity. It is commonly associated with the position of X2, but actually occurs over a broader range of salinities. Lateral circulation within the Estuary or chemical flocculation may play a role in the formation of the turbidity maximum of the Low Salinity Zone.

The Low Salinity Zone is thought to be biologically important to many species. Mixing and circulation in this zone concentrates plankton and other organic material, and increases food biomass and production. Larval fish such as striped

5 Baseline Conditions refers to both existing conditions and the Future No Action Conditions. Given the short timeframe for this supplement, these conditions are expected to be equivalent.

bass, delta smelt, and longfin smelt may benefit from enhanced food resources in the low salinity zone. Since about 1987, however, *Corbula*, the introduced Asian clam, populations have had a substantial impact on phytoplankton through grazing and has reduced zooplankton abundance through both predation and competition (Kimmerer 2002).

Although little to no enhancement of the base of the food chain in the Low Salinity Zone may have occurred during the past decade, this area continues to have relatively high levels of invertebrates and larval fish. Jassby et al. (1994 as cited in DWR and Reclamation 1996) showed that when X2 is in the vicinity of Suisun Bay, several estuarine organisms tend to show increased abundance. However, the mechanism behind this relationship is not clear. The observed correlations may result from a close relationship of X2 to other factors that affect these species.

Previous analyses have shown that delta smelt are usually distributed upstream of X2 (Kimmerer 2002). Ever since a population decline in the early 1980s, upstream placement of X2 during spring has been associated with low delta smelt abundance in DFG surveys (Kimmerer 2002). Prior to 1982, delta smelt abundance was highest when X2 was in or near the Delta. Currently, it is thought that the central and south Delta no longer provide generally suitable habitat for post larval delta smelt due to altered habitat conditions and entrainment losses (USFWS 2005). Additionally, the summer tow net index increased when outflow was between 34,000 and 48,000 cfs, which placed X2 between Chipps and Roe islands, downstream of the confluence (Jassby et al. 1994 as cited in DWR and Reclamation 1996).

When X2 is west of the confluence, delta smelt and other fishes are outside the area of influence of the pumps. Except for three years in the 1983-1994 period (1986, 1993, and 1994), indices of fish abundance from the summer tow net surveys have remained at consistently lower levels than experienced before 1983. These low levels correlate with the 1983 to 1994 mean location of X2 upstream of the confluence (USFWS 2005). Empirical physical evidence shows that when X2 is upstream of the confluence of the Sacramento and San Joaquin rivers, delta smelt are in the area of the San Joaquin River where flow conditions draw larval fish into the South Delta and expose them to other factors that potentially decrease survival (predation, warmer water temperatures and greater risk of entrainment at the SWP and CVP) (Bennett 2005). For delta smelt the concern is with upstream movement of X2 east of the confluence during the spring and early summer.

The relationship between fish abundance and X2 location is not as solid in wet years. In wet years, delta smelt typically are located well down into Suisun Bay and away from the influence of the pumps. Therefore, X2 does not necessarily regulate delta smelt distribution in all years. In wet years when abundance levels are high, their distribution is much more dispersed and they can be found well west of the X2 location. This change in distribution is believed to be related to the location of primary food resources (USFWS 2005). Food resources are more dispersed and smelt distribution mimics that of their food resources.

Similar physical processes affect other euryahine (tolerating a wide range of salinities) species, such as longfin smelt, outmigrating juvenile Chinook salmon and steelhead, and life stages of other species that move into or through the Delta during the spring and summer. The change in location of X2 relative to the confluence during key life history stages can be used to evaluate the effects of EWA on Delta conditions for Delta species.

X2 is also used as a surrogate for habitat quality in the western Delta and Suisun Bay. As discussed in Section 4.1.2.2, fall habitat quality has been related to fish population trends for several species (Feyrer et al. in press). Based on this, it is hypothesized that changes in habitat quality may be adversely affecting fish. During the fall, movement of X2 is indicative of habitat quality in Suisun Bay. Westward movement of X2 during this time would be considered beneficial for fish, while eastward movement would be considered an adverse change.

The location of X2 during the late winter through spring (February through June) is included as a regulatory requirement in the 1995 Water Quality Control Plan and D-1641 (SWRCB 2001). Between February and June, the location of X2 is managed to fall within certain geographic boundaries, the most important of which are Collinsville at rkm 81 upstream and Chipps Island at rkm 74, near Antioch.

Depending on the water year type the location of X2 is managed to be west of these compliance points for certain periods between February and June by managing Delta inflow and exports. Conditions are highly favorable for fish when X2 is downstream (west) of Chipps Island. Conditions are less favorable for fish when X2 is upstream (east) of rkm 81. Habitat improves as X2 moves to the west between these two points. Because the analysis did not include new CALSIM runs, the location of X2 could not be precisely ascertained. The location of X2 was estimated based upon empirical formulae. These formulae and the error inherent in them are described in Appendix B. The X2 values presented and discussed below, provide a relative location of X2, rather than a precise location; that is they indicate the direction in which X2 would change among alternatives, but may not be used to reliably estimate compliance with the regulatory criteria. The SWP and CVP are operated to comply with these criteria.

Approach. The X2 values presented and discussed in this document provide an assessment of the relative location of X2 for each alternative, rather than its precise location. These data are used to indicate the direction in which X2 would change among alternatives, but lack the resolution needed to determine the exact location of X2.

To assess the effects of action alternatives on the location of X2 relative to Baseline Conditions, the estimated locations of X2 were compared. The results were evaluated relative to the significance criteria discussed in Section 4.2.3.2.

4.2.2.3 Entrainment at SWP and CVP Facilities

Implementation of the action alternatives would change the amount and timing of pumping at the SWP and CVP facilities. The amount of water pumped at these facilities affects fish survival within the Delta both directly and indirectly (USFWS 2005). The number of fish lost to entrainment is assumed to be proportional to the numbers of fish salvaged. Recent estimates indicate that salvage numbers may be close to twenty percent of fish affected by entrainment. However, fish smaller than 20 mm at the SWP and smaller than 38 mm at the CVP are not well represented in salvage, and thus are under represented in the salvage density calculations. Additionally, these smaller fish are considered to be sensitive to handling during and after salvage, and may not survive salvage operations, and thus may be counted as salvaged, when in fact they die subsequently. Recent work with delta smelt has indicated better survival during the actual salvage process than previously suspected (J. Morinaka pers. comm. 2007). Survival of adult delta smelt ranges from 80 to 90 percent, while that of juvenile delta smelt ranges from 30 to 60 percent. These survival estimates may be an under-estimate as they include mortality from only the salvage operation. They do not include associated losses prior to entering the salvage facilities or after release. Nor do they include an estimated 10 percent additional loss that occurs during cleaning operations, when the louvers are lifted out of the water (NMFS 2004). In addition to salvage and entrainment at the pumping facilities, exports may also increase losses due to predation along the approaches to the pumps. These predation losses are believed to be substantial, especially for the SWP, but also occur to a lesser extent at the CVP. In addition, there is mortality associated with salvage operations including survival during the collection, handling, trucking and release of salvaged fish. For salmon these factors have been studied and are accounted for in calculations and are represented as “loss.” For other species, including delta smelt, these factors are not well understood and are not accounted for in the model. Potential mortality for these species is represented as “salvage.” Predation losses are influenced by operation of the pumps, in that exports can draw vulnerable fish into areas where predator densities are higher. Additionally, increased pumping can draw fish from more favorable to less favorable habitats within the Delta. Therefore, increased salvage numbers are considered to represent an overall adverse effect of an action or project on fish resources.

