Draft Revised Environmental Impact Report

Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement (Monterey Plus)

Document B, Volume II (unchanged)
(October 2007 Monterey Plus Draft EIR, Appendices)

SCH#: 2003011118

State of California
California Natural Resources Agency
Department of Water Resources

April 2016

Prepared by:
AECOM

Draft Environmental Impact Report

Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement (Monterey Plus)

Volume II - Appendices

SCH#: 2003011118

State of California
The Resources Agency
Department of Water Resources
October 2007

Prepared by:
PBSJ

STATE OF CALIFORNIA
Arnold Schwarzenegger, Governor

THE RESOURCES AGENCY
Mike Chrisman, Secretary for Resources

DEPARTMENT OF WATER RESOURCES
Lester A. Snow, Director

Gerald E. Johns
Deputy Director

Leslie F. Harder, Jr.
Deputy Director

Raphael A. Torres
Deputy Director

Timothy Haines
Deputy Director

Mark Cowin
Deputy Director

Casey Schimke
Assistant Director
Legislative Affairs

David Sandino
Chief Counsel

Susan Sims-Teixeira
Assistant Director
Public Affairs

MONTEREY PLUS EIR MANAGER
Delores Brown, Chief
Environmental Compliance Office

DIVISION OF ENVIRONMENTAL SERVICES
Barbara McDonnell, Chief

STATE WATER PROJECT ANALYSIS OFFICE
Robert B. Cooke, Chief

EIR COMMITTEE

Ernest Conant, Young Wooldridge, LLP
Adam Kear, The Metropolitan Water District of Southern California
Brian Morris, Plumas County Flood Control and Water Conservation District
Antonio Rossmann, Rossmann and Moore, LLP
Cliff Schulz, Kronick Moskovitz Tiedemann & Girard
Arve Sjovold, Citizens Planning Association of Santa Barbara
Sage Sweetwood, Planning and Conservation League

Monterey Plus EIR Staff

Peggy Bernardy, Staff Counsel IV
Monica Cross, Scientific Aids
Chi Doan, Chief, Project Power Contracts Branch
Dan Flory, Principal Engineer, W.R.
Andrea Glasgow, Senior Engineer
Mike Hendrick, Senior Environmental Scientist
Qinqin Liu, Environmental Scientist
Jagruti Maroney, Engineer, W.R.
Alan Olson, Engineer, W.R.
Nancy Quan, Bay Delta Hearings and Program Development
Linda Quok, Chief, Power Transmission Branch
Jerry Ripperda, Senior Environmental Scientist
Erik Reyes, Senior Engineer
Bhupinder Sandhu, Senior Engineer
Katherine Spanos, Staff Counsel III
Curtis Spencer, Principal Engineer, W.R.
Hanspeter Walter, Environmental Scientist
Marcus Yee, Environmental Scientist

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Prepared for:

State of California
The Resources Agency
Department of Water Resources

Prepared by:

PBS&J
Sacramento, CA

October 2007

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A. NOTICE OF PREPARATION

NOTICE OF PREPARATION

NOTICE OF PREPARATION OF ENVIRONMENTAL IMPACT REPORT FOR THE MONTEREY AMENDMENT TO THE STATE WATER PROJECT CONTRACTS (INCLUDING KERN WATER BANK TRANSFER) AND OTHER CONTRACT AMENDMENTS AND ASSOCIATED ACTIONS AS PART OF A PROPOSED SETTLEMENT AGREEMENT IN PLANNING AND CONSERVATION LEAGUE V. DEPARTMENT OF WATER RESOURCES

INTRODUCTION

To satisfy California Environmental Quality Act (CEQA) requirements (California Public Resources Code Section 21000 et seq), the California Department of Water Resources (DWR) will prepare an Environmental Impact Report (EIR) for the Monterey Amendment to the State Water Project (SWP) contracts (including Kern Water Bank transfer) and other contract amendments and associated actions as part of a proposed settlement agreement in Planning and Conservation League v. Department of Water Resources (83 Cal. App. 4th 892 (2000) (PCL v. DWR) (proposed project or Monterey Plus). During the preparation of the EIR, DWR will solicit comments from interested stakeholders through a series of scoping meetings.

Several terms with precise definitions are used in this Notice of Preparation. The Monterey Agreement is a set of principles agreed to by DWR and the SWP contractors. The Monterey Amendment is the amendment made to the contracts for state water as a result of the Monterey principles. The settlement agreement is the agreement proposed between the DWR, PCL, Citizens Planning Association of Santa Barbara, and Plumas County Flood Control and Water Conservation District (Plumas) that if executed would result in settlement of the litigation in connection with the 1995 Monterey Agreement EIR.

The EIR will evaluate the potential environmental impacts of changes to SWP operations that are a consequence of the Monterey Amendment. The EIR will also evaluate the additional actions set forth in an agreement to settle litigation regarding the 1995 Monterey Amendment EIR. See the project description below for more details.

In general, the EIR will serve as a Project EIR (CEQA Guidelines Section 15161). That is, the EIR will address the SWP contract amendments and the settlement agreement actions at a project-level of detail where no subsequent actions are expected and/or where sufficient information on subsequent actions are known or can be generated.

In some cases, subsequent actions that stem from the contract amendments or settlement actions may require additional environmental review prior to implementation. In these cases, the EIR will serve as a program EIR (CEQA Guidelines Section 15168) and will provide information and analysis that could provide a foundation for subsequent, site-specific environmental review.

BACKGROUND INFORMATION

In 1994, DWR and certain representatives of the SWP contractors agreed to a set of principles, known as the Monterey Agreement, to settle long-term water allocation disputes, and to establish a new water management strategy for the SWP. The disputes focused on the phrasing of Article 18 of the SWP contracts. Article 18 addresses the allocation of shortages in water supply, and particularly under what circumstances the initial reductions to agricultural use should be imposed prior to reducing allocations to urban contractors. Article 18(a) deals with temporary shortages that occur due to droughts and other temporary causes. Article 18(b) deals with the possibility of specified types of permanent shortages of supply of project water. The Monterey Agreement Statement of Principles, executed on December 1, 1994, resolved the allocation controversy by proposing contract revisions to eliminate initial agricultural use cutbacks and specifying that all project water was to be allocated in proportion to contract amounts (as shown in Table A).[1] The principles provided that the individual SWP contracts would be amended to conform to the principles and CEQA compliance would begin to evaluate the potential impacts of implementing the Monterey Agreement.

Pursuant to CEQA, in May 1995, a Draft EIR was prepared by the Central Coast Water Authority (CCWA) acting as Lead Agency. The Final EIR for the Monterey Agreement was completed in October 1995. CCWA certified the Final EIR in November 1995 and issued findings and mitigation measures. Subsequently, DWR relied on the EIR as a responsible agency and drafted a contract amendment. Twenty seven of the 29 SWP contractors (all except Plumas County and Empire West Side Irrigation District) executed the Monterey Amendment. DWR has been operating the SWP consistent with the provision of the Monterey Amendment since 1996. Certain actions provided for under the Monterey Amendment have undergone separate project-level environmental review where necessary (including several permanent water transfers and development of the Kern Water Bank).

On December 27, 1995, PCL filed a lawsuit against DWR and CCWA challenging the adequacy of the 1995 Monterey Agreement EIR. The Citizens Planning Association of Santa Barbara and Plumas County Flood Control and Water Conservation District joined the lawsuit.

Ultimately, on September 15, 2000, the Third District Court of Appeal ruled that DWR had the statutory duty to serve as Lead Agency in assessing environmental consequences of the Monterey Agreement. The appellate court further held that the 1995 Monterey Agreement EIR failed to adequately analyze the impacts of deleting Article 18(b) (the provision for reallocation of water among contractors in the event of a defined permanent water shortage) and directed that a new EIR be prepared. The court held the lack of an environmental analysis of eliminating Article 18(b) deprived public agencies and the public of information essential to understanding the environmental consequences of the provision's elimination, including the potential effect on land use planning decisions.

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1 Table A is contained in all SWP documents. It lists the amounts of SWP water made available each year. Under certain conditions, the contractor may receive a lesser amount.

PROJECT DESCRIPTION

The basic objective of the proposed project is to improve to the management of SWP supplies and operations through the Monterey Amendment and other contract amendments and associated actions as a part of a proposed settlement agreement in PCL v. DWR. This EIR will evaluate: (1) in accordance with the court decision, the potential environmental effects of implementing the Monterey Amendment to the SWP water contracts with respect to allocation of SWP supplies among contractors, certain use of SWP facilities, and other SWP operational matters to include financial matters as they may impact physical changes to the environment (Section 15131 of the CEQA guidelines); and (2) the potential environmental effects of additional actions which may be implemented through the proposed settlement agreement referenced earlier.

The EIR will evaluate potential environmental impacts of changes to SWP operations incorporated in the Monterey Amendment and the proposed settlement agreement which include the following elements as summarized below:

Allocation of SWP Water Supplies

- New method for allocation of all water supplies in proportion to each contractor's contract amount (Table A amounts).
- Elimination of the initial supply reduction to agricultural contractors in years of shortage
- Replacement of certain categories of water with a single category of Interruptible Water allocated on the basis of Table A amounts and delivered at the same power rate as Table A amounts
- Elimination of the permanent shortage provision

Transfer of Table A Amounts and Land

- Transfer to the DWR for permanent retirement 45,000 acre-feet of agricultural Table A amounts
- Make 130,000 acre-feet of agricultural Table A amounts available for permanent sale to urban contractors
- Transfer of the Kern Fan Element property to local control

Water Management Provisions

- Enable voluntary water marketing, groundwater banking, and more effective use of existing SWP facilities
- Explicitly provide for groundwater or surface storage of SWP water outside contractor's service area for later use within its service area
- Expand contractor rights to store water in San Luis Reservoir when storage space is available
- Specify contractor rights to flexible storage in terminal reservoir facilities
- Clarify terms for transport of non-SWP water for contractors
- Create a Turnback Pool for the annual sale to interested contractors of SWP supplies allocated to other contractors but unneeded by them

Financial Restructuring

- Use SWP funds to establish an SWP operating reserve
- Establish a program of water rate management which, when SWP cash flow permits, provides for a credit in charges to urban contractors, as well as agricultural contractor trust funds for rate management

Proposed Settlement Agreement

- Establish a watershed forum for Plumas to pursue watershed restoration and provide for amending Plumas' SWP contract regarding shortages
- Impose additional restrictions on use of the Kern Water Bank lands
- Amend and clarify SWP contracts to substitute in certain instances "Table A Amount" for "entitlement"
- Implement new procedures for disclosure of SWP delivery capabilities
- Issue guidelines on permanent Table A transfers
- Establish procedures for public participation in certain contract amendment negotiations
- Provide certain funding to the plaintiffs for multiple purposes, including watershed restoration

PROJECT AREA AND FACILITIES

The location of the proposed project includes the SWP facilities and service areas. The proposed project area is the SWP service area (including the Kern Water Bank lands) and the SWP contractors' service areas (see Figure 1). In addition, depending on SWP contractor actions under the proposed project, the area of influence could extend beyond the service areas.

The SWP is the largest state-built water project in the United States. Major catchments and facilities include dams, reservoirs, pumping plants, power plants, and canals and tunnels including the facilities listed below (see Figure 1):

- Lake Oroville and three other reservoirs in the Feather River watershed;
- Silverwood Lake
- San Luis Reservoir;
- Terminal Reservoirs (Lake Del Valle in the north and Castaic Lake and Lake Perris in the south);
- Harvey O. Banks Delta Pumping Plant;
- California Aqueduct;
- North Bay Aqueduct;
- Coastal Branch; and
- South Bay Aqueduct.

ENVIRONMENTAL BASELINE

CEQA Guidelines Section 15125 states that an EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the Notice of Preparation is published, or if no Notice of Preparation is published, at the time environmental analysis is commenced, from both a local and regional perspective. This environmental setting will normally constitute the baseline physical conditions by which a Lead Agency determines whether an impact is significant. Normally, the environmental baseline is the same as existing conditions. However, since completion of the 1995 Monterey Agreement EIR, DWR has operated under the terms of the Monterey Amendment provisions, and certain subsequent actions provided for under the Monterey Amendment have already been implemented. Therefore, in order to ensure that the whole of the action (proposed project) is adequately evaluated, it may be necessary to refine the existing conditions. Further analysis will determine what the appropriate environmental baseline will be for the project.

ALTERNATIVES

CEQA Guidelines Section 15126.6 states that an EIR shall describe a range of reasonable alternatives to the project, which would feasibly attain most of the basic objective of the project but would avoid or substantially lessen any of the significant adverse environmental effects of the project, and evaluate the comparative merits of the alternatives. An EIR is not required to consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation.

DWR has not identified the reasonable range of alternatives to implementation of the proposed project. Feasible alternatives that meet most of the basic project objectives and avoid or substantially lessen any of the significant effects of the project will be explored according to CEQA requirements in response to Notice of Preparation comments, scoping meetings and through subsequent environmental analysis.

However, DWR has identified a No Project Alternative, required under CEQA Guidelines Section 15126.6(e), with the following scenarios that will be evaluated in the EIR:

- No implementation of the Monterey Amendment with a permanent water shortage and implementation of Article 18(b); and
- No implementation of the Monterey Amendment without a permanent water shortage and no implementation of Article 18(b).

PROBABLE ENVIRONMENTAL EFFECTS

The EIR will analyze resources that could be affected by the project, including but not limited to aesthetics, agricultural resources, air quality, biological resources, cultural resources, cumulative impacts, geology and soils, growth-inducement, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, noise, population and housing, public services, recreation, transportation and traffic, utilities and service systems.

Subsequent comments on the Notice of Preparation, comments from the scoping meetings and subsequent analyses will identify additional environmental impacts, if any.

SCOPING MEETINGS

Scoping meetings will be held in February in the following locations:

February 3, 2003
10:00 AM – Noon
Resources Building Auditorium
First Floor, 1416 Ninth Street
Sacramento, CA

February 4, 2003
7:00 PM – 9:00 PM
Supervisors' Board Room
4080 Lemon Street
14th Floor
Riverside, CA

February 5, 2003
7:00 PM – 9:00 PM
Board of Supervisors Hearing Room
Hall of Administration
800 South Victoria Avenue
Ventura, CA

February 6, 2003
7:00 PM – 9:00 PM
Supervisors' Board Room
1115 Truxtun Avenue
5th floor
Bakersfield, CA

February 13, 2003
2:30 PM – 5:00 PM
Supervisors Board Room
Third floor Court House
520 Main Street
Quincy, California

Please note that the formal presentation and public comment will begin approximately 30 minutes from the start of each meeting. Anyone interested in more information concerning the EIR process, or anyone who has information concerning the study or suggestions as to significant issues, should contact Delores Brown as provided below.

WRITTEN COMMENTS

Within 30 days after receiving the Notice of Preparation, each Responsible Agency shall provide the Lead Agency with specific detail about the scope, significant environmental issues, reasonable alternatives, and mitigation measures related to the Responsible Agency's area of statutory responsibility that will need to be explored in the Draft EIR. In accordance with CEQA Guidelines Section 15082(b)(1)(B), responsible and trustee agencies should indicate their respective level of responsibility for the project in their response.

Comments from individual respondents, including names and home addresses of respondents, will be made available for public review. Individual respondents may request that their home address be withheld from public disclosure, which we will honor to the extent allowable by law. There also may be circumstances in which we would withhold a respondent's identity from public disclosure, as allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment. We will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public disclosure in their entirety.