The magnitude of losses resulting from export operations is a function of the magnitude of monthly water exports from each facility, the relative abundance of fish that are exposed to entrainment near the export facilities, and the vulnerability of species and lifestages to entrainment and the associated effects described above. When fish abundance near the export facilities is high, as indicated by salvage, and export flows also are high, fish losses are more likely to be high since the higher abundances place more fish at risk and higher exports increase the risk of entrainment. When export pumping is low or fish densities are low, losses would be expected to be lower as well.

Approach. An approach was developed to evaluate the relative amount of entrainment that might be experienced at the export facilities under alternative export scenarios. This approach is based upon that used in biological assessments for the long-term operations of the Projects (Reclamation 2004) and combines data developed by Reclamation on the number of fish salvaged by month and hydrological condition (wetter or drier conditions) and the amount of water exported via the pumps as simulated for various alternatives for both the CVP and SWP facilities. This information was used to develop an index of the relative risk of entrainment for different species and lifestages.

Reclamation used historical salvage data for listed species at the SWP and CVP for the period 1993-2004 to calculate salvage density by species and month for wetter and drier hydrological conditions[6]. Salvage densities were calculated by totaling salvage for each species by month for each export facility and dividing by the volume of water pumped during that month. This provided salvage densities by species for each export facility for each month and year of the evaluation. These were then averaged by water year condition to derive average salvage densities by species, month, and hydrological condition; wetter years consisting of wet and above-normal water years, and drier conditions consisting of below normal, dry, and critically dry water years. Salmon were calculated based on a loss index, which accounts for fish rescued through salvage. Other species, which did not exhibit high survival during salvage, were based on the salvage index. This approach was extended to non-listed species using the same techniques for this analysis.

The entrainment index for operational alternatives is calculated by multiplying the volume of water pumped in a month at a facility by the salvage density (or loss) for the appropriate water year condition for each species (Appendix D). The results for the two export facilities are totaled by month and year. Average calculated salvage by year (long-term average) is produced and tabulated for the overall evaluation period and by hydrological condition to facilitate evaluation of the alternatives.

The values calculated are considered an index, as this approach will not precisely calculate the number of fish entrained by the facilities or account for associated effects of pumping, such as predation, handling mortality, and negative flows in Old and Middle River that may draw fish from more favorable to less favorable habitats. It also will not account for entrainment of smaller lifestages that are not well represented in the salvage. However, it seems

[6] The 2004 EIS/EIR used data from 1979-1993. The more recent data used in the Supplement reflects more recent salvage densities based on evolving operations of the projects and better data collection techniques at the fish salvage facilities.

reasonable to assume that the relationship between export rates and these factors would be the same for all alternatives that are likely to be considered.

Underlying assumptions of the analysis include:

- The 1993–2004 species salvage densities are sufficiently representative for this analysis and can be used as a measure of comparison of the alternatives to predict future densities for similar hydrological conditions, wetter and drier years[7].
- Simulation of alternatives over the historic period of record is sufficiently representative of future conditions under those alternatives.
- Factors not included in this analysis would not unduly affect the validity of the evaluation of the comparisons of alternatives.

The entrainment indices by species for each alternative, by water year category and for all years combined, were considered in assessing effects. The net change in the entrainment indices indicates whether one alternative differs in effect from another. A difference of more than five percent in the entrainment index was used to assess significance, since there is some uncertainty in the salvage densities that are used with modeled flows as indicators of future operations. Significance criteria for this parameter are outlined in Section 4.2.3.3. Entrainment indices for late fall run Chinook, green and white sturgeon were not developed as the number of these fish salvaged were too low to support this type of analysis. Salvage data for lamprey are not species specific; therefore, entrainment of Pacific lamprey could not be evaluated.

4.2.3 Significance Criteria

The potential effects of the various alternatives to Delta fisheries and their habitat were evaluated using the indicators described above. Changes in the modeled values of these indicators were evaluated relative to Baseline Conditions based on the significance criteria described below. The significance criteria are based on: current or historic relationships between these indicators and physical conditions or biological response variables, current theory of relationships between physical and biological variables, or the significance criteria used in other studies. The CVP and SWP are operated to comply with regulatory standards and would not violate these standards under Baseline Conditions or either action alternative.

4.2.3.1 Delta Outflow

Delta outflow is linked to ecosystem health and has historically been related to the abundance of several species. Generally speaking, increases in Delta

[7] Salvage densities vary not only by month, but also with the population of the species being evaluated. During periods when populations are very high, salvage densities would be expected to be higher. Conversely when populations are very low, salvage densities would also be low. The 1993 to 2004 salvage numbers are used as an index to assess potential effects of the various alternatives.

outflow would be considered beneficial, while decreases would be considered adverse. In evaluating this parameter, tables of the frequency of occurrence of Delta outflow by month were generated and the two action alternatives were compared to Baseline Conditions. A 10 percent change in outflow was established as a threshold level, based on the error inherent in standard hydrologic measurements (Gordon et al. 1992) and in the modeling process, which only approximates actual operations. Significance was evaluated as:

- A reduction in Delta outflow of more than 10 percent, occurring with a frequency of more than 10 percent would be considered a significant adverse impact.
- An increase in Delta outflow of more than 10 percent, occurring with a frequency of more than 10 percent would be considered a benefit.
- A change in Delta outflow of less than 10 percent, or occurring less than 10 percent of the time would be considered less than significant.

4.2.3.2 X2 Location

As previously discussed, the estimates of X2 locations are useful in providing an indication of the change in direction of X2, but do not reliably indicate its exact location, and therefore, cannot be used to compare to regulatory criteria or specific location recommendations for fish. The projects would operate to meet these criteria under any alternative. For this evaluation the action alternatives are compared to Baseline Conditions during each month by water year type. In each of these comparisons, a 0.5 km significance threshold was applied following that used in the long-term Project operations BO (USFWS 2005).

- If an Alternative causes X2 to shift more than 0.5 km to the east, relative to Baseline Conditions, this would be considered a significant adverse impact.
- If an Alternative causes X2 to shift more than 0.5 km to the west, relative to Baseline Conditions, this would be considered beneficial.
- If an Alternative causes a shift in X2 location of 0.5 km or less, relative to Baseline Conditions, this would be considered a less than significant impact.

4.2.3.3 Entrainment Index at the CVP and SWP Facilities

Export volumes and fish salvage densities (fish/TAF) were used to calculate an entrainment index for each species of concern for which reliable data were available, as described in Section 4.1.2.4. Increases in the entrainment index indicate an increase in the total number of that species potentially lost to entrainment or related causes and are considered adverse. Given the sensitivities of the species involved, a change of 5 percent was selected as a conservative threshold for evaluating impacts. The significance criteria for the entrainment index are:

- If the entrainment index increases by 5 percent or more in comparison with Baseline Conditions, this would be considered a significant adverse impact.
- If the entrainment index decreases by 5 percent or more in comparison with Baseline Conditions, this would be considered beneficial.
- If the entrainment index changes by less than 5 percent in comparison with Baseline Conditions, the impact is considered less than significant.

4.2.4 ASIP Conservation Measures

Conservation measures included in the ASIP (Appendix C) are incorporated into the EWA project. These conservation measures have not changed from the 2004 EIS/EIR and ASIP. This updated impacts analysis incorporates one conservation measure at a new time of year:

- The EWA agencies will avoid acquisition and transfer of water that would reduce flows essential to maintaining populations of native aquatic species in the source river.

4.2.5 The No Action/No Project Alternative

As described in the 2004 EIS/EIR, it is anticipated that if the EWA were not implemented, actions to protect fisheries and benefit aquatic environments would continue pursuant to regulatory requirements. Compliance with regulatory requirements would cause pumping curtailments, resulting in reduced deliveries to the Export Service Area, particularly in dry years. DWR and Reclamation would continue to attempt to re-operate the SWP and CVP, respectively, to avoid decreased deliveries to export users.