Written comments on the scope of the EIR should be sent to Ms. Delores Brown, Chief, Mitigation and Restoration Branch, Department of Water Resources, 3251 S Street, Sacramento, CA 95816 or by e-mail at delores@water.ca.gov. Additional information on the Monterey Amendment EIR process can be found on the DWR web page http://www.water.ca.gov/.

Original Signed by Barbara McDonnell on January 24, 2003

_____

Barbara McDonnell
Chief, Division of Environmental Services
Department of Water Resources

Date _____

EIP ASSOCIATES

Source:
State of California Department of Water Resources "Management of the CA State Water Project" and the CDWR website

Project Number: 10682

Figure 1
State Water Project and Water Supply Contractors' Service Areas

B. COMMENTS RECEIVED IN RESPONSES TO NOTICE OF PREPARATION AND AT SCOPING MEETINGS

State of California

Memorandum

To: Ms. Delores Brown
Department of Water Resources
3251 S Street
Sacramento, CA 95816

Date: February 24, 2003

Place: Sacramento

Phone: (916) 654-0321

From: **Department of Food and Agriculture** Steve Shaffer, Director
Office of Agricultural and Environmental Stewardship

Subject: Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) on the Monterey Amendment to the State Water Project (SWP) – **SCH #2003011118**

The California Department of Food and Agriculture (CDFA) has reviewed the NOP for the proposed Monterey Amendments to the SWP. CDFA's mission is to protect and promote California agriculture and the natural resources upon which agriculture depends. Towards this end, we offer the following suggestions for the DEIR.

The Monterey Amendment to the SWP contracts reflects the principles agreed to by the Department of Water Resources (DWR) and SWP contractors in 1994. In 1995, the DEIR that was prepared for the Amendment was litigated, leading to the preparation of the DEIR at hand.

The subject DEIR will address the environmental effects of adopting the Monterey and other SWP contract amendments. Among other things, the Amendment would: (1) result in a new method for the allocation of SWP water supplies (i.e., allocation in proportion to each contractor's Table A contract amounts); (2) eliminate Article 18(b) that makes special provision for allocation reductions in the event of permanent shortages; (3) cause the permanent retirement and transfer of 45,000 acre-feet, and make available for permanent sale to urban contracts of 130,000 acre-feet, of agricultural Table A contract water; (4) enable voluntary water marketing and groundwater banking; and, (5) issue guidelines on permanent transfers of Table A water.

Overall, the Monterey Amendment has the potential for significant positive impacts on agricultural water users. With its well-defined rules of allocation, agricultural water users will benefit from a greater degree of water reliability from year to year. At the same time, the Amendment could have long-term adverse impacts on agriculture from water transfers away from agricultural and to urban users, both north and south of the Delta.

<u>Indirect and Growth-Inducing Impacts</u>
The Amendment will give conveyance priority at the Banks Pumping Plant to SWP contractors, including water transferred to SWP contractors from non-SWP sources. An example is the transfer of water from Northern California agricultural water districts by the Metropolitan Water District of Southern California to help offset the loss of Colorado River water. The same pumping priority rules could result in non-SWP urban water users resorting to water transfers from agricultural lands south of the Delta if Northern California water is unavailable due to lack of pumping capacity at the Banks Pumping Plant. Therefore, one indirect impact of the project could be the temporary or permanent loss of agricultural production capacity due to the greater opportunity (in one case), and necessity (in another), for water transfer away from agricultural water users, both north and south of the Delta. We recommend that this potential impact be addressed in the DEIR as both an indirect and growth-inducing environmental impact.

Cumulative Impacts

Currently there are no statewide policies or guidance on the temporary or permanent transfer of agricultural water to non-agricultural uses. The Monterey Amendment will enable greater flexibility for water transfers among agricultural water uses as well as from agricultural users to municipal and industrial users. The proposed settlement would require the issuance of guidelines on permanent transfers. However, transfers facilitated by the Monterey Agreement will be only one arena within which transfers are, or will be occurring. For example, the CALFED Bay-Delta Program's Environmental Water Account has as one of its purposes assisting in the transfer of water to help match water needs and supplies. The cumulative impact of water transfers being conducted throughout California's water landscape needs to be addressed to understand the full impact of this project on agricultural water and land resources. We recommend that the DEIR assess past permanent, current and foreseeable water transfers involving agricultural water users. The analysis should assess how, in aggregate, the transfers could affect production capacity and flexibility (range of crops that can be grown in response to market demands) of California agriculture. Also, among the cumulative impacts on agricultural land and water that are analyzed should be the potential concurrent loss of related habitat. For example, the idling of rice land in Northern California will not only result in the loss of production capacity, and the potential loss of jobs and local economic stimuli, but also of wildlife habitat, such as for migratory waterfowl and the Giant Garter Snake.

Alternatives

As noted, among of Monterey Amendment's agreements is the elimination of the permanent shortage provision (Article 18(b)). We understand that this provision may be reintroduced in some form or another as a project alternative or mitigation measure. If this occurs, we recommend that the impacts on agricultural land and water resources be thoroughly analyzed from the potential implementation of a phase down, over time, of agricultural water deliveries under likely shortage scenarios.

Mitigation Measures

The proposed settlement agreement calls for guidelines on permanent Table A Transfers. These guidelines may serve as an opportunity to partially mitigate some of the impacts mentioned above. For example, the guidelines could require that proposed transfers be contingent on the conduct of a cumulative environmental and economic impact analysis. The guidelines could also set forth transfer priorities based on the significance of affected agricultural lands, perhaps as indicated by USDA land capability classifications, the Department of Conservation's Important Farmland Series map designations and other factors. We recommend that these and other mitigation measures be considered in the DEIR.

Thank you for the opportunity to review and comment on the NOP. If you have questions on our comments, please feel free to contact me at (916) 657-4956. Also, please feel free to contact me during the preparation of the DEIR for assistance in responding to our concerns.

california water network

48 pages
Please call if there is a problem
Carolee Krieger
(805) 969-0824

Carolee K. Krieger
president

Arve R. Sjovold
vice president

Dorothy Green
secretary

Yvon Chouinard
director

Harrison C. (Hap) Dunning
director

Joan H. Wells
director

Ms. Delores Brown
Chief, Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

March 27, 2003

Re: Scoping comments for the new court mandated "Monterey Plus" EIR

Dear Ms. Brown:

We would like to take this opportunity to submit scoping comments on the new court mandated "Monterey Plus" EIR. We understand that the PCL v DWR Monterey case has reached a settlement and are aware of the terms of that settlement. It is very critical to us that DWR use accurate baseline information based on the "whole of the action" and that the results are clearly understood by and readily available to the public.

Environmental Baseline

As required by the settlement, the EIR must study both the pre-Monterey and present conditions. It is essential that a full analysis of Articles 18(a) and 18(b) be done. Article 21 dealing with surplus water needs to be considered in relation to the Article 18 analysis. As the settlement further provides, a full range of hydrologic conditions must be analyzed in regard to reliability, including the relevant historical period 1991-2002 and the last extended drought from 1987-1992.

No Project Alternative

CEQA requires that the no project alternative be analyzed. As the settlement points out, this requires DWR in its new EIR to fully study the consequences of enforcing the terms of pre-Monterey water supply contracts prior to eliminating them.

Assessment of SWP Reliability

The settlement requires DWR to publish bi-yearly SWP reliability reports. We are aware of the August 2002 Draft SWP Delivery Reliability Report and comments made about that report. We would like to incorporate the comments of Dennis O'Connor, Robert Wilkinson, Carolee Krieger and Arve Sjovold on this draft reliability report here in our scoping comments and have attached them to this letter so that they will be included in the "Monterey Plus" EIR scoping record. We agree with and share the concerns of the above named commenters.

808 Romero Canyon Road, Santa Barbara, CA 93108, email: caroleekrieger@cox.net, Phone: 805.969.0824, Fax: 805.565.3394

Kern Fan Element

The new EIR must fully address all of the consequences of the proposed transfer of the Kern Fan Element from DWR to the Kern County Water Agency and its subsequent transfer to the Kern Water Bank Authority. Included in these consequences must be the impact on the SWP from the loss of this facility to improve the reliability of the entire project for all of the contractors. There also must be an analysis of the legal consequences of turning over state property to a joint powers agency that is 48% owned by a private corporation.

Water Transfers

Water transfers are recognized as a constructive approach to water shortages but it is clear that no one benefits if the transfers are of the "paper water" type. Reliability and water transfers are intricately linked and must be analyzed as such. The original 1995 Monterey Amendments allowed <u>any</u> willing seller to sell to <u>any</u> willing buyer without DWR oversight. This must be analyzed for its legal implications in regards to the Burns Porter Act and financial implications to the rate payers as well as the full environmental and social consequences on transferring parties and all affected third parties.

Growth-Inducing Impacts

It is very important that the potential growth-inducing impacts of the new Monterey Plus amendments be analyzed. The court was very clear in recognizing that land-use decisions are dependent on water availability. Land-use planners and the public need to know the growth-inducing impacts of transfers by the contractors and the impacts of sales from the Kern Water Bank.

We would like to incorporate in our comments, the comments submitted by Roger Moore and Antonio Rossmann as well as those submitted by Robert Wilkinson.

Sincerely,

Joan Wells

Joan Wells

Attachments: Comments on SWP Delivery Reliability Report, 2002 Draft by:
Dennis O'Connor
Robert Wilkinson
Carolee Krieger
Arve Sjovold

Sent by email to delores@water.ca.gov and by U.S. Mail

February 24, 2003

Delores Brown, Chief
Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

Subject: Scoping Comments on the Monterey Amendment to the State Water Project Contracts et al Notice of Preparation of Environmental Impact Report (NOP)

Dear Ms. Brown:

Contra Costa Water District (CCWD or the District) has reviewed the Notice of Preparation for the Department of Water Resources' (DWR) Environmental Impact Report for the "Monterey Amendment to the State Water Project contracts (including Kern Water Bank Transfer) and Other contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources" (Project), released on January 24, 2003. CCWD is hereby providing its scoping comments on the Project.

CCWD is a publicly owned water supply agency serving approximately 450,000 people in central and eastern Contra Costa County and has a vital interest in protecting the quality and reliability of its water supply. A description of CCWD's existing water system and new facilities is attached (Attachment A). CCWD currently diverts its drinking water supply from intakes at Rock Slough, Old River south of Highway 4, and Mallard Slough. CCWD's drinking water supplies are vulnerable to degradation in San Joaquin River water quality. CCWD is concerned about elevated contaminant concentrations such as salt, total organic carbon (TOC), and pathogens at its Delta drinking water intakes. CCWD's service area is within or conveniently served from the legal Delta, and is therefore interested in the Delta Protection Act in particular and other statutes generally known as "Area of Origin" statutes.

CCWD has three specific scoping comments it anticipates seeing discussed in the Environmental Impact Report for the Project (EIR).

Water Quality and Water Supply Impacts

The EIR should include analysis of water quality and water supply impacts on CCWD's three Delta intakes. CCWD recommends using a water quality significance criteria of 5 mg/L or 5% chlorides increase, whichever is greater, as an indicator of whether a change might be an impact (changes greater than those levels found in the analyses should be examined further).

Fairfield, Benicia and Vacaville Water Rights Settlement

The EIR analysis of water quality and water supply impacts should include the implementation of settlement agreements relating to "Area of Origin" claims, such as the recent Fairfield, Benicia and Vacaville Water Rights Settlement.

Delta Protection Act and Area of Origin Statutes

The EIR should disclose how the Project will address the rights afforded other entities under the Delta Protection Act and "Area of Origin" statutes. This interpretation should not result in redirected impacts to other parties.

CCWD looks forward to reviewing the EIR prepared for this Project. If you have any questions regarding these comments, please contact Lisa Holm at (925) 688-8106, lholm@ccwater.com or myself at (925) 688-8187.

Sincerely,

Richard A. Denton
Water Resources Manager

LMH

Attachments

A. CCWD operations and facilities

SWP Contracts File

Attachment A
CCWD Operations and Facilities

The Contra Costa Water District ("CCWD") serves approximately 450,000 people throughout north, central and east Contra Costa County. Its clients also include 10 major industries, 36 smaller industries and businesses, and 50 agricultural users. CCWD operates raw water distribution facilities, water treatment plants, and treated water distribution facilities. CCWD supplies raw and treated water to Antioch, Concord, Diablo Water District (serving Oakley), Pittsburg, Southern California Water Company (serving Bay Point), Martinez, and parts of Pleasant Hill and Walnut Creek.

CCWD's treated water service area encompasses all or part of the cities of Concord, Clayton, Clyde, Pleasant Hill, Walnut Creek, Martinez, and Port Costa. Treated water for this service area is provided from the District's Bollman Water Treatment Plant in Concord. The 75 MGD Bollman facility uses chlorination for pre-oxidation, chlorination and intermediate ozonation for disinfection and chloramine for disinfection residuals. CCWD also supplies treated water to the Diablo Water District ("DWD"), which serves customers in Oakley from the Randall-Bold Water Treatment Plant, jointly owned by CCWD and DWD. This treatment plant is a 40 MGD direct/deep-bed filtration plant and utilizes both pre- and post-ozonation to provide a high quality drinking water to the customers in its service area.

CCWD is entirely dependent on the Delta for its water supply. The Contra Costa Canal and the recently completed Los Vaqueros Project make up CCWD's principal water supply and delivery system. CCWD diverts unregulated flows and regulated flows from storage releases from Shasta, Folsom, and Clair Engle reservoirs into the Sacramento River as a contractor of the United States Bureau of Reclamation's ("Reclamation") Central Valley Project ("CVP"). Under Water Service Contract I75r-3401 (amended) with Reclamation, CCWD can divert and re-divert up to 195,000 acre-feet annually ("AFA") of water from Rock Slough and the new Old River intake. Currently, CCWD uses between 125,000 and 140,000 AFA. Under CCWD's Water Rights Permit No. 20749, CCWD can divert up to 95,980 AFA of excess Delta flows to Los Vaqueros Reservoir for storage between November 1 of each year and June 30 of the succeeding year. CCWD can also divert up to 26,780 AFA of water from Mallard Slough under its own water rights (Water Rights License No.3167 and Permit No.19856). The City of Antioch and Gaylord Container, both customers of the District, also have water rights permits to divert water from the Delta.

CCWD has obtained its water supply from the Delta since 1940. Delta water is subject to large variations in salinity and mineral concentrations. CCWD and its customers' water supply from the Delta is also vulnerable to any man-made or natural sources that could degrade Delta water quality. Degradation in water quality is objectionable to many CCWD customers, costly to all residential and industrial users, and a health risk for some individuals. The most recent federal drinking water regulations promulgated in December 1998 impose stringent limits on

disinfection by-products in treated water. To ensure that the standards for the principle disinfection by-products that are currently regulated (maximum concentration limits for bromate, total trihalomethanes, and haloacetic acids) are met, low bromide and organic carbon levels in the source water are critical. Bromide level is directly proportional to the chloride concentration in Delta water.

Contra Costa Water District is committed to supplying its customers with the highest quality water practicable and providing all reasonable protection of the supply from any known or potential source of hazardous contamination. CCWD Resolution No. 88-45 states in part that:

> "CCWD is committed to reducing the concentration of sodium and chloride in the District's water, thereby reducing household and landscape irrigation concerns and industrial and manufacturing costs caused by the fluctuating sodium and chloride level of CCWD's Delta source...."

In May 1987, CCWD's Board of Directors adopted water quality objectives for water distributed within its service area. The acceptable concentration levels for sodium and chloride were established at 50 milligrams per liter (mg/l) and 65 mg/l, respectively. In 1988, the voter-constituents of CCWD approved the issuance of bonds to finance a $450 million water quality and reliability project known as the Los Vaqueros Project. The primary purposes of the Los Vaqueros Project are to improve the quality of water supplied to CCWD customers and minimize seasonal quality changes, and to improve the reliability of the emergency water supply available to CCWD. The Los Vaqueros Project consists of a reservoir with 100,000 acre-feet of storage, a new point of diversion (at Old River south of the State Highway 4 crossing) which operates in conjunction with the current Rock Slough diversion point, water conveyance and delivery facilities, pumping plants, and other facilities.

On June 2, 1994, the State Water Resources Control Board issued Decision 1629, which gives CCWD additional rights to divert and store water for beneficial uses. The State Board subsequently issued Water Rights Permits No. 20749 and 20750 for filling Los Vaqueros Reservoir from the new intake at Old River near Highway 4 and diversion and storage of the water of Kellogg Creek. These rights are in addition to the contractual rights to divert and store water furnished through the CVP. Construction of the reservoir began in September 1994 and was completed in January 1998. Diversion from the Old River intake for delivery to CCWD's service area began in the summer of 1997. Under Water Rights Permit No. 20749, CCWD can divert up to 95,980 AFA of excess Delta flows to Los Vaqueros Reservoir for storage between November 1 of each year and June 30 of the succeeding year. On January 28, 1999, the Los Vaqueros Reservoir was filled to 100,000 acre-feet for the first time. In February 1999, CCWD released water from the reservoir for use in the District's service area for the first time. Releases from the reservoir are also scheduled to provide net benefits to the Delta ecosystem by allowing CCWD to cease all diversions during fish-sensitive periods.

The key to successful performance of the Los Vaqueros Project is the District's ability to fill and continue to refill the reservoir from Old River with high quality water, and to use that water for blending when salinity at the District's Delta intakes exceed the 65 mg/L chloride goal. Any increase in Delta salinity caused by new Bay-Delta projects will increase the demand on blending water from the reservoir while at the same time reducing the availability of high quality water for refilling. The District and its 450,000 customers will be impacted through higher pumping costs to replace the extra blending water that is released, through additional treatment costs, and through increased corrosion and health effects of delivering higher salinity water.

March 28, 2003

Ms. Delores Brown, Chief
Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

Re: Notice of Preparation of EIR for the Monterey Amendment to the SWP Contracts

Dear Ms. Brown:

The East Bay Municipal Utility District (EBMUD or District appreciates the opportunity to comment on the proposed Draft Environmental Impact Report (DEIR) for the proposed Amendments to the State Water Project contracts to implement the Settlement Agreement reached in the *Planning and Conservation League v Department of Water Resources* litigation). EBMUD is a large west coast retail water supplier, serving over 1.3 million customers in portions of Alameda and Contra Costa Counties. The District's primary source of water is from the Mokelumne River, and the District also has a contract with the U.S. Bureau of Reclamation for a supplemental supply of water from the Central Valley Project (CVP).

As a CVP contractor, EBMUD continues to have a keen interest in the inter-relationship between the CVP and the State Water Project. The District has also participated in several CALFED Bay-Delta stakeholder processes, and continues to closely monitor programs, projects and emerging rules that affect Bay-Delta operations. With this perspective, EBMUD offers the following comments.

The relationship between CALFED's 8500 cfs / South Delta Improvement Program DEIR and the Monterey Agreement DEIR should be clearly described in the pending EIRs. It is the District's understanding that the 8500 cfs project will result in firmer SWP deliveries, which appears relevant to the underlying Planning and Conservation League (PCL) lawsuit. Revised operating rules are also part of the 8500 cfs efforts, which again seems relevant to the "firmness" of deliveries. EBMUD's interest in the 8500 cfs project relates to the impacts such a project could have on Mokelumne River fisheries and the need for adequate mitigation for any impacts.

The DEIR must also clarify the terms and conditions that would be imposed for transporting non-SWP supplies through the Delta, and the potential fishery impacts and proposed mitigation measures to minimize or eliminate any impacts. This year, the Metropolitan Water District of Southern California may move up to 200,000 AF of non-SWP water through the Delta. The pending DEIR should clearly state that any such transfers require separate environmental documentation and are not covered by the Monterey Agreement DEIR.

Under CEQA, the DEIR must address a project as a whole. With respect to the Kern Water Bank, the DEIR needs to address the permit changes required for banking of DWR's surface water in groundwater basins, in accordance with the Water Transfer Workgroup's final report to the State Water Resources Control Board:

> …. the SWRCB's practice has not been entirely consistent with respect to whether a change order is required for banking of water within the service area of large water wholesalers such as the State Water Project, Metropolitan Water District, or the Central Valley Project. Since their permits allow a wide variety of beneficial uses throughout their service territory, SWRCB practice has been to not require a change order. Still, <u>unless groundwater banking is expressly authorized in the permit, it would be prudent to obtain a change order in order to assure that the project will be eligible for a permanent license</u>. (p. 34, *Water Transfer Issues in California*, June 2002, emphasis added)

The SWRCB's permitting process is one of the ways legal users of water, such as the USBR, can access the impacts on the fishery resource and water supply availability and timing changes to their CVP contractors.

Specific to that last point, the DEIR must identify how operation of the Kern Water Bank would affect deliveries to Central Valley Project contractors. Storage of water in the Bank in wetter years may make less water available to SWP and CVP contractors in later years.

If you have any questions, please call Mr. Alan Thompson of my staff at 510/287-1185.

Very truly yours,

Gary W. Darling, Manager
Water Supply Improvements Division

GWD:ALT:alt
W:\wsid\WORK\ALT\MADEIRComments2.doc

Bc: Records Management
JBL Chono
Randy Kanouse
Lena Tam
Robert Helwick
WSID File U-CVP-05

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March 27, 2003

Ms. Delores Brown, Chief
Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

Subject: Scoping Comments for EIR for Monterey Amendment to the State Water Project Contracts (including Kern Water Bank Transfer) and Other Contract Amendments and Associated Actions, as Part of a Proposed Settlement[1]

Dear Ms. Brown:

Environmental Defense appreciates the opportunity to provide comments on the Monterey Plus EIR. While the proposed contract amendments would provide significant benefit to urban and agricultural contractors through improved supply allocation and financing provisions of the State Water Project (SWP), there is no apparent benefit to the environment. Environmental Defense is extremely concerned about the existing tentative state of environmental assurances in place to protect and restore fishery populations in the San Francisco Bay-Delta and Central Valley Watershed and believes that the SWP has a responsibility to provide and guarantee such assurances. Therefore, Environmental Defense asks that the Monterey Plus EIR include one or more alternatives that would incorporate fishery protection measures, beyond those required in the 1995 Water Quality Control Plan.

Environmental Defense has been interested in the Monterey Agreement process from the beginning, but was precluded from participation in the discussions that led to the agreement. We did express, however, our views on SWP financing and the Monterey agreement twice before State legislative committees at the time of the agreement. In August 1994, John Krautkraemer presented *Options for Financing California's Water Projects*[2], and in 1995, David Yardas presented *The Monterey Agreement Principles: Issues, Concerns, and Opportunities*[3](both are attached).

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[1] The Shorthand "Monterey Plus" will hereinafter be used in lieu of the lengthy title.
[2] Testimony of Environmental Defense Fund on the "Options for Financing California's Water Project", John Krautkraemer, Senate Committee on Agriculture and Water Resources, August 1, 1994.
[3] Testimony of Environmental Defense Fund on "The Monterey Agreement Principals: Issues, Concerns, and Opportunities", David Yardas, Joint Hearing of Senate Committee on Agriculture and Water Resources and Assembly Committee on Water Parks and Wildlife, November 17, 1995.

The views we expressed in 1994-1995 have not changed. Environmental Defense still believes that a significant portion of the Monterey Agreement's financial benefits should be dedicated to the environment that has been greatly impacted by SWP development and operations. These funds could be used to buy water for fishery protection and restoration, either by augmenting streamflow in harmony with fishery needs or by reducing Delta exports, when entrainment reaches high levels. We also believe that it would be appropriate to dedicate some of the projects entitlement to the environment, which could also be used directly to increase streamflow or to reduce exports.

These two key mechanisms are, of course, presently used by CALFED's Environmental Water Account (EWA) to accommodate operational flexibility to protect fisheries. The key difference, of course, is that the EWA's current funding is an awkward combination of bond funding and legislative appropriations and its long-term funding is entirely uncertain. If this operational flexibility were instead built into the operations of the SWP, two problems would be solved. First, the certainty of long-term funding would no longer be an issue. And secondly, the contractors who benefit from the SWP would directly pay for their share of mitigation, rather than shifting that burden onto the taxpayer.

Environmental Defense firmly believes it is imperative to increase the operational flexibility of major water projects to protect and restore fisheries and ecosystem health in the San Francisco Bay-Delta estuary and Central Valley watershed. We are not convinced, however, that the EWA, as it exists today, is an appropriate long-term solution in this ongoing effort. In particular, the looming South Delta Improvements Program is expected to place an even greater burden on EWA assets. Instead, we believe that similar fisheries and ecosystem objectives can be met more appropriately through operational flexibility and user fees provided by the contractors who directly benefit from the SWP. To this end, we ask that the Monterey Plus EIR include alternatives that significantly increase project flexibility to accommodate environmental objectives.

Thank you for considering these views.

Sincerely,

Spreck Rosekrans
Senior Analyst

Friends of the Santa Clara River
660 Randy Drive Newbury Park, California 91320 (805) 498 - 4323

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3-28-03

Ms. Dolores Brown
Chief, Mitigation and Restoration Branch
Dept. of Water Resources
3251 S Street
Sacramento, Ca. 95816

Re: Notice of Preparation for Monterey Agreement EIR

Dear Ms. Brown:

FSCR have been very concerned about the over-statement of state water supplies because of the impact of this mis-information on local surface flows. When SWP water is over-stated, there is no place to go during a drought except to the local ground water. In the case of the Santa Clara River, surface flows are already disappearing because the river is being severely over-drafted. This is causing a loss of habitat and degradation of the water quality (increased TDS, chloride and nitrate levels, see recent report from the Regional Water Quality Board. We are currently litigating the Santa Clarita Regional Urban Water Management Plan because it over-states SWP supplies.

Evaluating SWP supply should include thorough analysis of article 18(a), 18(b) and surplus water (article 21). We hope that this process will help put a stop to the mis-information disseminated locally in environmental documents on this issue.

We request that you also address the issue of the growth-inducing impacts and the conversely linked issue of loss of farm land seemingly promoted by water transfers as we are experiencing here with the huge 21,000 unit Newhall Ranch proposal.

Please also address the issue of potential water privatization and ensuing control, hoarding and manipulation of public water resources that may result from the Kern Fan water bank being 48% privately held. We are already seeing this occur in the Newhall Ranch Project where a private developer has purchased Kern River water and stored it in its private holding in the Semi-Tropic Storage Facility to serve *ONLY ITS OWN PROPOSED DEVELOPMENT*. This project also proposes SWP entitlement transfers directly from farmers. How will you provide oversight for this developing problem?

Thank-you for the opportunity to comment on this proposal. We request that we receive all environmental documents and notification.

Sincerely,

Ron Bottorff
Chair
Faxed 3-28-03 - Hard Copy to follow via regular mail

NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

March 28, 2003

Ms. Delores Brown
Chief, Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

RE: Scoping Comments: Notice of Preparation for EIR on Monterey Amendment

Dear Ms. Brown:

On behalf of the Natural Resources Defense Council (NRDC) and our more than 500,000 members, we appreciate the opportunity to provide scoping comments in response to the NOP for the above referenced environmental impact report on the Monterey Amendments and related contract amendments and program features arising from the recent settlement agreement.

You are already receiving extensive scoping comments from the Planning and Conservation League (PCL) and other plaintiffs submitted by the Law Office of Antonio Rossmann, as well as scoping comments by Professor Robert Wilkinson and others. Rather than reiterate these important comments, we simply wish to highlight the following points:

1. It is essential that the EIR fully study both the pre-Monterey conditions and present conditions. For example, the contractual baseline condition must be the pre-Monterey SWP contracts and the EIR must include a complete analysis of the environmental consequences of enforcing the pre-Monterey permanent shortage provision, article 18(b).

2. The EIR must include a careful and complete assessment of the historical record of project deliveries. It must also include an integrated assessment of SWP and CVP exports, and consideration of changes in SWP and CVP operations since the signing of the COA. For example, the Bureau of Reclamation has asked DWR to support 25 year renewal contracts for the Cross Valley Canal Division of the CVP using SWP export pumps and facilities, yet neither the Bureau nor DWR has done an adequate analysis of the environmental consequences of this proposed long term contractual commitment.

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71 Stevenson Street, Suite 1825
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3. The EIR must fully consider all environmental impacts of the transfer of the Kern Water Bank, including the sources of water for the Bank (including from the San Joaquin River) and competing environmental demands for that water. This analysis should also evaluate the comparative effects on San Joaquin River restoration of retaining State control of the Kern Water Bank vs. transferring control to local interests who may not share the State's public trust obligations. Without a full analysis of this critical element, any EIR on Monterey will be seriously flawed.

Thank you for considering our views.

Sincerely,

Hamilton Candee
Senior Attorney

Patrick Porgans & Associates

ENVIRONMENT REGULATORY INTERVENTION — HOLISTIC RESOURCE CONVERGENCE

Tele: (916) 374-8197 Fax: 372--7679 P.O. Box 1713, W. Sacramento, CA 95691

Dolores Brown
Mitigation and Restoration Branch
California Department of Water Resources
3251 S. Street
Sacramento, CA 95816

March 28, 2003

☞ **Hand Delivered** ☜

Re: Porgans & Associates, Inc., Comments to Notice of Preparation of Environmental Impact Report for the Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources (DWR)

Attention: Ms. Dolores Brown

On behalf of its clients', Patrick Porgans & Associates (P&A), Inc., submit the following comments pertinent to the *Notice of Preparation* (NOP) *of the Environmental Impact Report* (EIR) *for the Monterey Amendment to the State Water Project* (SWP) *Contracts (Including Kern Water Bank Transfer) and other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources.*

Background Information

In 1994, DWR and certain representatives of the SWP contractors agreed to a set of principles known as the Monterey Agreement, to settle long-term water allocations disputes, and to establish a new water management strategy for the SWP. The dispute focused on the phrasing of Article 18 of the SWP contracts. Article 18 addresses the allocation of shortages to water supply, and particularly under what circumstances the initial reductions to agricultural use should be imposed prior to reducing allocations to urban contractors. Article 18 (a) deals with temporary shortages that occur due to droughts and other temporary causes. Article 18(b) deals with the possibility of specified types of permanent shortages of supply of project water. The Monterey Agreement Statement of Principles, executed on December 1, 1994, resolved the allocation controversy by proposing contract revisions to eliminate agricultural cutbacks and specifying that all project water was to be allocated in proportion to contract amounts (as shown in Table A). The principles provided that the individual SWP contracts would be amended to conform to the principles and CEQA compliance would begin to evaluate the potential impacts of implementing the Monterey Agreement.

Ultimately, on September 15, 2000, the Third District Court of Appeal ruled that DWR had the statutory duty to serve as Lead Agency in assessing environmental consequences of the Monterey Agreement. The appellate court further held that the 1995 Monterey Agreement EIR failed to adequately analyze the impacts of deleting Article 18 (b) (the provisions for reallocation of water among contractors in the event of a define permanent shortage) and directed that a new EIR be prepared. The court held the lack of an environmental analysis of eliminating Article 18(b) deprived public agencies and the public of information essential to understanding the environmental consequences of the provision's elimination, including the potential effect on land use planning decisions.[1]

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[1]DWR, *Notice of Preparation of Environmental Impact Report for the Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources,* Feb. 27, 2003, p. 2.