There would be no variation in CVP/SWP reservoir storage levels, river flows, or water temperatures under the No Action/No Project Alternative, as described in the 2004 EIS/EIR Affected Environment/Environmental Setting. Therefore, there would be no impacts on fisheries and aquatic ecosystems associated with the No Action/No Project Alternative.

The CEQA basis for comparison is the affected environment. The NEPA basis for comparison is the future conditions without the project. As described in the above paragraphs, the affected environment and the future conditions without the project would be the same; therefore, they are collectively referred to as the Baseline Condition in the following sections (i.e., the characteristics of the Baseline Condition and the conditions under the No Action/No Project Alternative are essentially the same; hence, the impacts relative to CEQA would be comparable under NEPA).

4.2.6 Environmental Consequences/Environmental Impacts of the Flexible Purchase Alternative

4.2.6.1 Delta Outflow

The Flexible Purchase Alternative would generally increase Delta outflow from January through September and decrease outflow from October through December.

Delta outflows under the Flexible Purchase Alternative would closely track the Baseline Condition Delta outflows from March through December, varying by 10 percent or less, and substantially less most of the time (Table 4-8). In January and February, the Flexible Purchase Alternative would result in higher outflows than occur under Baseline Conditions, as EWA fish actions would be undertaken to improve environmental conditions and reduce the potential for entrainment. The increase in outflows would be similar during nearly every year. The greatest percentage increases in outflow occur in drier years (at the 90 percentile flows). In January, higher percentage increases in outflows occur under all but the wettest conditions (occurring 1 percent of the time or less); in February, substantially higher percentage increases in outflows occur in normal and drier conditions. This indicates that the greatest benefit is provided under normal or drier conditions. Outflow is increased during wetter conditions as well, but these increases do not rise to the threshold of significance.

Outflow is increased to a lesser degree in March through September, as well. EWA fish actions would reduce pumping and increase outflow from March through June. In July, August, and September, the EWA agencies would be moving purchased water through the Delta export pumps, and a portion of that transfer water would increase outflow to maintain water quality. Outflows would be decreased by a less than significant amount in October through December as the EWA agencies pumped surplus water from the Delta (when available) to reduce debt in San Luis Reservoir. In December, reductions in Delta outflow would be constrained by the conservation measures (see Section 4.2.4) to less than significant levels. While Table 4-8 indicates decreases in outflow up to 20 percent for very dry years, the EWA agencies would limit pumping to reduce debt if the pumping could have adverse effects on fish (as indicated in the conservation measure).

Historically, Delta outflow has been linked to populations of some pelagic species (Kimmerer 2002). While these relationships are not apparent in the last several years, these generally higher outflows under the Flexible Purchase Alternative are anticipated to create more favorable habitat conditions for pelagic species. Higher Delta outflow also keeps eggs, larva and fry further from the pumps and therefore reduces entrainment risk. Finally, higher outflows would be expected to improve the emigration success of salmonids and other species moving downstream through the Delta at this time. The Flexible Purchase Alternative would have a beneficial effect on outflow relative to Baseline conditions during the most critical periods of the year, January and

February. It would result in a less than significant reduction on Delta outflow in October through December, due in part to the conservation measures included as part of the project.

Table 4-8. Percent Change in Delta Outflow under Flexible Purchase Alternative[1]

Percent of Time Greater Than or Equal To		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Low Occurrence High Value ↓	1	-5%	0%	-3%	9%	4%	2%	2%	3%	0%	0%	1%	1%
	10	0%	0%	-9%	14%	5%	2%	3%	4%	0%	1%	2%	1%
	25	-1%	-1%	-5%	22%	7%	3%	4%	3%	0%	2%	2%	0%
Median	50	-1%	-1%	0%	31%	12%	5%	4%	6%	3%	1%	2%	2%
↑ High Occurrence Low Value	75	-5%	-5%	-11%	37%	16%	6%	6%	4%	1%	1%	3%	3%
	90	-7%	-4%	-9%	41%	19%	5%	2%	0%	0%	3%	4%	3%
	99	-4%	-7%	-20%	32%	6%	10%	0%	0%	0%	3%	4%	4%

Notes:
[1]Positive percentages indicate an increase in Delta outflow, while negative percentages indicate a decrease in Delta outflow

4.2.6.2 X2 Location

The Flexible Purchase Alternative would result in the estimated location of X2 moving to the west relative to Baseline Conditions during most months, but eastward in October through December.

The Flexible Purchase Alternative would move the estimated location of X2 westward most of the time in January through September, and eastward from October through December (Table 4-9). The EWA agencies would take actions, described in Section 4.2.6.1, that change Delta outflows; the same actions would move the location of X2. January through May would generally see beneficial changes in X2 location and provide a benefit to aquatic ecosystems and the fisheries dependent upon them. The eastward change in November and December would be constrained by the conservation measure in Section 4.2.4 and thus would not be as great as indicated. The EWA agencies would not pump water to reduce debt in San Luis Reservoir if the pumping would adversely affect fish; the EWA agencies would apply this conservation measure to X2 by not causing the X2 location to shift to the east of the confluence of the Sacramento and San Joaquin Rivers (rkm 81). Shifts in X2 during October through December therefore would be less than significant.

Table 4-9. Difference in Estimated X2 Location (River Kilometer) from Baseline Conditions for the Flexible Purchase Alternative[1]

WY Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0.4	0.6	0.5	-2.0	-0.7	-0.3	-0.4	-0.6	-0.2	-0.1	-0.1	-0.1
Above Normal	0.2	0.1	0.1	-2.6	-1.0	-0.4	-0.4	-0.5	-0.1	-0.2	-0.3	0.0
Below Normal	0.1	0.2	0.4	-3.0	-1.1	-0.6	-0.5	-0.5	-0.1	-0.2	-0.3	0.0
Dry	0.4	0.5	1.2	-3.4	-1.7	-0.7	-0.5	-0.4	-0.1	-0.2	-0.3	-0.2
Critical	0.3	0.4	1.1	-3.5	-1.5	-0.8	0.0	0.0	0.0	-0.3	-0.4	-0.4
1922-1994 WY Avg	0.3	0.4	0.7	-2.8	-1.2	-0.5	-0.4	-0.4	-0.1	-0.2	-0.3	-0.1

Notes:
[1]Positive values represent an eastward shift and negative values represent a westward shift

The Flexible Purchase Alternative would have a beneficial effect on X2 location relative to Baseline conditions during January through May. It would have a less than significant impact during the remainder of the year. These changes in X2 would result in an overall net benefit to fisheries and aquatic resources.

4.2.6.3 Entrainment

The Flexible Purchase Alternative would result in substantially reduced entrainment indices for most species evaluated, including all listed species. The entrainment indices for threadfin shad and American shad would be increased.

Considering all water years (Table 4-10), the Flexible Purchase Alternative would substantially decrease the entrainment index for all but four species.[8] The entrainment indices for threadfin shad and American shad would be increased. The entrainment indices for striped bass and splittail would be similar to those under Baseline Conditions. For most species, the percent change relative to Baseline Conditions is similar in wetter and drier years. For species where a substantial decrease would occur, these decreases usually exceed 10 percent and often approach or exceed 15 percent, indicating a substantial benefit to these species. The decreased entrainment indices for delta smelt, in all time periods and for both wetter and drier years, ranges from 11 to 19 percent, with the greatest benefits occurring in the January through March period, when early spawning individuals would be present. This represents an important benefit relative to Baseline Conditions.