Re: Porgans & Associates, Inc., Comments to *Notice of Preparation of Environmental Impact Report for the Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources*

Project Description:

Basic objective of the proposed project is to improve the management of the SWP supplies and operations through the MA and other contract amendments associated activities as a part of a proposed settlement agreement in PCL v. DWR. The EIR will evaluate: (1) in accordance with the court decision, the potential environmental effects of implementing the MA to the SWP water contracts with respect to allocation of SWP supplies among contractors, certain use of SWP facilities, and other SWP operational matters to include financial matters as they may impact physical changes to the environment (Section 15131) of the CEQA guidelines; and (2) the potential environmental affects of additional action which may be implemented through the proposed settlement agreement referenced earlier.[2]

Please be advised that P&A's clients, are within the Feather River watershed, upstream and downstream of the SWP's Oroville Dam and Reservoir facilities, and have and continue to be adversely impacted by the ongoing operation of the SWP, resulting from the project's inherent water shortages and over-committed water deliveries. The impacts include but are not limited to socioeconomic, environmental, cultural and loss of prime agricultural land. The Monterey Agreement amendments (MA), as proposed, unless mitigated, will continue to exacerbate the adverse impacts sustained by P&A's clients. Therefore, it is essential that DWR's proposed EIR fully assess and mitigate those impacts in a manner that is consistent with CEQA requirements and DWR trust responsibilities, to wit, P&A provides a synopsis of the issues and submits the following comments and/or suggestions.

Probable Environmental Effects

The EIR will analyze resources that could be affected by the project, including but not limited to aesthetics, agricultural resources, air quality, biological resources, cultural resources, cumulative impacts, geology and soils, growth-inducement, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, noise, population and housing, public services, recreation, transportation and traffic, utilities and service systems.[3]

Elimination of Article 18b of the Water Supply Contracts is Problematic and Potentially Detrimental to P&A's Clients Interests, Public Trust Resources, Sacred Burial Sites, Area of Origin Water Needs and Delta Water Quality Protections:

Based upon the DWR's past SWP operations track record, and its inherent conflict of interest as a water purveyor and public trustee, there is the real potential for DWR to make future SWP operational decisions to maximize project yield and water availability to meet contractors' demands, especially during dry years, that will cause irreparable socioeconomic, environmental and cultural damages to both public trust resources and private property. The impacts attributable to SWP shortages and DWR operational decisions are contained herein.

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[2] *Ibid.*, p. 3.

[3] *Ibid.*, p. 5.

Re: Porgans & Associates, Inc., Comments to *Notice of Preparation of Environmental Impact Report for the Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources*

Major Permanent Reductions in Total Entitlements Needs to Be Fully Considered and Assessed as an Alternative:

The historical operational of the SWP support the position that the inherent water shortage related impacts are problematic; i.e, the less water that is in the system, and the greater the demand on the limited supplies create proportional impacts. In essence, the proposed reduction in total annual entitlements, as provided for in the SWP Water Supply Contracts, as stipulated in the MA are too small to make any significant difference on related socioeconomic and environmental impacts.

The problems and impacts attributable to the over-committed SWP, considering the systems limitations, can only be realistically be minimized by a significant permanent reduction in total annual entitlements, which is provided for in Article 18(b) of the Water Supply Contracts.[4] If it is DWR's intent to significantly reduce the impacts associated with the SWP inherent water shortages, then any action to eliminate Article 18 (b) would be extremely difficult, if not impossible to justify. In fact, it is the only legitimate way to resolve the shortages associated with the over committed SWP; essentially, it was the original fail- safe mechanism to backstop shortages, and the only sensible way to address the "paper water" conundrum. The paper water issue can only be resolved by DWR taking a realistic approach to water reduction more in line with the existing systems capabilities. **Albeit, if DWR and its contractors eliminate 18 (b) for permanent water reduction, then they should also fully assess the impacts to private and public resources, and provide the required mitigation throughout the entire Feather River watershed and the Sacramento-San Joaquin Delta.**

Recommendations and/or Potential Mitigation Measures:

DWR should consider the use of SWP "forth priority funds " as a means to finance the permanent reduction of total SWP entitlements; providing that such an action is consistent with the California Water Resources Development Bond Act, legislative mandates and related covenants. If such an action can be implemented, it would provide the mechanism for a more realistic permanent water reduction, maintain the financial integrity of the SWP, and help to minimize and/or mitigate the project's impacts on private property, sacred cultural sites and public trust resources. In addition, if allowable, those same funds, which are predominately from the earned interest generated from the California Water Fund, should also be explored for use in mitigating impacts attributable to the elimination of 18 (b) for watershed protection and enhancement and compensation for losses and/or damages to private and public trust resources and indigenous people. Notwithstanding, to proceed with a token reduction in total entitlements and/or elimination of 18 (b) needs to be fully assessed and all of the related impacts fully mitigated and compensated.

The SWP system deficiency (water shortages) appears to contribute to conflicting management decisions that are advantageous to DWR and SWP contractors, but harmful and destructive to tribal, and public and private trust resources. Specific examples of the adverse impacts associated with SWP water shortages and delivery needs, include but are not limited to the following types of consequences:

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[4] DWR, ***The California State Water Project, Water Supply Contracts,*** Bullctin, No. 141, Vol. I, Nov. 1965, and as amended.

1 ❶ Mismanagement of SWP water storage facilities, which conflict with federal rules and regulations;

2 ❷ Unauthorized use of flood storage space during critical periods to enhance water supplies;

3 ❸ Endangerment of public property and lives downstream from Oroville Reservoir;

4 ❹ Accelerated exposure of tribal ancestral burial grounds and other sacred objects, which DWR left
5 buried in the Oroville Reservoir fluctuation zone;

6 ❺ Violation of water right/water quality standards imposed on DWR's water right permits for the SWP;

7 ❻ Destruction of public trust resources (fish and wildlife), and/or

8 ❼ Illegal export of water from the Area of Origin and Delta.

9 **Historical Documentation That DWR Acknowledged Inherent SWP Water Shortages 40 Years Ago:**

10 The inherent SWP water shortages were recognized as early as 1963, as referenced in DWR's Bulletin 132-63, which
11 states:

12 *In the operation of the State Water Project, Oroville and San Luis Reservoir will be operated in conjunction*
13 *with surplus flows in the Delta to develop an initial firm annual yield for delivery of 4,000,000 acre-feet. The*
14 *present surplus flows in the Delta will be diminished in the future, because of further development of wate*
15 *rin the area tributary to the Delta, particularly in the Sacramento River Basin. Therefore, additional water*
16 *supplies must be made available in the Delta, both to offset the effects of depletions resulting from increased*
17 *upstream development, and to meet export demands.*[5]

18 *Detailed operation studies of the Central Valley incorporating the foregoing estimates of future water uses*
19 *indicate that the yield of the initial conservation facilities will satisfy project water demands until about the*
20 *mid-1980's. At that time, an additional conservation facility, herein considered to be a project on the Middle*
21 *Fork Eel River, will be needed. This facility will develop about 800,000 acre-feet annually to meet*
22 *increasing water requirements up to the project yield of 4,000,000 acre-feet annually and to offset the effects*
23 *of depletions in the yield of the project expected to result from increased use of water in and above theDelta.*[6]

24 **SWP Inherent Water Shortages Compounded by Internal Conflicts Between Agricultural and Urban Contractors**
25 **Contributing to Impacts to Public Trust Resources, Sacred Cultural Sites, Area of Origin Needs and Private**
26 **Property Destruction and/or Losses:**

27 The inherent SWP water shortages were compounded by the internal conflicts between the project's urban and
28 agricultural water contractors pertinent to Delta protections and ability to pay for new water development. The

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[5]California Department of Water Resources, ***The California State Water Project in 1963***, April 1963, p. 96.

[6] *Ibid.*, p. 127.

project's inherent shortcomings and internal conflicts have and continue to adversely impact public trust resources, sacred cultural/burial sites, area of origin needs and private property losses and/or damages that have yet to be fully assessed and/or mitigated.

The measure of the SWP's delivery capability is founded on the concept of "firm yield" operation. Defined in the water supply contracts as "minimum project yield," firm yield is the dependable annual water supply that can be made available without exceeding specified allowable reductions in agricultural deliveries during extended dry periods.

"The firm yield of existing SWP facilities is approximately 2.4 million acre-feet per year. Since 1987, contractor requests for entitlement water have exceeded that amount (see Table 14.)"[d]

Examples: During the 1970s, three major SWP contractors filed lawsuits against DWR for releasing water to protect Sacramento-San Joaquin Delta - impeding the development of additional water facilities to meet anticipated SWP shortages, especially during drought periods.

For decades the agriculturalists (Boswell, Salyer et al), opposed water quality protection for the Delta, and North Coast rivers, despite the fact that they agreed to Delta protections as SWP contractors. They became involved in extended and protracted litigation against the DWR for releasing SWP water to meet Delta water quality standards, during the late 1970s, and lost on all counts.

Three cases challenge DWR's authority to make releases from stored water for Delta water quality control that are larger than those needed for exporting water of suitable quality.

*1. **Berrenda Mesa Water Storage District v. Department of Water Resources**, filed 9/10/76, Sacramento Superior Court No. 262976, Injunction, declaratory judgment.*

The complaint seeks to enjoin releases of water to the Delta above those that are required for operation the SWP.

*2. **Tulare Lake Basin Water Storage District v. State of California, et al**, filed October 19, 1976, Sacramento County Superior Court No. 263582, Declaratory Relief, preliminary and Permanent Injunctions, undetermined amount of damages.*

On October 19, 1976, Tulare Lake Basin Water Storage District and Dudley Ridge Water District both SWP water supply contractors, filed suit against DWR.

The complaint alleged that DWR had acted illegally in releasing water into the Delta that should have been sold as surplus water.

*3. **Salyer Land Co. v. State of California**, Department of Water Resources, filed 5/9/77, Sacramento County Superior Court, No. 267012, $3.7 million.*

The suit was filed by Salyer Land Company against DWR on May 9, 1977; an amended complaint was filed on July, 1977. The plaintiff company farms land in the service area of the Tulare Lake Basin Water Storage District, a SWP contractor. The plaintiff alleges that it is a third party beneficiary of the water supply contract between DWR and the Tulare Lake Basin Water Storage District, and that DWR's action allowing water to flow

out of the Delta in 1976 until present violated the terms of that contract. [7]

In operating the SWP, DWR is required to comply with the Delta water quality standards established under the provisions of State land and the Federal Clean Water Act.[8] *(Section 13247 of the Water Code.)*

DWR Won Lawsuit Against SWP Contractors - Court Rules DWR Obligated to Release Water to Protect Delta:

The most important State Water Project (Project) Court decision in nearly 20 years was handed down by the Sacramento Superior Court in ***Tulare Lake Basin Water Storage District v. State of California****. The action was brought by Tulare and other Project contractors. The decision, which was in favor of the Department of Water Resources on all counts, held that the Department did not breach its water supply contracts in 1976-77, when it released stored water for salinity control in the Delta in compliance with the State Water Resources Control Board (SWRCB) Basin Plans. In further finding that the Department acted under its broad powers in its management of the Project, the Court has completely vindicated our past operational actions in compliance with SWRCB orders. The Court further found that (1) the Delta Protection Act requires the Department to provide an adequate water supply for the Delta that is not conditioned on advance payment by Delta users; (2) the Porter-Cologne Act requires the Department to comply with water quality control (basin) plans; and (3) the Burns-Porter Act did not create an exception for the Project. The decision will make future Project operations considerably easier and should rest forever attempts by some water contractors to deny Project obligations to protect the Delta.*[9]

DWR ILLEGALLY EXPORTED AND/OR IMPOUNDED $29 MILLION OF WATER FROM DELTA TO PROVIDE WATER TO SWP CONTRACTORS AND TO KEEP WATER CONTRACTORS SOLVENT - IN VIOLATION OF THE LAWSUIT IT SUCCESSFULLY DEFENDED TO PROTECT DELTA WATER QUALITY:

Ironically, subsequent to the lawsuit, DWR, under its succeeding director, David Kennedy, began to violate these standards, by illegally impounding or diverting water designated to protect the Delta, as a means to make more water available to SWP contractors. It is because of the intrinsic shortcomings of the project, the department resorted to desperate, drastic, and illegal actions in an attempt to keep its agricultural contractors solvent. During 1991-92, the department and the U.S. Bureau of Reclamation (USBR) unilaterally violated state and federal water quality standards, and the terms and conditions of their respective water rights permits, by illegally diverting $29 million of water from the Bay/Delta Estuary. Their irresponsible actions have and continue to be at the expense and to the demise to both private property and public trusts resources in the Delta, Suisun Marsh, and along the Feather River.

According to State Water Resource Control Board (SWRCB) data, DWR and the USBR committed hundreds of violations of Delta and Suisun Marsh water quality standards, in 1991 and 1992, more than in all of the previous years

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[7] Department of Water Resources, ***Delta Water Facilities,*** Programs for: Delta Protection and Water Transfer, Water Conservation, Water Recycling, Surface and Ground Water Storage, July 1978, pp. 37, 38, and 39.

[8] *Ibid.*, p. 36.

[9] Department of Water Resources, *Bulletin 132-81,* ***The California State Water Project -- Current Activities and Future Management Plans,*** November 1981, p. iii.

combined, since the enactment of the Board's Water Right Decision 1486 (D-1485).[10] In the process it illegally stored and/or diverted approximately 300,000 acre-feet of water designated for Delta/Marsh water quality protection, and made that water available to its SWP contractors, at the expense and to the demise of private business and public trust resources.[11] The water was worth approximately $29 million. During the drought years record-breaking water exports occurred.

Porgans, et al, Compelled State Water Resources Control Board to Hold Hearings on DWR's Delta Water Quality Violations - Although Board Acknowledged the Violations, It Did Not Fine DWR for the Violations:

In 1991, P&A formally notified the State Water Resources Control Board (SWRCB) of the excessive Delta water quality violations committed by DWR and the USBR. In the ensuing year, P&A sent additional letters to the SWRCB requesting that it take an enforcement action against its sister agency and the USBR for violating Water Right Decision D-1485 water quality standards.[12]

On November 20, 1992, the SWRCB held a public hearing to discuss the D-1485 violations. Porgans presented testimony before the Board at that time. (Refer to Appendix 30.) DWR and the USBR both admitted that they violated the D-1485 standards, which the Board's staff documented; however, despite the facts presented at the hearing, the SWRCB advised DWR and the USBR that it would not take an enforcement action against them for the 1991 and 1992 D-1485.[13]

Group of Legislators Send Letter to SWRCB Expressing Their Deep Distress Over the Board's Failure to Enforce D-1485 Water Quality Standards:

> *We are deeply distressed by the Board's recent failure to enforce water quality standards for the Sacramento-San Joaquin Delta as required by Water Right Decision 1485. Salinity standards in D-1485 were violated by the State Water Project and the Central Valley Project on 289 separate occasions in 1991 and 1992.*
>
> *The basis for the Board's failure to enforce standards that protect public trust resources in the estuary was not explained to the public. The California Department of Water Resources and the U.S. Bureau of Reclamation were simply informed by your executive director, Mr. Walt Pettit, in a July 11, 1993 letter that the Board would not take any enforcement action.*

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[10] SWRCB, Exhibit 19, Presented at the Board's Public Hearing: ***Consideration of Compliance with Water Right Requirements for the Sacramento-San Joaquin Delta and Suisun Marsh***, November 20, 1992.