[8] As stated in Section 4.2.1.4, entrainment indices for late fall run Chinook, green and white sturgeon were not developed as the number of these fish salvaged were too low to support this type of analysis. Salvage data for lamprey are not species-specific; therefore, entrainment of Pacific lamprey could not be evaluated.

Table 4-10. Simulated Change in Annual Average Entrainment Indices for the Flexible Purchase Alternative Relative to Baseline Conditions for Combined Banks (SWP) and Jones (CVP) Exports

Fish Species	All Years	Wetter Years	Drier Years
Delta smelt	-11%	-11%	-12%
Delta Smelt - Pre-spawning and adults[1]	-18%	-17%	-19%
Delta Smelt - juveniles[2]	-12%	-11%	-12%
Striped bass	2%	3%	1%
Longfin smelt	-15%	-18%	-14%
Threadfin shad	7%	3%	10%
Fall-Run Chinook[3]	-17%	-16%	-17%
Late Fall-Run Chinook[3]	-9%	-11%	-6%
Winter-Run Chinook[3]	-13%	-14%	-12%
Spring-Run Chinook[3]	-15%	-15%	-16%
Steelhead[3]	-15%	-15%	-15%
Splittail	0%	0%	-9%
American shad	8%	8%	9%

Notes:
[1]January - March
[2]April - June
[3]Entrainment indices based on loss ratios instead of only salvage numbers

The two species that would be adversely affected, threadfin shad and American shad, are both introduced species. Threadfin shad are one of the species associated with the POD, while American shad are recreationally important. The entrainment indices for these species are increased primarily in July and August, and into September. This later entrainment period reflects the life history of these introduced species which are present in the area near the pumps after most native species have moved to other areas. Both species are affected more in drier years than in wetter years, due to greater increases in pumping under drier conditions relative to Baseline Conditions.

The Flexible Purchase Alternative would have a beneficial effect on entrainment indices relative to Baseline Conditions for all listed species and most native species. It would have a significant adverse impact on two non-native species. This would be a significant and unavoidable impact.

4.2.7 Environmental Consequences/Environmental Impacts of the Fixed Purchase Alternative

The Fixed Purchase Alternative would result in many of the same changes relative to Baseline Conditions as were described for the Flexible Purchase Alternative, but these changes would be decreased in magnitude relative to the Flexible Purchase Alternative. A notable exception occurs with regard to entrainment losses for threadfin shad and American shad, where the Fixed Purchase Alternative would not result in substantial increases in their entrainment indices.

4.2.7.1 Delta Outflow

The Fixed Purchase Alternative would generally increase Delta outflow from January through May and decrease outflow in October through December.

The Fixed Purchase Alternative would result in similar changes in Delta outflow relative to Baseline Conditions as described for the Flexible Purchase Alternative. The increase in outflows under the Fixed Purchase Alternative would be similar during nearly every year, but the changes would be of lesser magnitude and would not occur as frequently as they do under the Flexible Purchase Alternative (Table 4-11).

Under the Fixed Purchase Alternative, the highest percentage increase in outflow would occur in January and February, as fish actions were implemented to improve environmental conditions and reduce the potential for entrainment. In January these higher percentage increases in outflows occur under all but the wettest conditions (those occurring 10 percent of the time or less); in February, substantially higher outflows occur under drier conditions. These higher outflows would benefit fisheries. During October through December, Delta outflow would be decreased, as the EWA agencies pumped surplus water from the Delta to reduce EWA debt in San Luis Reservoir (Table 4-11). The conservation measure described in Section 4.2.4 would prevent the EWA agencies from pumping water in December if it could adversely affect fish. The outflow changes in December would therefore have less than significant effects on fish. This would be similar to what was observed for the Flexible Purchase Alternative.

Table 4-11. Percent Change in Delta Outflow under Fixed Purchase Alternative[1]

Percent of Time Greater Than or Equal To		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Low Occurrence High Value ↓	1	-14%	0%	-3%	6%	3%	2%	2%	3%	0%	0%	0%	0%
	10	0%	0%	-9%	9%	4%	2%	3%	3%	0%	0%	1%	0%
	25	-1%	-1%	-6%	15%	5%	3%	4%	3%	0%	0%	1%	0%
Median	50	-1%	-1%	-2%	20%	9%	5%	3%	5%	0%	0%	1%	0%
↑ High Occurrence Low Value	75	-5%	-5%	-11%	25%	12%	6%	6%	3%	0%	0%	1%	0%
	90	-7%	-4%	-9%	27%	15%	5%	1%	0%	0%	1%	1%	0%
	99	-4%	-7%	-20%	26%	6%	10%	0%	0%	0%	1%	1%	0%

Notes:
[1]Positive percentages indicate an increase in Delta outflow, while negative percentages indicate a decrease in Delta outflow

The Fixed Purchase Alternative would have a beneficial effect on outflow relative to Baseline Conditions during January and February. It would result in a less than significant reduction in Delta outflow in October through December, due in part to the conservation measures included as part of the project.

4.2.7.2 X2 Location

The Fixed Purchase Alternative would result in the estimated location of X2 moving westward relative to Baseline Conditions during January through August, and eastward in October through December.

The Fixed Purchase Alternative would move the estimated location of X2 in a manner similar to that described for the Flexible Purchase Alternative, with a similar frequency, but to a lesser magnitude in January and February, and with a similar magnitude in other months (Table 4-12). Shifts in X2 in January through March would result in a benefit relative to Baseline Conditions. The eastward change in November and December would be constrained by the conservation measures in Section 4.2.4. Shifts in X2 during October through December therefore would be less than significant. These changes in X2 would result in an overall net benefit to fisheries and aquatic resources.

Table 4-12. Difference in Estimated X2 Location from Baseline Conditions (River Kilometer) for the Fixed Purchase Alternative[1]

WY Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0.5	0.6	0.7	-1.4	-0.6	-0.3	-0.4	-0.5	0.0	0.0	-0.1	0.0
Above Normal	0.2	0.1	0.2	-1.8	-0.8	-0.4	-0.4	-0.4	0.0	0.0	-0.1	0.0
Below Normal	0.1	0.2	0.4	-2.1	-0.9	-0.6	-0.5	-0.4	0.0	0.0	-0.1	0.0
Dry	0.4	0.5	1.2	-2.4	-1.3	-0.7	-0.3	-0.3	0.0	-0.1	-0.1	0.0
Critical	0.3	0.4	1.1	-2.6	-1.2	-0.8	0.0	0.0	0.0	-0.1	-0.1	0.0
1922-1994 WY Avg	0.3	0.4	0.8	-2.0	-0.9	-0.5	-0.3	-0.3	0.0	0.0	-0.1	0.0

Notes:
[1]Positive values represent an eastward shift and negative values represent a westward shift

4.2.7.3 Entrainment

The Fixed Purchase Alternative would result in substantially reduced entrainment indices for most species evaluated, including all listed species. This would result in beneficial effects for these species. The entrainment indices for threadfin shad, American shad, striped bass and splittail would be similar to those under Baseline Conditions.

The Fixed Purchase Alternative considering all water years (Table 4-13), would substantially decrease the entrainment index for most species analyzed, including all listed species. These decreases usually range from 8 to 15 percent, a benefit to these species. The entrainment indices for threadfin shad, American shad, striped bass and splittail would remain similar to those under Baseline Conditions. For most species, the percent change relative to Baseline Conditions is similar in wetter and drier years, although the entrainment index for longfin smelt decreases less in drier years than in wetter years and the reverse is true for splittail. Decreased entrainment indices for delta smelt in all time periods and for both wetter and drier years ranges from 8 to 14 percent, with the greatest benefits occurring in the January through March period, when early spawning individuals would be present. This represents a substantial benefit over Baseline Conditions. No species would be adversely affected by the Fixed Purchase Alternative.

The Fixed Purchase Alternative would have a beneficial effect on entrainment indices relative to Baseline Conditions for all listed species and most native species. It would have a less-than-significant impact on two non-native species.

Table 4-13. Simulated Change in Annual Average Entrainment Indices for the Fixed Purchase Alternative Relative to Baseline Conditions for Combined Banks (SWP) and Tracy (CVP) Exports

Fish Species	All Years	Wetter Years	Drier Years
Delta smelt	-8%	-8%	-8%
Delta Smelt - Pre-spawning and adults[1]	-13%	-12%	-14%
Delta Smelt - juveniles[2]	-8%	-8%	-8%
Striped bass	0%	0%	0%
Longfin smelt	-12%	-18%	-10%
Threadfin shad	1%	0%	1%
Fall-Run Chinook[3]	-13%	-13%	-13%
Late Fall-Run Chinook[3]	-5%	-6%	-3%
Winter-Run Chinook[3]	-10%	-10%	-10%
Spring-Run Chinook[3]	-14%	-14%	-13%
Steelhead[3]	-12%	-12%	-13%
Splittail	0%	0%	-8%
American shad	2%	2%	2%

Notes:
[1]January - March
[2]April - June
[3]Entrainment indices based on loss ratios instead of only salvage numbers

4.2.8 Cumulative Effects

The cumulative analysis includes one new water acquisition program in addition to the programs that were included in the 2004 EIS/EIR (see Table 5-1). The new program is associated with the Yuba River Accord.

In addition, two structural programs are included in the cumulative analysis:

- South Delta Improvements Program (SDIP), and
- California Aqueduct – Delta Mendota Canal Intertie.

These programs and their interrelationship with the EWA program are described in Section 5.2. These projects could affect the magnitude and timing of pumping based on the interrelationships of the Yuba River Accord with EWA and the hydrodynamic changes created by the SDIP and Intertie projects. The cumulative impacts of these projects and the Flexible Purchase Alternative are described below. The cumulative effects of these projects with the Fixed Purchase Alternative were not evaluated separately. The cumulative projects with the Fixed Purchase Alternative would result in changes in the same direction, but of lesser magnitude and duration than those described for the cumulative projects with the Flexible Purchase Alternative.

4.2.8.1 Delta Outflow

The cumulative projects in combination with the Flexible Purchase Alternative would substantially increase Delta outflow in July and August 10 to 25 percent of the time. The cumulative effects on Delta outflows from December through June (months with fish actions) would be caused by the Flexible Purchase Alternative because increased pumping from the cumulative projects would not occur during these months (Table 4-14). During October and November, the cumulative effect of these projects and the Flexible Purchase Alternative would be the same as those under the Flexible Purchase Alternative. This decrease in Delta outflow would not exceed the significance criteria under drier conditions in December because these reductions would be constrained by the project conservation measures to be less than significant.

Overall, the effect of the cumulative projects in combination with the Flexible Purchase Alterative on Delta fisheries would be less than significant with respect to Delta outflow.

Table 4-14. Percent Change in Delta Outflow for the Cumulative Projects Relative to Baseline Conditions[1]

Percent of Time Greater Than or Equal To		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Low Occurrence High Value ↓	1	-4%	0%	-3%	9%	4%	2%	2%	3%	0%	0%	3%	2%
	10	0%	1%	-9%	14%	5%	2%	3%	4%	0%	2%	3%	1%
	25	1%	0%	-5%	22%	7%	3%	4%	3%	0%	3%	2%	0%
Median	50	2%	-1%	0%	31%	12%	5%	4%	6%	3%	3%	3%	2%
↑ High Occurrence Low Value	75	0%	-4%	-11%	37%	16%	6%	6%	4%	1%	5%	11%	7%
	90	-2%	2%	-9%	41%	19%	5%	2%	0%	0%	19%	22%	8%
	99	1%	-6%	-20%	32%	6%	10%	0%	0%	0%	17%	20%	6%

Notes:
[1]Positive percentages indicate an increase in Delta outflow, while negative percentages indicate a decrease in Delta outflow

4.2.8.2 X2 Location

The cumulative projects in combination with the Flexible Purchase Alternative would result in largely beneficial changes in X2 location (Table 4-15). Changes in X2 location in the fall are caused by the Flexible Purchase Alternative, as none of the other cumulative projects would be operating during this time of year. The cumulative effect on X2 location from December through June (months with fish actions) would be the same as those for the Flexible Purchase Alternative because the cumulative projects would not increase pumping during these months.

During the rest of the year, the position of X2 would be slightly farther west than under Baseline Conditions, providing a slight benefit to fisheries. In July and August of dry and critically dry years, there would be a beneficial cumulative effect, with X2 being west of where it would be under the Baseline Condition.

Table 4-15. Difference in Estimated Change in X2 Location from Baseline Conditions (River Kilometer) for the Cumulative Projects[1]

WY Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0.2	0.5	0.5	-2.0	-0.7	-0.3	-0.4	-0.6	-0.2	-0.2	-0.2	-0.1
Above Normal	0.0	-0.1	0.1	-2.6	-1.0	-0.4	-0.4	-0.5	-0.1	-0.2	-0.5	0.0
Below Normal	-0.2	0.0	0.4	-3.0	-1.1	-0.6	-0.5	-0.5	-0.1	-0.3	-0.3	0.0
Dry	0.1	0.2	1.2	-3.4	-1.7	-0.7	-0.5	-0.4	-0.1	-0.6	-1.0	-0.3
Critical	-0.1	0.0	1.1	-3.5	-1.5	-0.8	0.0	0.0	0.0	-1.9	-2.2	-1.4
1922-1994 WY Avg	0.0	0.2	0.7	-2.8	-1.2	-0.5	-0.4	-0.4	-0.1	-0.6	-0.7	-0.3

Notes:
[1]Positive values represent an eastward shift and negative values represent a westward shift

4.2.8.3 Entrainment

The cumulative projects in combination with the Flexible Purchase Alternative would result in reduced entrainment indices for most species (except threadfin shad and American shad) relative to Baseline Conditions (Table 4-16). The impact of the cumulative projects in combination with the Flexible Purchase Alternative would be significant to threadfin and American shad.

The entrainment indices under the Flexible Purchase Alternative in all year types for the threadfin and American shad would be 7 percent and 8 percent, respectively. Under the cumulative condition, the entrainment indices would be 23 percent and 18 percent. The Flexible Purchase Alternative would contribute to an increase in the entrainment index, which is above the significance criteria, under the cumulative condition. Therefore, the cumulative impact of the Flexible Purchase Alternative would be cumulatively considerable. This would be a significant and unavoidable cumulative impact.

With the exception of the two shad species, the entrainment indices under the cumulative condition would be lower than the Baseline Conditions. This would provide a beneficial cumulative impact.

Table 4-16. Simulated Change in Annual Average Entrainment under the Cumulative Condition Relative to Baseline Conditions for Combined Banks (SWP) and Jones (CVP) Exports

Fish Species	All Years	Wetter Years	Drier Years
Delta smelt	-23%	-32%	-15%
Delta Smelt - Pre-spawning and adults[1]	-18%	-17%	-19%
Delta Smelt - juveniles[2]	-24%	-35%	-16%
Striped bass	-9%	-15%	-3%
Longfin smelt	-8%	-1%	-10%
Threadfin shad	23%	6%	35%
Fall-Run Chinook[3]	-19%	-25%	-11%
Late Fall-Run Chinook[3]	-8%	-10%	-5%
Winter-Run Chinook[3]	-13%	-14%	-12%
Spring-Run Chinook[3]	-10%	-10%	-10%
Steelhead[3]	-15%	-15%	-15%
Splittail	-18%	-18%	-7%
American shad	18%	11%	29%

Notes:
[1]January - March
[2]April - June
[3]Entrainment indices based on loss ratios instead of only salvage numbers

4.3 Comparative Analysis of Alternatives

Table 4-17 summarizes the effects of each of the action alternatives and compares them to Baseline Conditions.