[11] SWRCB, Exhibit 20, Presented at the Board's Public Hearing: ***Consideration of Compliance with Water Right Requirements for the Sacramento-San Joaquin Delta and Suisun Marsh***, November 20, 1992.

[12] Porgans' letter to Don Maughan. Chairman, SWRCB, Re: ***Status of the Board's Progress to Take Enforcement Action Against the Department of Water Resources and the U.S. Bureau of Reclamation for Violations of D-1485 Standards in Water-Year 1991***, June 15, 1992.

[13] Walt Pettit, Executive Director, letter to David Kennedy, Director, DWR, and Roger Patterson, Regional Director, USBR, Re: Compliance During 1991 and 1992 With Water Right Decision 1485, June 11, 1993.

Mr. Pettit's letter concluded that 'this matter is closed.' On the contrary, the question concerning enforcement of water quality standards, which strikes to the heart of the Board's function as a regulatory agency, is far from settled, and there are a number of troubling issues which need to be fully addressed by the Board.

1. What findings of fact were made by the Board as to the impacts on beneficial uses caused by the 1991-2 violations? Did the Board's findings, if any, take into account the existing degraded condition of the Bay/Delta environment?[14]

Porgans, et al, v Babbitt, et al, Litigation to Stop Government From Violating Delta Water Quality Standards and Illegal Diversion:

On December 7, 1993, subsequent to the Walt Pettit's letter of July 11, 1993, P&A et al, filed a lawsuit against both the DWR and the federal government for illegally diverting water from the Bay/Delta Estuary.[15]

UNAUTHORIZED STORAGE OF WATER IN THE DESIGNATED FLOOD STORAGE AREA CAN DEFEAT ITS PURPOSE:

Utilizing the flood storage space for water conservation and simultaneously restricting flood water releases, on certain occasions, can prove to be of benefit to DWR and its water contractors; however, when weather patterns change, and runoff increases into the reservoir, DWR records prove that in the past it had to compensate for its unauthorized encroachment by significantly increasing the overall amounts of flood water released from the reservoir, and in so doing, extended the duration that these high flood flows were sustained, which exacerbates property and crop damages downstream from the reservoir. P&A provided the USACE personnel with numerous government documents to support this assertion. In fact, P&A provided the USACE's Environmental Resources Branch with a copy of its *Preliminary Performance Report, Oroville Dam and Reservoir, California State Water Project, Flood Control Laws, Flood Water Releases, Erosion and Channel Scouring.* DWR's operational records for the SWP's Oroville facilities also indicate that on numerous occasions it failed to make the proper flood water releases from the reservoir while encroached, primarily by restricting outflow when inflow where high and conversely increasing flood releases at higher rates than inflow. That and other information were contained in the aforementioned report, which also included a voluminous appendix report that provides all of the government data to support the findings in that report. (A bibliography listing P&A's SWP and related reports are attached.)

DWR ADMITS USE OF FLOOD STORAGE NEGATES FLOOD PROTECTION BENEFITS:

The use of flood storage space for other purposes, such as power generation or conservation storage, negates the benefits derived from flood protection. When heavy storm runoff fills the reservoir's flood storage space, it is tempting to release water slowly through the turbines than to quickly evacuate the space by additional controlled releases which may be called for by the standard operating procedures. This practice could defeat the

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[14] Senator Marks', et al, letter to John Caffrey, Chairman, SWRCB, July 12, 1993.

[15] *Porgans, et al v. Babbitt, et al.*

flood protection operation.[16]

DWR sold more water to its SWP contractors than the project is capable of delivering, especially in dry years. The DWR's decision to illegally store more water in the designated flood storage space is highly profitable for its contractors; it keeps water costs down and increases the contractors ability to repay their respective annual repayment obligations, and in the past made large volumes of cheap surplus water available to contractors. However, this practice has proven to be extremely deleterious to downstream property owners and public trust (fish and wildlife) resources.

Ongoing Desecration of Sacred Tribal Burial Sites:

SWP demands continue to desecrate tribal burial sites and other sacred areas, which result from water demands and fluctuating reservoir levels that expose tribal ancestral remains to vandalism, destruction and accelerated rate of decomposition. Currently, Governor Davis has established a committee to assess the impacts on sacred burial sites throughout the State of California, and ways to mitigate the impacts.

Watershed Protection Funds:

The proposed "Settlement Agreement" establishes a "Trust Account" for "watershed restoration projects," in Plumas County, P&A respectfully suggest that the concept of funding for watershed restoration projects also include areas within Butte County.

Time does not permit me to go into all of P&A's clients concerns, and/or to provide the level of detail pertinent to the clients' related losses and/or damages. Nevertheless, P&A would appreciate DWR's considerations of the comments, concerns and/or recommendations contained herein, and respectfully request that they be included as a part of the EIR where appropriate. Thank you for your time and interest.

Respectfully,

Patrick Porgans

fnl:2/montagree/comments

cc: Interested Parties

Attachments

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[16]California Department of Water Resources, Bulletin 199, ***California Flood Management:*** *An Evaluation of Flood Prevention Program*, September 1980, p. 33.

Porgans & Associates
P.O. Box 1713, W. Sacramento, CA 95691
Tele. (916) 374-8197 Fax 372-7[illegible]

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March 28, 2003

Ms. Delores Brown
Chief, Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

Via Fax at (916) 227-7554

RE: Comments in Response to DWR's Notice of Preparation for Environmental Impact Report for "Monterey Plus"

Dear Ms. Brown:

Thank you for providing an opportunity for public comment and input on scoping for the Environmental Impact Report (EIR) for "Monterey Plus". These comments are Public Citizen's perspectives upon the matter. Public Citizen is currently engaged in a national campaign to protect water as a human right and maintain water in the public trust through democratic means.

The State Water Project represents a vital component of water distribution in this state, leaving many people dependent on the effective management of their water resources by the state. The design and implementation of the EIR for "Monterey Plus" with have numerous, long lasting effects upon the quality of environmental conditions for both native species and the citizens of California. Public Citizen feels that "Monterey Plus" has taken steps in the wrong direction towards protecting the rights of these users. The importance of a quality EIR in this case is essential. The following comments are submitted in the interest of improved public policy with regard to water resources management.

Specific Elements to be Included in the Scope of the EIR

The scope of the EIR should include the following elements:

DWR Water Rights and "Surplus" Water

The state has legal rights to certain waters from the Feather River watershed, and it pumps "surplus" water out of the delta. Most of the water DWR extracts water from the

delta is in fact unclaimed "surplus" water, not Feather River water. Because DWR is a "junior" appropriator relative to most of the other entities with claims to water within the watershed, this surplus water may not exist under a number of circumstances. The impacts of extracting both surplus water and water to which DWR holds rights should examined in the EIR.

DWR's Assertion of SWP Reliability

DWR released a draft report in 2002 asserting that the SWP can *reliably* extract and deliver – *on average over time* – about 1 million acre feet *more water* than it delivered in the 1980s or the 1990s.The EIR will need to examine the impacts of changes in extractions under both pre-Monterey and proposed project conditions.

Integrated Assessment of the SWP and CVP

The State Water Project and the Central Valley Project extract water from the delta in a coordinated management program – including pumping, storage, and conveyance. Both systems must therefore be examined in an integrated way. Given that neither system can deliver the full volumes of water they "promised" to users back in the mid-1900s, the EIR will need to analyze both the limits of the systems and the tradeoffs between them.

The No Project Alternative

The no project alternative in this EIR needs to include a careful examination of the impacts of managing the limited water supplies in the SWP system under provisions and terms included in the pre-Monterey contracts. The law also requires that the EIR examine "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services."

Implications of Limits and the Requirement for Restoration

In response to environmental damage, Congress, the legislature, administrative agencies, and the courts have established requirements for *restoration* of environmental systems and species. The new EIR will need to take a broad view of the potential impacts of the proposed project and it must proceed under the logic of watershed management developed in the Racanelli decisions and since.

Land-Use Planning and Water for Smart Growth

The California legislature has addressed the issue of water scarcity and management and promulgated new laws since DWR's first ill-fated EIR effort. In 2001, California finally legislated a meaningful link between water supplies and development. As of January 1, 2002, projects of 500 units of more must show that adequate water supplies are available for the project.

The claims of DWR regarding reliability, and the impacts associated with extraction, diversion, and use of those amounts, must be examined in the new EIR. Land-use decisions are being made based on DWR's assertions of reliability.

Minimizing the Need for Inter-Basin Transfers

In 2001, a little-noticed provision in SB 672 regarding urban water management plans requires that the state of California in the state water plan (Bulletin 160-03), examine ways to "*minimize the need to import water from other hydrologic regions*".

The EIR will need to take this new legal requirement into consideration as it examines alternatives to the proposed project. Specifically, the EIR needs to consider alternatives to both existing and proposed levels of extraction of water from the delta.

In Conclusion

DWR's task and responsibilities with regard to this EIR are considerable. The "Monterey Plus" project, and the no project alternative, along with other appropriate project alternatives that may be identified, will require careful analysis. CEQA requires, as noted above, a level of analysis that provides the public and decision-makes with sufficient understanding of the issues and potential impacts to make informed decisions. These decisions will include both water management and land-use decisions, as well as ecosystem restoration decisions.

I look forward to seeing the new and improved EIR process address these issues in the spirit worthy of the public trust.

Sincerely,

Juliette Beck
Senior Organizer, Water for All Campaign

LAW OFFICE OF ANTONIO ROSSMANN

Attorneys at Law

380 HAYES STREET, SUITE ONE
SAN FRANCISCO, CALIFORNIA 94102 USA
TEL (01)(415) 861-1401 FAX (01)(415) 861-1822
www.landwater.com

ANTONIO ROSSMANN
ADMITTED IN CALIFORNIA
NEW YORK AND
THE DISTRICT OF COLUMBIA
ar@landwater.com

ROGER B. MOORE
ADMITTED IN CALIFORNIA
rbm@landwater.com

March 28, 2003

Ms. Delores Brown
Chief, Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

Re: Scoping comments in response to Notice of Preparation for Environmental Impact Report for the "Monterey Plus" EIR

Dear Ms. Brown:

We appreciate the opportunity to provide scoping comments in response to the Notice of Preparation (NOP) for the above-referenced EIR on behalf of the Planning and Conservation League (PCL) and the Citizens Planning Association of Santa Barbara County (CPA). PCL, CPA, and the Plumas County Flood Control and Water Conservation District challenged the environmental review and validity of the original 1995 Monterey Amendments to the State Water Project contracts, and participated in two years of settlement negotiations that followed the Third District Court of Appeal's decision in that case. The court set aside the 1995 Monterey Agreement EIR ("1995 CCWA EIR") prepared by a local joint powers agency, the Central Coast Water Authority (CCWA) and required DWR to prepare a new EIR. (*Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892 (*PCL v. DWR*).)

All three plaintiffs have executed the resulting settlement agreement, which is awaiting final ratification by the Department of Water Resources and the local water districts and agencies that participated in the negotiations. Although the text of the settlement agreement had not yet been released to the public at the time the NOP issued, it is now available on DWR's website (http://www.montereyamendments.water.ca.gov/). DWR is to be commended for encouraging public participation, by extending the scoping comment period for another month following the public release of this agreement.

The new project described in the settlement agreement includes both the Monterey Amendments and additional contract amendments and other program features described in the agreement. The NOP's reference to the new project as "Monterey Plus" is therefore accurate. We believe that the new project offers important benefits that will bring greater public accountability and environmental responsibility to the State Water Project (SWP) in comparison to the original version of the Monterey Amendments reviewed in the invalidated 1995 CCWA EIR.

Equally important as its substantive provisions, the settlement agreement also anticipates that DWR will now prepare an EIR that provides other decision-makers and the public the responsible environmental review denied to them in the 1995 CCWA EIR. In *PCL v. DWR*, the court referred to "the…contractors and the members of the public who were not invited to the table" in the negotiations that led to the Monterey Agreement. (83 Cal.App.4th at 905.) Section III of the settlement agreement provides a detailed overview of elements that DWR has committed to include in its new EIR, while recognizing that the proposed project to be assessed will be specifically defined during the scoping process.

DWR as lead agency retains the ultimate responsibility to ensure that its environmental review and new project decision properly inform decision-makers and the public. We provide specific scoping comments below to encourage DWR to prepare an EIR that is fully consistent with the court's ruling in *PCL v. DWR*, the terms of the settlement agreement, and the requirements of law. If DWR is to overcome the "aura of unreality" identified by the court of appeal in its assessment of the 1995 CCWA EIR (83 Cal.App.4th at 913), the department must prepare a new EIR that is solidly grounded in both legal and hydrologic reality.

PCL v. DWR

The EIR must, as a starting point, analyze the substance of the court of appeal's decision in *PCL v. DWR* and ensure that its new project assessment is consistent with the Third District's analysis in that case. The key components of the ruling are as follows:

- **Lead agency requirement**

Holding that CCWA erroneously acted as lead agency, the court ruled that CEQA required DWR, the only entity with the requisite statewide authority and expertise, to assume its proper role as lead agency in preparing a new EIR.

- **"No project" alternative**

The court also held that the CCWA EIR was fatally defective under CEQA for failing to analyze implementation of pre-Monterey state water contract terms, and particularly the permanent shortage provisions of article 18(b), as part of the EIR's no-project alternative. In the event of a permanent shortage (i.e., inability to reliably deliver the full 4.23 million annual acre-feet (MAF) of previously-labeled "entitlements" listed in Table A of the project contracts), pre-Monterey article 18(b) required the proportional reduction of each contractor's amount listed in Table A to match the available supply.

- **"Paper water" problem**

The relationship between so-called "entitlements" and land-use planning was central to the court's holding that the EIR failed to address the "no project" alternative. The court connected this error to the risk of statewide land-use decisions made on the basis of "paper" water entitlements not grounded in real, deliverable water. The court openly criticized the false expectation that the State Water Project will deliver on its full "entitlement" level of 4.23 MAF when the project's historic capability, evidenced in DWR's own data, has only been roughly half this level. The ruling therefore noted the "huge gap between what is promised and what can be delivered." (83 Cal.App.4th at 908.) With respect to the "humbler, leaner reality" of project capability, the Court also noted the implicit assumption in the Monterey Amendments' rebate provisions (article 51) that certain facilities originally envisioned for the SWP will not be built. (*Id.* at 914.)

- **Validation procedure**

In addition to ruling for the plaintiffs on these CEQA claims, the court of appeal found that the plaintiffs had properly initiated a proceeding to question the substantive validity of the Monterey Amendments, including DWR's transfer of a 20,000-acre conservation and storage facility, the Kern Fan Element, to Kern County Water Agency. The court rejected a procedural challenge based on the theory that nonparty state water contractors were indispensable to the validation challenge.

In sum, as a consequence of the appellate ruling in *PCL v. DWR*, DWR must prepare its own EIR as lead agency. That EIR must fully address the "no project" alternative, and therefore must confront the "paper water" concerns the court of appeal identified in its assessment of that issue. As an integral part of the Monterey Amendments, the Kern Fan Element transfer must also be fully addressed in the new EIR.

Settlement Agreement

The EIR must also accurately describe the project based upon the settlement agreement in sufficient detail to inform decision-makers and the public of its potential impacts. Both the "Monterey" and "plus" components must be fully described. Among the provisions of the agreement are these (all references, except as noted, are to the Settlement Agreement):

- Specified provisions of the SWP contracts shall be amended to delete the term "entitlement," to be replaced with the "Table A amounts" as referenced in Table A of the contracts. (Attach. A.)