4.3.1 Flexible Purchase Alternative

The Flexible Purchase Alternative would result in overall improved conditions for most Delta-dependent species (Table 4-17). The most critical period for these species is from January through June, when many are spawning or migrating through the Delta. During this portion of the year, the Flexible Purchase Alternative would generally increase Delta outflow and move X2 westward relative to Baseline Conditions. These factors are believed to improve habitat quality by improving water quality, assisting emigrant fish through the Delta and on to their final destination, and moving the location of productive hydrologic zones within the Delta to areas where the most habitat is available for species that rear in the Delta. This alternative also would provide the benefit of reducing the amount of water exported during this season and moving fish further from the pumps, where they are less susceptible to entrainment or associated effects. During the remainder of the year, project effects would be less than significant on both of these parameters, due in part to the conservation measures, and would not be expected to adversely affect fisheries resources.

The Flexible Purchase Alternative results in substantially reduced entrainment indices for most species, including all of the listed species. Increased exports in July and August under drier conditions would result in increased entrainment of threadfin shad and American shad. Threadfin shad are one of the indicator species for POD, because they share a pelagic life history with the other POD species. American shad are also introduced and support a recreational fishery.

In spite of the impacts described above, the Flexible Purchase Alternative would result in generally improved habitat conditions within the Delta and Suisun Bay and would substantially decrease annual entrainment relative to Baseline Conditions for most species. These combined benefits could improve conditions for Delta-dependent species. This would provide a substantial net benefit to fisheries and aquatic ecosystems relative to Baseline Conditions.

Table 4-17. Comparison of the Effects of the Alternatives on Fisheries Resources Relative to Baseline Conditions

Potentially Affected Resource Parameter	Flexible Purchase Alternative	Fixed Purchase Alternative
Outflow	B-Jan-Feb	B-Jan-Feb
Changes in location of X2 (Monthly)	B- Jan-May	B-Jan-Mar
Entrainment		
Delta Smelt	B	B
Delta Smelt - Pre-spawning and Adults[1]	B	B
Delta Smelt - Juveniles[2]	B	B
Striped bass	LTS	LTS
Longfin Smelt	B	B
Threadfin Shad	S	LTS
Fall-Run Chinook[3]	B	B
Late Fall-Run Chinook[3]	B	B
Winter-Run Chinook[3]	B	B
Spring-Run Chinook[3]	B	B
Steelhead[3]	B	B
Splittail	LTS	LTS
American shad	S	LTS

Notes:
This table compares the effects and level of significance of the action alternatives to Baseline conditions.
B = Beneficial
LTS = Less than Significant Impact (May Contain Beneficial Impacts)
S = Significant Impact
[1]January through March
[2]April through June
[3]Entrainment indices based on loss ratios instead of only salvage numbers

4.3.2 Fixed Purchase Alternative

Like the Flexible Purchase Alternative, the Fixed Purchase Alternative would generally increase Delta outflow and move X2 westward relative to Baseline Conditions, which, as previously discussed are believed to improve habitat quality (Table 4-18). The Fixed Purchase Alternative would include fewer fish actions in January through June. Therefore, the Fixed Purchase Alternative would not result in the same magnitude and duration of change as the Flexible Purchase Alternative, although the direction of change would be similar. The Fixed Purchase Alternative would not provide the same relative benefits to overall habitat quality. It also would not reduce entrainment indices by the same magnitude as would the Flexible Purchase Alternative, except for threadfin shad and American shad.

The Fixed Purchase Alternative would not reduce entrainment indices for most species as much as the Flexible Purchase Alternative. The decreased exports in July and August under drier conditions, relative to the Flexible Purchase Alternative, would result in decreased entrainment of threadfin shad and American shad relative to the Flexible Alternative, although similar to that under Baseline Conditions.

During the October through December period, conditions under the Fixed Purchase Alternative would be quite similar to those under the Flexible Purchase Alternative and the effects would be similar in direction and magnitude. Delta outflow would be decreased and X2 would be moved east relative to Baseline Conditions. As with the Flexible Purchase Alternative, these changes would be less than significant, due in part to conservation measures, and are not expected to affect fish and aquatic resources.

Overall, the Fixed Purchase Alternative would not provide as much benefit for fisheries and aquatic resources as the Flexible Purchase Alternative. While the Fixed Purchase Alternative would reduce entrainment of the two shad species during limited periods in July and August, this relative benefit does not outweigh the more substantive benefits provided by the Flexible Purchase Alternative during the January through June period. This is not to say that the impacts to the two shad species should not be considered. Rather, that the greater benefits provided to delta smelt, salmonids and other native species by the Flexible Purchase Alternative should not be discarded for the limited benefits provided to shad under the Fixed Purchase Alternative.

4.4 Potentially Significant Unavoidable Impacts

Significant and unavoidable impacts with regard to fisheries and aquatic ecosystems were identified for the Flexible Purchase Alternative, but not for the Fixed Purchase Alternative.

For the Flexible Purchase Alternative this impact is increased entrainment of threadfin shad and American shad. This entrainment impact is created by increased Delta export pumping during drier years in July and August to make up water that was not exported earlier in the year as a result of EWA fish actions. Decreasing pumping at these times has the potential to reduce this impact, but it would substantially reduce the EWA agencies' opportunities to move water through the Delta in these years. These opportunities would already be constrained by fish needs during the remaining months of the year, and reducing pumping opportunities in July, August, and September would make it difficult, if not impossible, for the EWA agencies to purchase enough water to account for all of the fish actions. Therefore, mitigating this impact by reducing export pumping in July, August, and September would not be feasible.

4.5 References

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Chapter 5
Other Required Disclosures

5.1 Growth Inducing Impacts

The 2004 EIS/EIR evaluated the growth inducing impacts of implementing the Flexible and Fixed Purchase Alternatives. The document concluded that the EWA agencies cannot "estimate the magnitude of growth, its location, or the level of significance of any direct, indirect, or cumulative impacts that may be caused by growth based on the limited role that the EWA alternatives may or may not play in local water supply assessments and local decision making processes." That conclusion is the same relative to the potential growth inducing impacts of implementing the EWA from 2008 through 2011; therefore, the conclusion of the 2004 EIS/EIR remains unchanged relative to this Supplement.

5.2 Cumulative Effects

The 2004 EIS/EIR evaluated the cumulative effects of the Flexible and Fixed Purchase Alternatives. The following text describes changes in programs included in the cumulative assessment. The South Delta Improvements Program and the California Aqueduct – Delta Mendota Canal Intertie are described in the cumulative effects section because it is reasonably forseeable that they would be implemented during the period of analysis.

5.2.1 Water Acquisition Programs

The Governor's Drought Risk Reduction Investment Program

The 2004 EIS/EIR included the Governor's Drought Risk Reduction Investment Program (DRRIP) as a water acquisition project in the cumulative condition. Because of California's budget crisis, the program lost funding and was discontinued in 2003. The DRRIP may become active again in the next several years; therefore, it is included in the cumulative analysis.

Proposed Lower Yuba River Accord

The 2004 EIS/EIR did not include the proposed Lower Yuba River Accord in the cumulative analysis.

Flows on the Lower Yuba River are controlled by the SWRCB's Revised Water Rights Decision 1644, which is currently under litigation. Yuba County Water Agency (Yuba County WA), in negotiations with the parties to the litigation, state and federal fisheries agencies, water supply agencies, and other parties, has developed the proposed Lower Yuba River Accord (Yuba Accord). The Yuba Accord serves to resolve issues related to operation of the Yuba County WA's Yuba River Development Project, fisheries protection and enhancement, and water supply. The Yuba Accord Draft EIS/EIR was released to the public in June 2007.

The Yuba Accord is composed of three interrelated agreements: 1.) "Principles of Agreement for Lower Yuba River Fisheries Agreement;" 2.) "Outline of Proposed Principles of Agreements with Yuba County WA Member Units in Connection with Proposed Settlement of SWRCB D-1644;" and 3.) "Agreement for the Long-term Purchase of Water from Yuba County WA by the Department of Water Resources and the Bureau of Reclamation" and related actions. Under these agreements, Yuba County WA would provide instream flows based on a new water year index (the North Yuba Index) by increasing flows by 25,000 acre-feet in a dry year to more than 170,000 acre-feet in a wet year; and improve water supply reliability for DWR and Reclamation by providing 60,000 acre-feet annually to DWR to use in coordination with CDFG to benefit fish and up to 140,000 acre-feet in drier years with low SWP and CVP allocations (HDR and SWRI 2006). In the No Action/No Project Alternative, the 60,000 acre-feet would help complete fish protection and restoration actions that are mandated by regulatory requirements.

Water Acquisition Program Interrelationships

Several important relationships exist among the water acquisition programs, including the timing of water acquisitions, the methods and locations of the acquisitions, and the associated need for conveyance through Project facilities. Priority at the Project pumps is a critical factor in the cumulative condition because the Delta pumps have limited available capacity at certain times of the year. Several programs, including Sacramento Valley Water Management Agreement (SVWMA), the Dry Year Program, and, at times, the CVPIA Water Acquisition Program, have pumping priority over the EWA. If pumping capacity were not available for EWA purchases, the EWA agencies would acquire water from sources in the Export Service Area. Therefore, the locations and types of acquisition become factors for operation of these programs. Table 5-1 summarizes the timing, location, and nature of water acquisition program actions.

The preferred location and type of water acquisition is similar among most programs and is based mainly on costs. Water purchases in the Upstream from the Delta Region tend to be less expensive than purchases in the Export Service Area. Typically, the first acquisition priority for all programs would be non-Project surface water, because it is usually the least expensive source. If surface water were no longer available for purchase, the water acquisition programs would look to groundwater substitution and direct groundwater purchases to acquire water. Temporary crop idling would be the last water acquisition option utilized by most programs.

Table 5-1. Summary of the Cumulative Condition of Water Acquisition Programs

			Location Relative to Delta		Potential Acquisition and Management Actions					
Program	Frequency/ Year Type for Implementa-tion	Status	Upstream	Export Service Area	Surface Water Purchase	Ground-water Purchase	Ground-water Substitution	Ground -water Storage	Crop Idling	Source Shifting
EWA	Annual	Current	X	X	X	X	X	X	X	X
SVWMA	Critical, Dry, Below Normal	Future	X		X		X			
Dry Year Water Purchase Program	Critical, Dry	Current	X		X		X		X	
CVPIA WAP	Annual	Current	X	X	X		X		X	
EWP	Annual	Un-certain	X		X	X	X		X	
Yuba Accord	Annual	Future	X		X		X			
DRRIP	Critical	Future	X	X	X	X, Export Service Area	X		X	

Furthermore, as indicated in Table 5-1, all the acquisition programs could be operated in a critical water year and most in a dry year. Surface water supplies would not likely provide enough water for needs of all programs during a dry year. Other types of acquisitions, including crop idling, would likely be used. The potential for cumulative effects to occur during dry years would be the greatest, as all programs would seek to acquire water in the Upstream from the Delta Region through all acquisition types.

In many instances, the same agencies (DWR and Reclamation) would be involved in the acquisitions or approval of the acquisitions; therefore, agencies would coordinate purchases. Coordination of the programs would be particularly crucial during critical and dry years, when all programs were in operation.

5.2.2 South Delta Improvements Program

The South Delta Improvements Program (SDIP) proposes structural and operational changes within the south Delta to help achieve better water quality and fish protection while allowing the SWP to export water at a greater capacity. The program's purpose includes the following objectives (Jones and Stokes 2005):

- Reduce the movement of San Joaquin River watershed Central Valley fall-/late fall-run juvenile Chinook salmon into the south Delta via Old River;

- Maintain adequate water levels and, through improved circulation, water quality available for agricultural diversions in the south Delta, downstream of head of Old River; and

- Increase water deliveries and delivery reliability to SWP and CVP water contractors south of the Delta and provide opportunities to convey water for fish and wildlife purposes by increasing the maximum permitted level of diversion through the existing intake gates at CCF [Clifton Court Forebay] to 8,500 cfs.

Reclamation and DWR have identified a two-stage approach for implementing the SDIP: the structural component (Stage 1) of the preferred alternative includes installing permanent operable gates on Old River, Grantline Canal, and Middle River; dredging portions of Middle River, Old River and West Grant Line, Victoria and North Canals; and extending up to 24 agricultural intakes. Stage 2 would include operational changes of the SWP export facilities by increasing diversions from 6,680 cfs to 8,500 cfs, but will not occur during the timeframe of this project. Stage 1 is included in the cumulative programs because it is reasonably forseeable to be completed before 2011, but Stage 2 is not included because implementation is uncertain and will likely not occur before 2011.

5.2.3 California Aqueduct – Delta Mendota Canal Intertie

The intertie consists of constructing and operating a pumping plant and pipeline connection between the Delta-Mendota Canal (DMC) and the California Aqueduct. The primary purpose of the intertie is to allow for operation and maintenance activities on the Jones Pumping Plant and fish facility, the DMC, and the O'Neill pumping plant and intake canal. The intertie would include a 467 cubic feet per second (cfs) pumping plant at the Delta-Mendota Canal (DMC) that would allow up to 467 cfs to be pumped from the DMC to the California Aqueduct through an underground pipeline. The CVP currently has to limit pumping through the Jones Pumping Plant because of a lack of conveyance capacity downstream in the DMC, but the intertie would remove that conveyance restriction. The intertie also would be used in a number of ways to achieve multiple benefits, including meeting current water supply demands, allowing for the maintenance and repair of the CVP Delta export and conveyance facilities, and providing operational flexibility to respond to emergencies related to both the CVP and SWP.

5.2.4 Cumulative Effects for Individual Resource Areas

The 2004 EIS/EIR cumulative effects analysis by resource area would be affected by the addition of the Yuba Accord, SDIP, and the intertie relative to the analysis conducted in the EIS/EIR.

The Yuba Accord would include surface water purchase and groundwater substitution from the Upstream from the Delta region. The SVWMA and the Dry Year Program (during dry and critical years), and CVPIA Water Acquisition Program also include these tools upstream from the Delta. Resource area analyses in the 2004 EIS/EIR evaluated the combination of the EWA and other programs that use similar tools within the same region and year type as would occur with the Yuba Accord.