- New Article 58 of the SWP contracts will require DWR to issue biennial reports starting in 2003 to city, county and regional planning agencies, providing information on SWP delivery capabilities under a range of hydrologic conditions, as well as historic delivery figures. DWR will also produce guidelines by January 2004 to municipal and industrial contractors to provide accurate information for land use planning, with plaintiffs' input. (Attach. A, B.)

- DWR will issue guidelines on permanent transfers of Table A amounts. The negotiations will take place in public, CEQA compliance will be required, and the place and purpose of use must be specified. (Attach. C.)

- Future project-wide contract amendments and amendments to transfer Table A amounts will be in public with opportunities for public participation (Attach. D.)

- The agreement specifies in detail DWR's commitment to assess certain specified elements in the new EIR, which will analyze the Monterey Amendments, "attachment A" amendments, and other settlement provisions. (Section III.)

- Funding will be provided to Plumas in an amount totaling $8 million, principally to improve and restore the Feather River watershed, including the establishment of a locally run watershed forum. The goals of the program are water retention and quality, vegetative management, and groundwater storage. (Section IV.)

- The Kern Water Bank will become subject to new land use restrictions that protect 490 acres of additional land from development, beyond the restrictions currently in place in the applicable Habitat Conservation Plan. Transfer, development and operation of the bank will be addressed in the EIR. (Sections V, III.F.)

- Funding to plaintiffs ($5.5 million total) will support a variety of purposes, including watershed restoration projects, technical studies, and follow-up actions arising from the settlement. (Section VII.)

Non-reliance on CCWA's 1995 EIR

The appellate ruling required DWR to prepare a new EIR, finding that CCWA's 1995 EIR "failed to meet the most important purpose of CEQA, to fully inform the decision makers and the public of the environmental impacts of the choices before them." (*PCL v. DWR*, 83 Cal.App.4th at 920.) The court found it unnecessary to adjudicate the other CEQA deficiencies identified by the plaintiffs after analyzing the defects in the lead agency selection and no project assessment, observing that "DWR, with its expertise on the statewide impacts of water transfers, may choose to address those issues in a completely different and more comprehensive manner." (*Id.*) The court also noted that the deficiencies in the 1995 EIR might be related to the "provincial experience" of CCWA. (*Id.*)

The settlement agreement likewise requires DWR to prepare a stand-alone EIR (section III), and disclaims further reliance on the 1995 EIR to support any new project approved after March 26, 2001 (section VII.A). To ensure consistency with the appellate ruling and the settlement agreement, the new EIR must fully reflect DWR's independent judgment and assessment as lead agency, and must not incorporate or otherwise rely on CCWA's assessments in the invalidated 1995 EIR.

Project Definition

Leading CEQA decisions have long since recognized that "an accurate, stable and finite project definition is the *sine qua non* of the of an informative and legally sufficient EIR." (*County of Inyo v. City of Los Angeles (III)* (1977) 71 Cal.App.3d 185, 199.) The CEQA process cannot "freeze the ultimate proposal in the precise mold of the initial project; indeed, new and unforeseen insights might emerge during the investigation, evoking revision of the original proposal." (*Id.*)

Precision and consistency in a lead agency's characterization of the project under review also reinforces related principles of CEQA: that the project must embrace the "whole of the action" (14 Cal. Code Regs., § 15378(a)); and that assessments in an EIR may not be used to justify a decision already made. In sum, CEQA "compels an interactive process of assessment of environmental impacts and responsive modification which must be genuine." (*County of Inyo v. City of Los Angeles* (*VI*) (1984) 160 Cal.App.3d 1178, 1185.)

As appropriately noted in the NOP, both the Monterey Amendments and the additional program components specified in the settlement agreement are integral parts of the new project to be reviewed in the EIR. That understanding is also consistent with the settlement agreement (section III.C). The EIR must describe each component of the project in sufficient detail to adequately inform decision-makers and the public about the nature of the project under review.

Environmental Baseline

Without the development of an adequate baseline condition, "analysis of impacts, mitigation measures and project alternatives becomes impossible." (*County of Amador v. El Dorado County Water Agency* (1999) 76 Cal. App. 4th 931, 953.) The baseline for these assessments must be based on an analysis of "real conditions on the ground," rather than mere opinion or narrative. (*Save Our Peninsula Committee v. Monterey County Board of Supervisors* (2001) 87 Cal.App. 4th 99, 121.)

The NOP correctly observes that although the environmental baseline is "normally" existing conditions at the time the notice is published (14 Cal. Code Regs. § 15125), the baseline for this EIR must be augmented to address DWR's operation under the Monterey Amendment, and partial implementation of those amendments, since completion of the 1995 EIR. This augmentation (producing two baselines) is necessary to ensure that the EIR fully addresses the "whole of the action," including the Monterey Amendments.

This observation requires clarification in two respects. First, the SWP contracts of two contractors that have not signed the Monterey Amendments (Plumas and Empire Westside) are still governed by the pre-Monterey terms. Second, notwithstanding project approvals in 1995, none of the Monterey Amendments went into effect until August 1996. At that time, following the superior court's announcement of its intended decision but before any review by the court of appeal, DWR and the state water contractors who had signed the Monterey Amendments agreed to waive a provision in the original Monterey Amendments which otherwise required all litigation to be resolved before the Monterey Amendments took effect.

Instead of arbitrarily selecting a single point in time (such as 1995 or 2003) to define the environmental baseline, the EIR will need to fully study *both* pre-Monterey and present conditions. In developing the baseline, it will be useful to consider the different senses of "conditions" that together form the basis for studying project impacts. For example:

- The *contractual* baseline condition must be the pre-Monterey SWP contracts. Any effort to define the baseline as incorporating the Monterey Amendments, or even partial implementation of some of its elements, would make it impossible for the EIR to properly assess the "whole of the action."

- The *hydrologic* baseline condition should not be confined to a single calendar year. Rather, the impacts of water management changes are best addressed under a range of hydrologic circumstances. Constraints on SWP system performance must also be addressed. Anticipating that need, the settlement agreement provides that the new EIR's "environmental setting" section shall analyze "information on water deliveries of the SWP over the relevant historical period (at least 1991-2002), as well as data regarding the deliveries in the last extended drought (at least 1987-1992)." (Section III.C.1.)

- The *regulatory* baseline condition should examine the range of legal and environmental constraints, other than the contracts and hydrologic conditions, that could impact water deliveries to SWP contractors and the environmental impacts of these deliveries. These constraints might include such matters as Delta water quality standards, endangered species requirements, the SWP's coordinated operations agreement with the Central Valley Project (CVP), competing water rights, and elements of the CALFED program. Such constraints should be studied both as they existed before any elements of Monterey were implemented and as they have evolved since that time.

No Project Alternative

CEQA requires that the no project alternative address "existing conditions" as well as "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." (14 Cal. Code Regs. §15126(e)(2).) That requirement compels DWR in its new EIR to fully study the consequences of enforcing the terms of pre-Monterey water supply contracts prior to eliminating them.

To overcome the prejudicial error noted in the appellate ruling, DWR must "fulfill its mandate" in the new EIR "to present a complete analysis of the environmental consequences" of enforcing the pre-Monterey permanent shortage provision, article 18(b). (*PCL v. DWR*, 83 Cal.App.4th at 915.) The EIR must directly evaluate reduced Table A allocations resulting from application of that article. As a useful starting point, DWR should carefully review and perform the analysis requested in public comments referenced in the Third District's opinion. (*Id.* at 908, 915.) In addition to confirming the SWP's historic inability to deliver anywhere close to full Table A amounts, these comments "corroborate the common sense notion that land use decisions are appropriately predicated in some large part on assumptions about the available water supply." (*Id.* at 915.)

Section III.C.2 of the settlement agreement provides that the new EIR shall include "[a]s part of the CEQA-mandated 'no-project' alternative analysis, an analysis of the effect of pre-Monterey Amendment SWP contracts, including implementation of Article 18 therein. This analysis shall address, at a minimum, (a) the impacts that might result from application of the provisions of Article 18(b) of the SWP Contracts, as such provision existed prior to the Monterey Amendments, and (b) the related water delivery effects that might follow from any other provisions of the SWP Contracts." Two of the "other" contract provisions inevitably related to this assessment are articles 18(a) and 21, which prior to Monterey required, respectively, that agricultural contractors endure the first cutbacks in water allocations in times of temporary shortage and receive the first allocations in times of surplus.

The environmental effects of proportional reductions in Table A amounts, as calculated in the no project assessment, must be directly compared to those of the proposed project. As the court of appeal made clear in *PCL v. DWR*, neither claims of "infeasibility" nor purported legal disagreements can serve as an excuse for avoiding comparison of the environmental consequences of the no project alternative and the project. (*PCL v. DWR*, 83 Cal.App.4th at 918.)

Project Alternatives

The NOP accurately summarizes the lead agency's requirement under CEQA to examine a range of reasonable alternatives that would feasibly obtain most of the project objectives, but avoid or substantially lessen any significant adverse effects of the project. (14 Cal. Code Regs. §15126.6.) In its screening and review of alternatives, the EIR must provide more than "cursory" analysis. (*PCL v. DWR*, 83 Cal. App. 4th at 919.) It should not construe project objectives so tautologically that only the proposed project could conceivably be capable of achieving them. Nor should the EIR allow the mere "threat of litigation" under a proposed alternative to prevent its environmental review. (*Id.* at 914.)

Assessment of SWP Reliability

DWR's record of deliveries to contractors under the SWP figured centrally in the Third District's conclusion that the 1995 EIR must be set aside. (See *PCL v. DWR*, 83 Cal. App. 4th at 908 (noting the "huge gap between what is promised and what can be delivered" and that "actual, reliable water supply" is "in the vicinity of 2 to 2.5 MAF of water annually" rather than the 4.23 MAF of Table A "entitlements"); 83 Cal. App. 4th at 913 (average actual deliveries under the SWP from 1980-1993 "were around 2.0 MAF").

Similarly frank assessment of DWR's record of deliveries will be essential to a wide variety of issues to be addressed in the new EIR, including the no project alternative as well as the assessment of hydrologic impacts, land use and planning impacts, growth-inducing impacts, and cumulative impacts. As mentioned above, the settlement agreement anticipates this need by calling for assessment of historic deliveries at least from 1987-1992 and 1991-2002. DWR should also coordinate its information about SWP capability with related discussions of the same subject in other contexts, such as hearings in the California Legislature and the pending efforts to revise DWR's Bulletin 160.

Conversely, although computer models can be useful when applied for their intended objectives, no single computer modeling approach, such as the CALSIM II model referenced in DWR's draft State Water Project Delivery Reliability Report (See http://swpdelivery.water.ca.gov/ "draft reliability report")), should substitute for careful assessment of the historical record of project deliveries. Any model must be assessed and calibrated in terms of actual SWP deliveries. Although the draft reliability report is important in its recognition that the SWP cannot reliably deliver the full 4.23 MAF of table A amounts, we do not recommend that DWR's EIR rely on the model-driven conclusions in this version of the report, which have been the subject of significant criticism and calls for redrafting. The report must be read in light of substantial criticisms made in public comments. (See http://swpdelivery.water.ca.gov/commentletters.htm.)

Relying on the CALSIM II model, the draft reliability report constructs delivery probability charts for the SWP for two years, 2001 and 2021. As noted by several commenters, the median delivery identified in the report (3.297 MAF) is on the order of 50% greater than the actual record of historic deliveries to the SWP as reported by DWR. A detailed analysis by Dennis O'Connor for the California Research Bureau, referenced in the comment letter of Senator Machado, indicates that the draft reliability report provides no credible explanation for this disparity. O'Connor's analysis concludes that among other problems, the results are inconsistent with previous estimates and models, recent deliveries were lower than the modeled 2001 conditions, and 2021 does not reflect any growth in upstream consumptive use. His assessment also observes that CALSIM II is not calibrated or otherwise verified, and that the draft reliability report does not use the CALSIM II model as designed. Because the draft reliability report appears to overstate the supply reliability of the SWP, O'Connor's analysis warns that DWR's assessments of reliability should not replace the "paper water" problem with a new, simulation-based "cyber water" problem. Other comment letters, notably those of Robert C. Wilkinson, Peter Gleick, and Arve Sjovold, reach similar conclusions.

Several other points deserve emphasis as they relate to the EIR's references to SWP reliability:

- Any references to SWP delivery reliability in the EIR should be based upon the portion of full Table A amounts that the project can reliably deliver, not the percentage of contractor "requests" that can be met in any given year. The SWP contractual provisions governing allocations in the event of shortages are based upon Table A amounts, not requests. In *PCL v. DWR*, the court of appeal considered and rejected CCWA's attempt to shift the reliability discussion away from Table A-percentages to the request-percentages. (83 Cal. App. 4th at 913.)

- Any assessment of the reliability of SWP Delta exports in the EIR must be integrated with an assessment of CVP exports. Both projects extract water from the Delta in a coordinated management program that includes pumping, storage, and conveyance. Without integrated study of these projects, it would be impossible to discern whether reliability attributed to the SWP was based on water from the CVP.

- The need for integrated assessment of SWP and CVP exports is corroborated in the Bureau of Reclamation's February 21, 2003 scoping comments, which recognize that many changes have

taken place since the 1986 signing of the coordinated operations agreement (COA). Reclamation observes that the operation of the Kern Water Bank and of Metropolitan Water District's Eastside Storage Reservoir "are two prominent influences on SWP operations that were facilitated by the Monterey Amendment" and not considered in the development of the COA. Reclamation also expresses concern about "current and future CVP access to SWP Delta pumping capacity," noting that Monterey Amendment implementation may have influenced these. Reclamation appropriately requests that the EIR "examine in detail how the proposed action would affect CVP access to SWP Delta export capacity both from a historical and future condition perspective. In addition, should the proposed action affect CVP use of SWP Delta export capacity, the EIR should address the environmental and socio-economic effects of these changes."

- Any assessment of the reliability of SWP Delta exports must also consider other potential regulatory and environmental constraints on deliveries. In addition to the COA, these might include Delta water quality standards, endangered species requirements, competing water rights, and elements of the CALFED program.

Changes in SWP Operations and Deliveries

The settlement agreement states that DWR's new EIR shall include "analysis of the potential environmental impacts of changes in SWP operations and deliveries resulting from implementation of the proposed project. If the proposed project results in modifications to the water sources relied upon for the SWP, those sources will be identified and the resulting environmental effects will be assessed." (Section III.C.3.) The EIR must provide this analysis to ensure compliance with the agreement and the requirements of CEQA.

Kern Fan Element Transfer

The EIR must fully address the environmental consequences of transferring the Kern Fan Element from DWR to Kern County Water Agency under article 52 of the Monterey Amendments, as well as its subsequent transfer from KCWA to the Kern Water Bank Authority. As provided in the settlement agreement, "the new EIR shall include an independent study by DWR, as the lead agency, and the exercise of its judgment regarding the impacts related to the transfer, development and operation of the Kern Water Bank" in light of existing environmental permits. (Section III.F.) That study "shall identify SWP and any non-SWP sources of deliveries to the Kern Water Bank." (*Id.*) The EIR must provide this analysis to ensure compliance with the agreement and the requirements of CEQA.

State ownership of the Kern Fan Element must be addressed as the "no project" condition. For the EIR to provide an assessment that can support transfer of the bank to local control, it must provide a sufficient explanation as to whether it would have been feasible to maintain the water bank as a state resource, and under what conditions it could remain a state resource.

The EIR should also analyze an alternative that would allow the Kern Water Bank to remain in local control, subject to operational and financial criteria designed to maximize environmental benefits.

One such alternative would require the bank to store environmental water in time of surplus and make it available at no cost to the state in time of drought, as part of the consideration for allowing the asset to operate the rest of the time for local purposes. In sum, a variety of operating and financial arrangements must be explored to maximize the bank's contributions to the State's environment.