The analysis conducted in the 2004 EIS/EIR associated with Delta water levels assumed operation of temporary barriers. The SDIP EIS/EIR preferred alternative includes construction of three permanent operable flow control gates. (Completion of channel dredging and diversion extensions is expected by fall 2008 and completion of the four permanent gates is scheduled for spring 2009 (Stage 1 actions).) Once the permanent gates are installed, the water levels as described in the 2004 EIS/EIR for the Flexible and Fixed Purchase Alternatives may be altered. However, the SDIP EIS/EIR concluded no significant impacts to south Delta water levels resulting from implementation of Stage 1 actions. Although the south Delta water levels may change from those reported in the 2004 EIS/EIR, it is anticipated that the water levels would not be lowered. Water levels described in the 2004 EIS/EIR would be expected to be maintained or raised once the permanent barriers are installed.

If the intertie was completed, the additional pumping capacity could have cumulative effects on fisheries. Chapter 4, Fisheries and Aquatic Ecosystems, includes a resource specific cumulative analysis incorporating the intertie.

The addition of the Yuba Accord and SDIP to the cumulative projects would not substantially change the analysis conducted in the 2004 EIS/EIR. Therefore, an updated cumulative analysis by resource area is not warranted.

5.3 Consultation and Coordination

Informal agency communications, formal interagency meetings, and public meetings were conducted during the preparation of the 2004 EIS/EIR and ASIP.

Under Section 7 of the ESA, the proposed extension of the EWA program to 2011 changes the timeframe of the proposed action. Therefore, the EWA agencies intend to request reinitiation of formal consultation with USFWS and request concurrence from NMFS that the action is not likely to adversely affect listed [fish] species based on the ASIP, as was done in 2003.

5.3.1 Public Involvement

EIS/EIR Scoping

Project scoping was completed for the 2004 EIS/EIR. The comments received at the public scoping meetings, as well as those received in response to the Notice of Intent (NOI) and Notice of Preparation (NOP) for the 2004 EIS/EIR were considered during its preparation. This Supplement does not include substantial changes to the project description; therefore, scoping was not conducted again, as the scoping comments received would still be applicable. (NEPA and CEQA (Section 15163) guidelines do not require scoping for Supplemental EIS/EIRs.)

Public Review of Draft Supplemental EIS/EIR

The public Draft Supplemental EIS/EIR is available for review and comment for 60 days following filing of the Notice of Availability (NOA) of the EIS with the U. S. Environmental Protection Agency and the Notice of Completion (NOC) of the EIR with the California State Clearinghouse. The NOA was published in the Federal Register. The NOC was filed with the California State Clearinghouse.

5.4 Irreversible and Irretrievable Commitments of Resources

NEPA Section 102(C)(v) (CEQ Regulations Part 1502.16) requires Federal agencies to consider to the fullest extent possible any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. CEQA Guidelines Section 15126.2(c) echoes this same intention. Nonrenewable resources committed during project initiation may be irreversible, since commitments of such resources may permanently remove resources from further use. CEQA requires evaluation of irretrievable resources to assure that consumption is justified. For example, fossil fuels are nonrenewable because they are not replaceable in a manner that makes them sustainable.

The EWA program is a water acquisition and management strategy that does not involve construction or the use of resources except water, with one exception. That exception is the use of fuel that is required to power generators for the extraction of groundwater. The acquisition strategies, thresholds, and avoidance actions incorporated into the design of the EWA program prevent the irreversible and irretrievable commitment of other nonrenewable resources. There is no other commitment of nonrenewable resources, and the EWA Program does not commit future generations to permanent use of natural resources.

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

NEPA Section 102(C)(iv) (CEQ Regulations 1502.16) requires all Federal agencies to disclose the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. All EWA water acquisition and management processes in this Supplement are temporary, and would not directly lead to long-term benefits to the sustainability and reliability of California's water supply, fish, and fish habitat. Therefore, this discussion will focus on the tradeoffs between short-term environmental and human health costs and long-term environmental benefits if the EWA were to be continued beyond 2011.

Water acquisition through crop idling is a short-term acquisition option that could result in both long- and short-term effects. Crop idling under certain circumstances could produce windborne dust that could result in human health effects and a permanent loss of soil due to wind erosion. Crop idling under EWA water acquisitions would include mitigation measures to prevent these adverse effects. The temporary idling of productive farmland would also result in increased localized farm labor unemployment. Long-term productivity related to water supply reliability issues would be dependent on continuation of the EWA beyond 2011. EWA actions could lead to improvements that address California's surface and groundwater supplies, water quality, fish protection and recovery and sustain agricultural economics and social issues if decisions were made to continue the EWA program indefinitely.

The EWA program would not provide for protection of the long-term productivity of urban and rural populations by increasing their water supply reliability unless it was continued beyond 2011. Through a continued EWA, farmers could sustain food production in the Central Valley through use of reliable sources of surface water instead of turning to over drafted groundwater basins during times when the surface water supply is interrupted. Enhanced management of groundwater would also ensure its long-term sustainability.

5.6 References

HDR and Surface Water Resources, Inc (SWRI). 2006. *Draft Initial Study and Proposed Negative Declaration for the Yuba County Water Agency, Proposed Extension Petition for the Interim Instream Flow Requirements Under State Water Resources Control Board Revised Water Rights Decision 1644, October 2006*. Prepared for: Yuba County Water Agency. Accessed 04 12 2007. Available at: http://www.waterrights.ca.gov/hearings/docs/yra2007/oct06ispmnd.pdf

Jones and Stokes. 2005. *South Delta Improvements Program Environmental Impact Statement/Environmental Impact Report, October 2005*. Prepared for: Bureau of Reclamation and California Department of Water Resources. Accessed 05 03 2007. Available at: http://baydeltaoffice.water.ca.gov/sdb/sdip/documents/draft_eis_eir/vol-1/vol-1-eir.html

Chapter 6
List of Preparers and their Qualifications

Name/Professional Discipline	Expertise and Experience	Role in Preparation
EWAT Preparers		
Teresa Geimer CEQA Program Manager DWR	23 years experience in public and private sectors	CEQA compliance, guidance, review, and oversight
Sandy Osborn Project Manager Reclamation	17 years experience in public sector natural resources planning	Contract administrator and reviewer
Victoria Poage Fish & Wildlife Biologist Fish & Wildlife Service	20 years public sector experience in fishery science	Delta fisheries coordination and review, ASIP preparation
Tim Rust Program Manager Reclamation	25+ years experience in water resources management and wastewater master plan development in the public and private sectors	Oversight and review
Curtis Spencer Principal Engineer DWR	35+ years public and private sector CEQA and NEPA experience in NEPA/CEQA documents, water resources planning and design	Project description and review
Jim White Staff Environmental Scientist Dept of Fish & Game	20+ years experience in fisheries biology	Aquatic resource coordination, ASIP preparation, and review
CDM Preparers		
Carrie Buckman Project Manager	9 years experience in water resource planning	Project management and review
Patricia Reed Biologist	7 years experience environmental consulting	Author vegetation and wildlife, review of biology sections, ASIP production
Anthony Skidmore Planner	25+ years NEPA/CEQA compliance experience	NEPA/CEQA compliance issues
Gina Veronese Economist	6 years experience in economics analyses	Author regional and agricultural socioeconomics, land use
Michelle Wilen Planner	6 years experience environmental planning	Author introduction, project description changes, most resource area changes, and other analyses
John Wondolleck Project Director	30 years experience environmental resource management	Guidance, oversight, and review
ENTRIX Preparers		
Larry Wise Fisheries	22 years experience fisheries and aquatic ecology	Author, project coordination
Jean Baldrige Water Resources Director	25 years water resource studies	Senior reviewer, fisheries

Name/Professional Discipline	Expertise and Experience	Role in Preparation
Michael Aceituno Fisheries	32 years experience in public and private sectors focusing on aquatic ecology and fisheries	Senior reviewer, fisheries
Wayne Lifton	25+ years water resource studies	Entrainment analysis, senior reviewer, fisheries