Transfers of Table A Amounts Under the Monterey Amendments

The settling parties recognize the finality of certain transfers of table A amounts from agricultural to urban contractors, listed in attachment E of the agreement. (Section III.D) That list does not include as "final" a single transfer of 41,000 acre-feet of table A amount from Kern County Water Agency to Castaic Lake Water Agency, since that transfer remains the subject of active litigation. (Section III.E; see *Friends of the Santa Clara River v. Castaic Lake Water Agency* (2000) 95 Cal. App. 4th 1373 (ordering the EIR for that transfer set aside due to unlawful "tiering" from the invalidated 1995 Monterey EIR)). Nonetheless, since each of these transfers directly relies on the Monterey Amendments, the settlement agreement provides that DWR's new EIR shall study the potential environmental effects of both the attachment E transfers and the Kern- Castaic transfer. (Section III.C.4.)

Growth-Inducing Impacts

In light of the court of appeal's recognition in *PCL v. DWR* of the close connection between water planning and land-use decision-making, it is crucial that the new EIR fully address any potential growth-inducing impacts of the Monterey Amendments, including those arising from changes in project management and operation, failure to reduce Table A amounts to existing and reasonably foreseeable SWP capability, financial restructuring of the project contracts, water transfers facilitated by Monterey, and water sales from the locally administered Kern Water Bank. The cumulative impacts of these changes also require careful analysis. The growth-inducing effects of "completed" attachment E transfers and the Kern-Castaic transfer must be studied, since they were made pursuant to the Monterey Amendments. (Section III.C.4.)

Conclusion

We hope that these scoping comments assist DWR in preparing an exemplary EIR that will succeed in informing decision-makers and the public of the environmental consequences of the proposed action, continuing the spirit of cooperation and inclusion that the settlement agreement has made possible. Do not hesitate to contact us if you have further questions.

Respectfully,

Roger B. Moore

Antonio Rossmann

Robert Shulman
Plumas County Counsel
520 W. Main St., Rm 302
Quincy, CA 95971
530-283-6240

March 28, 2003

Ms. Delores Brown
Chief, Mitigation and Restoration Branch
Dept. of Water Resources
3251 S Street
Sacramento, CA 95816

RE: SCOPING COMMENTS BY PLUMAS COUNTY – "Monterey Plus" Project - Plumas Watershed

Dear Ms. Brown:

Thank you for the opportunity to comment on the EIR Preparation. The proposed project includes a Plumas component in recognition of the importance of the northernmost state water contractor. The environmental review of that component should be programmatic, because site-specific environmental review will occur later as required as part of specific project approvals.

The Plumas watershed is the primary watershed of the Feather River. The watershed catches rain and snow, which enter streams through surface and groundwater. The streams that are tributaries of the Feather River supply Lake Oroville, the major northern reservoir of the State Water Project (SWP). There are three Upper Feather River reservoirs, Antelope, Davis, and Frenchman, which add 162,000 AF of artificial storage to the immense natural storage of the watershed.

The Plumas watershed, similar in area to the State of Rhode Island, is a hydrologic region funneling water to Lake Oroville. In general, if the watershed is degraded, the water is released more quickly than if the watershed is properly maintained in good condition, or restored, so as to release water during the late spring and summer when demand on Lake Oroville is highest. A properly managed watershed also contributes to flood protection.

Therefore, the EIR should depict the Plumas watershed as a strategic natural asset in the northern water supply system of the SWP. Specific benefits accrue from investments in the watershed, as follows:

a) Streamflow augmentation – the base flows of the streams are raised by managing the watershed in various ways to increase groundwater storage and aquifer recharge.

b) Water Storage in Meadows – wide mountain meadows provide storage for significant acre-feet of water late into the summer if downcutting of streams is reversed, and the meadow is managed to prevent bank erosion and compaction by cattle.

c) Floodplain Protection – the protection of floodplains also contributes to reduced flooding downstream and a more gradual release of water from the system.

d) Water Quality – is improved by sedimentation (nonpoint pollution) reduction. Stream bank stabilization by various means leads to a reduction in sediments.

e) Water Quality and Quantity Protection: Proper forestry and vegetative management lead to a more fire-resistant forest, with a semi-open canopy that facilitates percolation of surface water within semi-shade conditions. Thinning is needed to reduce the risk of catastrophic fire.

f) Watershed Protection Adds Value Through Recreation and Tourism – the Plumas watershed is known as a quality destination for recreation and tourism. The three Upper Feather River reservoirs attract many visitors. It is therefore important that the reservoir drainages, or sub-watersheds, be maintained in A-1 condition, through investments derived from the SWP. “Fourth priority funding” could be used.

Many of the benefits of watershed restoration have already been demonstrated on a small scale by the Coordinated Resources Management (CRM) program, which the Dept. of Water Resources has assisted in the past 10 years. “Monterey Plus” and its Plumas component will accelerate the pace of watershed work for the next 10 years. The program establishes a new relationship between the northernmost state water contractor and the SWP, including more collaboration on management of the Upper Feather River reservoirs.

The Plumas watershed emphasis is in some ways parallel to the Monterey Amendment’s emphasis on the Kern Fan Element (Kern Water Bank). In both cases, added water storage potential can augment supply capability in the SWP system, yet be subject to local control to ensure local benefits. Both are symbolic of the need for the SWP to evolve new programs and management practices to help meet the needs of the system and local service areas.

Sincerely,

Robert Shulman
Plumas County Counsel

Cc: Members, Board of Supervisors

United States Department of the Interior

BUREAU OF RECLAMATION
Mid-Pacific Regional Office
2800 Cottage Way
Sacramento, California 95825-1898

IN REPLY
REFER TO:
MP-150
ENV-2.00

FEB 21 2003

Ms. Delores Brown
Chief, Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

Subject: Response to Notice of Preparation (NOP) for an Environmental Impact Report (EIR) for the Monterey Amendment

Dear Ms. Brown:

We have reviewed the subject NOP and provide comments below. At this time we are only generally aware of the provisions of the Amendment, therefore, our comments are general in nature. Once a draft EIR is circulated we may provide more substantive and detailed comments.

Reclamation's concerns relate to the issue of how the Amendment and other provisions may affect the Central Valley Project (CVP) and State Water Project (SWP) responsibilities and accomplishments under the Coordinated Operations Agreement (COA). Rather than revising the COA, DWR and Reclamation have continued to implement the COA by extending its original terms to cover all the many changes in standards and other regulatory requirements that have occurred since 1986 when COA was signed. Since that time, we have seen a buildup in SWP water demands and the advent of water marketing as a major part of California water resource management. Water allocation procedures, re-allocation of water supplies, and water management enhancement strategies may affect the SWP, and thus the CVP. The current operation of the Kern Water Bank and the addition and current operation of MWD's eastside storage reservoir are two prominent influences on SWP operations that were facilitated by the Monterey Agreement. Neither of these facilities were considered in the development of the COA. Reclamation also continues to be concerned about current and future CVP access to SWP Delta pumping capacity. It seems likely that implementation of the Monterey Amendment has influenced that, as well.

It may be that the actions the SWP takes in "Monterey Plus" are entirely consistent with the COA. However, the issues raised with respect to the sufficiency of the current COA in addressing Reclamation's interests, in addition to the potential changes in SWP operations, may require an evaluation of the existing COA terms.

In essence we are requesting that the EIR examine in detail how the proposed action would affect CVP access to SWP Delta export capacity both from a historical and future condition perspective. In addition, should the proposed action affect CVP use of SWP Delta export capacity, the EIR should address the environmental and socio-economic effects of those changes.

We look forward to reviewing your Draft EIR when available and request that we be included on any mailing lists for that document. Please contact me if you have any questions relative to this matter at 916-978-50

Sincerely,

Frank Michny

Frank Michny
Regional Environmental Officer

SCOPE

Santa Clarita Organization for Planning the Environment

TO PROMOTE, PROTECT AND PRESERVE THE ENVIRONMENT, ECOLOGY
AND QUALITY OF LIFE IN THE SANTA CLARITA VALLEY

POST OFFICE BOX 1182, CANYON COUNTRY, CA 91386

3-28-03

Ms. Dolores Brown
Chief, Mitigation and Restoration Branch
Dept. of Water Resources
3251 S Street
Sacramento, Ca. 95816

Re: *Notice of Preparation for New Monterey Agreement EIR*

Dear Ms. Brown:

SCOPE was founded in 1987 by a group of residents that wanted to ensure adequate infrastructure accompanied development approvals. In the early 90s we addressed school over-crowding and library facilities. By the late 90s our concern had turned to the adequacy of water to supply required by the inordinate amount of new growth approved in our valley. We hope that this process will help put a stop to the mis-information disseminated locally in environmental documents. We request that we receive all environmental documents and notification.

We have been very concerned about the over-statement of state water supplies and hope you will address this issue through an analysis of article 18(a) and 18(b) and surplus water (article 21). We have litigated on this issue of properly reporting water supplies in Environmental Impact Reports, recently winning a strong opinion from the 2nd Appellate Court (*SCOPE v. Los Angeles County*).

We request that you also address the issue of the growth-inducing impacts and the conversely linked issue of loss of farm land seemingly promoted by water transfers.

Lastly, we would like to express a grave concern over the potential privatization and ensuing control, hoarding and manipulation of public water resources that may result from the Kern Fan water bank being 48% privately held. We are already seeing this occur in the Newhall Ranch Project where a private developer has purchased Kern River water and stored it in its private holding in the Semi-Tropic Storage Facility to serve *ONLY ITS OWN PROPOSED DEVELOPMENT*. This water is being channeled to new development in spite of a spreading ammonium perchlorate pollution plume in the local ground water aquifer that serves current residents. Such water hoarding must not be permitted. Please address these issues in the EIR.

Thank-you for your time.

Sincerely,

Pat Saletore

Pat Saletore

REPORTER'S TRANSCRIPT OF Scoping Meeting

Environmental Impact Report for Monterey Amendment to the State Water Project Contracts (including Kern Water Bank Transfer) and Other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources (SCH No. 200301118)

Thursday, February 6, 2003

Bakersfield, California

Reported by: Tya Hudspeth, CSR No. 7565

APPEARANCES

For URS Corporation:

URS Corporation
MR. JOHN A. DAVIS
Senior Consultant
111 SW Columbia
Suite 900
Portland, Oregon 97201

For Department of Water Resources:

MS. BARBARA McDONNELL, Chief
Division of Environmental Services
Department of Water Resources
3251 S Street
Sacramento, California 95816

Bakersfield, California

Thursday, February 6, 2003; 7:25 p.m.

JOHN DAVIS: Good evening. I'd like to welcome you all to the scoping meeting for the Monterey Amendment. What we'd like to do this evening is make a presentation for about 20 minutes, and then we'll have a question session, if there's anyone who has a question about the topic of the materials that have been presented. Because as what many of you know, Monterey Agreement is not a simple topic. So we would try to answer any questions you had. And then finally, we'll come to the part of the meeting that's most important to us, which is to hear your comments. Because we need those in order to shape the Environmental Impact Report or the Monterey Agreement.

So I'd like to hand over the mic to Barbara McDonnell, who's the Chief of environmental services for Department of Water Resources, and she'll make the presentation. And then later, I'll return and run the questions and the comments session.

BARBARA McDONNELL: Good evening. And if you didn't pick them up in the back are a handout of the slides that we're gonna go over, if you'd like to have those.

These board rooms are not really set up for these kind of presentations. They are set up to talk to the board. So this is a little difficult to kind of orchestrate. So I need to sit over here so I can work the -- the little eye thing here to move the slides. So I apologize for having to sit and be in the corner, but it's the only thing I could figure out on how to do this tonight.

Welcome. We're pleased that you are here tonight and happy that there's an interest in this project. And this is our scoping meeting to develop some comments, hopefully, from all of you. So it will be very helpful to us in preparing this document if you can give us your ideas, your interest areas for -- for our scoping process.

Why are we doing an EIR?

As required by the California Environmental Quality Act, the Department of Water Resources will prepare an Environmental Impact Report to the Monterey Amendment to the state water project contracts, including the Kern Water Bank transfer --

(Reporter interruption.)

BARBARA McDONNELL: -- and other contract amendments and associated actions as part of a proposed settlement agreement in Planning and Conservation League versus Department of Water Resources.

Okay. The purpose of our meeting is to obtain the views of agencies and interested parties. The department will conduct five scoping meetings throughout the state to obtain the views of agencies and other interested parties about the scope and content of the environmental information and analysis relevant to agency statutory responsibilities and stakeholder interests in the project.

By way of background. The State Water Project contracts date from the early 1960s. Each contract has been amended many times over the intervening years.

As water management in California has changed over the years, there were issues between the department and the contractors that the contracts had some provisions that ran counter to good financial and

water management practices.

The Monterey Agreement is a set of 14 principles agreed to by DWR and representatives of the water contractors in 1994 to remedy some of these problems. The Monterey Amendment is the amendment made to the contracts as a result of the Monterey principles. The amendment resolved the long-term water allocation issues and established a new water management strategy for the State Water Project.

The water allocation issue focused on Article 18 of the State Water Project contracts. Article 18 addresses the allocation of shortage in water supply and under what circumstances the initial reductions to agricultural use should be imposed before reducing allocations to urban contractors.

The contentious portion of the water shortage contract provision dealt with Article 18(b), which dealt with specified types of permanent shortages of supply of project water and stated that DWR would reduce entitlements in the event of a permanent shortage.

This Article 18(b) has never been invoked to date.

Article 18(a), which deals with cuts to agricultural contractors first during droughts and other types of temporary shortages has been invoked.

The Monterey Statement of Principles arrived at in December of 1994 resolved this allocation issue by proposing contract revisions that eliminated the initial agricultural use cutbacks and specifying that all project water would be allocated based on contractors' annual Table A amounts thereby eliminating the need for different shortage provisions.

In May of 1994, Central Coast Water Authority, serving as

lead agency, prepared a draft EIR to address the effects of implementing the Monterey Agreement Statement of Principles.

The final EIR was completed in October of 1995 and subsequently used by DWR to support the decision to amend certain State Water Project water supply contract provisions.

Since 1995, 27 of the 29 contractors have executed the Monterey Amendment. The few that have not are the Empire Westside Irrigation District and Plumas County Flood Control and Water Conservation District.

Then in December of 1995, the Planning and Conservation League sued the Department of Water Resources on the basis that DWR should have been the lead agency preparing the EIR, and that the lack of an analysis with respect to deleting Article 18(b) was a fatal flaw.

The lower court ruled in the department's favor, but the decision was overturned by the Third District Court of Appeal. The Court ruled that DWR had the statutory responsibility to serve as lead agency and the EIR failed to adequately analyze the effects of deleting Article 18(b).

The department and most of the State Water Project contractors have been in a settlement process with the Plaintiff since 2000. This process is nearing completion and will be included in the -- as the basis for the proposed project.

We should mention that PCL was joined in this lawsuit by the Plumas County Flood Control & Water Conservation District, which I'm gonna refer to as Plumas, and the Citizens Planning Association of Santa Barbara. So we term all three of these the Plaintiffs.

So that brings us to today and the reason for the scoping

meeting.

We are now starting a brand-new CEQA process with DWR as lead agency. The proposed project includes the original Monterey Amendment provisions as well as other contract amendments and actions to be carried out by DWR as a result of the proposed settlement agreement.

The objective of this project is to improve the operation and management of the State Water Project water supply through the Monterey Amendment and other contract amendments and to carry out associated actions of PCL versus DWR proposed settlement agreement.

The new EIR will evaluate potential environmental effects of the following five elements from the Monterey Amendment and additional actions.

Now, you'll recall that I said there were 14 principles, so what we've done is we've grouped those 14 principles into these first four bulleted elements.

The allocation changes for State Water Project water supplies, transfer of Table A amounts and land. Water management provisions, and financial restructuring.

Additionally, we're going to be talking about the potential additional actions from the proposed settlement.

Now, I'll go over each of these five bullets in a little bit greater detail.

Okay. First, the allocation changes for State Water Project water supplies.

What we are were included in these elements are the -- to allocate all water supplies in proportion to each contractor's Table A amounts, to eliminate the initial supply reduction to agricultural

contractors in years of shortage, to replace certain categories of water with a single category called (Interruptible Water) allocated on the basis of annual Table A amounts, and to eliminate the permanent shortage provision.

Now, for a definition of Interruptible Water. The department may make Interruptible Water available to contractors when it is not needed for fulfilling contractors' annual Table A water deliveries or for meeting project operational requirements, including reservoir storage goals. Interruptible Water has been made available during excess stealth (phonetic) conditions.

Okay. The second element is the transfer of Table A amounts and land. And this was to permanently retire 45,000 acre-feet of agricultural Table A amounts annually, to make 130,000 acre-feet per year of agricultural Table A amounts available for permanent sale to urban contractors, and to transfer the Kern Fan Element properties to local control.

And the Kern Fan Element of the Kern Water Bank was initially described in an EIR written in December of 1996.

DWR owned the Kern Water Bank lands but transferred the property to local control as part of the Monterey Amendment.

And the Kern Water Bank is located southwest of Bakersfield in Kern County.

Now, the transfers that we're talking about in terms of permanent transfers are listed here. And I think they are also on one of our displays.

So far, 111,781 acre-feet have been transferred. 18,219 acre-feet remain to be transferred.

And the agencies who have received the water from Kern

County water agency are the Mojave Water Agency, Castaic Lake Water Agency, Palmdale Water Agency, Alameda County Flood Control & Water Conservation District, Solano County Water Agency, and the Napa County Flood Control & Water Conservation District.

And we should mention that the Castaic Lake Water Agency transfer, while it has been essentially accomplished, they are going through a new EIR process on that. Their notice of preparation was published just recently, and that is available from the state clearinghouse. I haven't looked on their web site to see if it's available through there. But it is available. And that is an active EIR project that's just getting underway as well.

Okay. The next element is on the water management provisions.

These are to enable voluntary water marketing, groundwater banking, and improved use of existing State Water Project supplies, to allow groundwater or surface water storage of State Water Project water outside of the contractor's service area for later use within its service area, and to expand contractor's ability to store in San Luis Reservoir when space is available.

Other water management provisions are to permit contractors to withdraw and later restore water from the State Water Project terminal reservoirs, clarify terms for transport of contractors' non-project water, and to create a Turnback Pool for the annual sale of contractors' unneeded State Water Project water supplies to other interested contractors.

And the terminal reservoirs that we speak of here are Castaic and Perris. And these programs provide greater coordination in management of local and State Water Project supplies.

The financial restructuring element included establishing a State Water Project operating reserve and establishing a water rate management program when cash flow permits.

Now for some potential additional actions from the proposed settlement agreement.

First is to establish a Plumas watershed forum for watershed restoration, amend Plumas' State Water Project contract regarding shortages, impose additional restrictions on use of the Kern Water Bank lands or the Kern Fan Element lands, amend the State Water Project contracts to substitute the term "Table A amounts" for the term "entitlement."

Other additional actions are to disclose new procedures for State Water Project delivery capabilities, issue permanent Table A transferred guidelines, establish public participation procedures for certain contract amendment negotiations.

I will note here that the first bullet on here deals with the State Water Project delivery capability procedures. There is a draft report that -- there may be still some copies left on the table in the back. That draft report has been out for public comment for several months. I understand a final report is scheduled to be released later in February. Look on the DWR home page. You'll find the draft report. You'll find the comments that have been received. And later on, they will respond to the comments and issue the final report.

Okay. For the project location, it includes the State Water Project facilities, including the conveyance facilities and the Delta, the State Water Project service areas, including the Kern Fan Element lands and the Kern Water Bank, and the State Water

Project contractors' service area.

Now, depending upon the actions that we'll be evaluating under the proposed project, the area of influence could extend beyond these boundaries and the service areas, et cetera. So we just want to note that here, that while we have a project location, our analysis may lead us to extend the project area into some other slightly wider area. We don't know what that might be right now.

Okay. The environmental baseline.

As required by CEQA, an EIR must include a description of the physical environmental conditions in the vicinity of the project as they exist at the time of the Notice of Preparation.

The environmental setting normally constitutes the baseline physical conditions by which a lead agency determines whether impact is significant. Normally, the environmental baseline is the same as existing conditions. However, in the case of the Monterey amount amendment, the two are different. And this deals with the fact that actions have been completed under the Monterey Amendment.

So the baseline is going to be one of our issues that we have to deal with.

We have not yet identified the reasonable range of alternatives to be evaluated. However, to comply with the Court's instructions, we do know we will be evaluating a No Project Alternative with and without invoking Article 18(b) of the permanent short -- or the permanent shortage provision.

Okay. The EIR will analyze all resource categories that could be impacted by the proposed project. The proposed project's physical changes include re-operation of water deliveries with and without Article 18(b), reservoir operation changes, water storage in

the service areas, and the watershed actions in Plumas County, as well as other actions that we have previously described.

Okay. And at this time, I'm gonna turn it back over to John for the questions and public comments and to go over our schedule.

JOHN DAVIS: The slide here -- oh.

The slide -- previous slide showed you where to send your comments. I think there's some of the cards and the other information at the back has the same address on it.

This last slide shows the CEQA process. And I realize it's probably not to visible from where you are sitting. But it is in the back of the handout. And there really is a -- simply a flow chart showing the various steps that we have to go through in the CEQA process. We're right at the beginning right now. The first box was filing the Notice of Preparation and issuing it. That's one of the items on the table here today. And that was sent out in January. After that's sent out, there's a 30-day period in which we accept comments that we can then use to shape the scope of work for the Environmental Impact Report itself.

And, in fact, probably if comments came in a little later, we would still likely -- likely be able to accept them.

The main part of the work is preparing the draft EIR, doing the technical analyses that are necessary to analyze all of the components of the project that Barbara just explained to you. And we're expecting that that will take about a year. And we'll be working with an EIR committee which has representatives of the state water contractors, DWR, and the Plaintiffs in the lawsuit.

Our expectation is that the draft EIR will be published in

the Spring of 2004. And, at that point, they'll be another comment period, another opportunity for you and others who are interested to comment on what's in the draft EIR.

In the summer of 2004, we expect to be spending our time preparing -- considering the comments that we got and preparing responses to them, and then the Department of Water Resources expects to certify the EIR in the fall of 2004.

Findings then have to be adopted, and the project could be approved by the winter of 2004.

So that's the basic schedule. And as Barbara described to you -- I think she covered all the key points, many of which we're going to need to address in the EIR.

What I wanted to do first is simply ask if you have any questions or any needs -- need for clarification before we take your comments.

Clearly, you all fully understand that I may take your phone numbers and call you at some time for your clarification.

AUDIENCE MEMBER: We'd be happy to help you.

BARBARA McDONNELL: Can I have a show of hands for who in here are responsible agencies?

Pretty much. Yeah.

JOHN DAVIS: Okay. I'd like to move on to the comment period. And I'll take the cards in the order that I think they were handed in.

First speaker is Gary Bucher.

JOHN STOVALL: Actually, it might be better if Jim Beck went first.

JOHN DAVIS: Okay.

JIM BECK: I want to thank you for the opportunity to present testimony today. My name's Jim Beck. I'm the Assistant General Manager of the Kern County Water Agency.

The Kern County Water Agency is the largest agricultural contractor on the State Water Project, and we're the third largest urban contractor.

Overall, the agency is second only to Metropolitan Water District of Southern California in terms of Table A entitlement.

Our Table A entitlement is about one million acre-feet annually. Eighty-five percent of that water is used for agricultural production. The remaining 15 percent is used for residential and industrial purposes.

The State Water Project is very important to Kern County. It generates over a billion dollars a year in farm value in our county's economy. And when you add linkages to the entire local economy, the value of the State Water Project to Kern County nearly doubles.

The project provides irrigation water to nearly 600,000 acres of productive farmland in Kern County. About 35 percent of this acreage is planted in high-value trees and vines. And this farmland provides employment for over 32,000 people or about ten percent of our local work force.

Besides the direct and indirect economic values generated by the 600,000 acres, the state project provides water to help deal with Kern County's groundwater overdraft.

Since 1970, state project water supplies delivered over the groundwater basin have reduced pumping lifts for pumpers. Studies have shown that the value of the reduced pumping lifts is about 16

million dollars annually.

There are many benefits of the Monterey Amendment to Kern County. Prior to the amendment, agricultural contractors on the state project took the brunt of the shortages. Under the original state project master contract, the state was supposed to develop sufficient facilities to meet the needs of all of its contractors under a repeat of the 1928 through '34 drought hydrology. The Ag First Shortages were not to exceed about 175,000 acre-feet per year on average.

Because the state didn't develop capacity to meet the demands of its contractors, due partially to reductions in available water supplies because of increasing environmental regulations, the impacts of the ag-first shortages were borne disproportionately by the agricultural contractors, and in particular by districts on the west side of our county such as Belridge Water Storage District that -- these districts don't have alternative water supplies.

In 1990, the agricultural contractors suffered through a 50 percent shortage. This caused the loss of 12,000 acres of crops in Kern, and a corresponding 27 million dollars lost in crop revenues. In 1991, the agricultural contractors suffered a one hundred percent shortage, with a hundred and ten thousand acres idled and the loss of 385 million dollars in crop values. Nearly 7,000 jobs were lost. In 1992, agricultural contractors suffered another 55 percent shortage, resulting in 50,000 acres out of production, 130 million dollars in lost farm revenues and 2,000 jobs lost.

These consecutive shortages caused devasation on the west side of Kern County, where there were no alternative supplies other than the State Water Project. Because of the fact that our SWP

fixed costs must be repaid regardless of how much water we receive, we were saddled with paying 100 percent of the fixed costs, even though we received 50 percent, zero percent and 45 percent of our supplies in 1990 through '92. The debt burden caused a number of farm operators on the west side to go out of business. The effect of this was that the state project fixed costs had to be spread over a smaller number of farmers.

I've got about six more pages.

No. I only have one.

Economists that studied the effects of the drought for the agency concluded that an economic death spiral was imminent, unless something was done to increase the amount of water delivered by the project, or something was done to restructure financing. In addition to the impacts on our groundwater overdraft, the forced fallowing of tens of thousands of acres of agricultural land on our west side resulted in increased airborne dust.

On a more personal level, Fred Starrh, director of our agency and a family farmer who has been unable to be here tonight, tells of the anguish of turning away workers who had worked for him for years and years. He had to turn these workers away because he simply had no work for them because of the drastic shortages under the old contract.

The Monterey Agreement restructured the shortages suffered and payments made by agricultural contractors. A trust fund was established to stabilize payments when shortages occurred. Mechanisms were established to smooth the drastic variations in supply which threatened agricultural bankruptcy and loss of permanent crops. These were important improvements to the contract

that were achieved by the Monterey Amendment. Without it, we were in danger of entire water districts on the west side becoming insolvent. This would have impacted the long-term financial stability of the entire State Water Project.

I want to emphasize to you the importance of the State Water Project to Kern County's economy and its employment base, and the role the Monterey Amendment has played in helping to achieve a healthy agricultural economy in Kern County thereby improving the health of the entire Kern County economy which relies on agriculture as a mainstay.

Thank you.

JOHN DAVIS: The next card I have is Gary Bucher. But I wasn't -- is that the right order?

Would you prefer --

JOHN STOVALL: I'll jump ahead of him too. We pick on him all the time.

JOHN DAVIS: Okay.

JOHN STOVALL: Just for the record. John Stovall. I'm the general counsel of the Kern County Water Agency.

I wanted to tell you Barbara and John, and your staffs -- and before you get out of here that we really do appreciate your coming to Kern County. We know you've been running around the state doing this kind of thing, and I think the number of people here probably emphasizes to you the importance of the project to Kern County. Even though we have this huge room. We thought we were gonna be upstairs in the small conference room. We are very appreciative of your being here. And it's that -- I'm not gonna -- we submitted this statement that I'm gonna make, and I'm not gonna

read it word-for-word, but it's -- I'd like to emphasize a couple of things.

Because it's difficult for us to understand here -- and I think it's really important that -- that you and John understand the situation that existed back at the time the Monterey Amendments were entered.

As we sit here today, the agency, the other state contractors, and the department have a very constructive and creative relationship together. And we've worked out many -- I hate to use a trite
phrase -- but win- win solutions. And we think that in large part, the constructive atmosphere created by Monterey allowed those solutions to occur and allowed even the CALFED process to occur. And so
it's -- it's important for you to realize that that was not the situation back in 1994. In fact, the two points I'd like to raise is that we were very near litigation in 1994, and we were having extreme, very tough negotiations on the Kern Water -- Kern Fan properties at that time.

Regarding the first one -- and the reason I say this is because, as you analyze the alternatives, I think you have to consider the fact that a continuation of the status quo of the existing contract, as it was administered at that time, it truly wasn't feasible. Our agency having experienced the catastrophic losses in 1990, nineteen ninety -- particularly 1991 and '92 had come to the conclusion that we were, in fact, in danger of a death spiral. And, frankly, we -- if we were going down, we were gonna take a lot of folks with us.

We had come to the conclusion that we were going to go to court. We had spent many, many tens of thousands -- hundreds of thousands of dollars in preparation of a comprehensive lawsuit that we had prepared and were ready to file had Monterey not been entered. And we, of course, feel we would not have spent that money if we did not feel that we would have been successful in that lawsuit.

And it was, in fact, the Monterey Amendments that cut that litigation short and allowed the kind of constructive environment that we have today. So I think it's very important to consider that.

The other point I would like to make is that -- regarding the -- what we call Water Code Section 11258 contract, which is the contract required by the water code for the department to develop water banking facilities in a county, the department's required to enter into an agreement with the county water agency, our agency in this instance. And those negotiations had been underway for many years. And they are very tough negotiations.

And the point I'd like to make is that when you consider the environmental impact of this transfer, I think you have to consider that in those negotiations, we would have insisted on the same kind of local rights -- very significant local rights in the use of any water bank created in order for that contract to be signed. So the true environmental impact of the transfer is significantly diminished, because those -- the things that occurred, many of them we would have

insisted on occurring even if the department had retained the property and been able to turn it into a water bank, which was -- you know, we doubt that they could have done it as efficiently as we could. And you probably feel differently. But that I think is a consideration. But as far as this environmental review goes, the point we want to make is that the actual environmental difference from that transfer really is probably not that significant, and if there has been some, it's been beneficial. So --

That's my portion of the statement.

And I think if you want to -- Bill Talby I think was our next planned speaker. But there may be other folks, so --

JOHN DAVIS: Bill Talby.

BILL TALBY: My name's Bill Talby. I'm the Engineer/Manager at Wheeler Ridge Maricopa Water Storage District. I'm also a director and vice-chair of the Kern Water Bank authority. I am a registered civil engineer in the state of California and have 31 years' experience.

I'd like to direct my comments today toward the -- the Kern Water Bank, and in light of the -- the baseline issue note that the Kern Water Bank as we see it today is quite a substantially different facility from that which existed back in 1994 and 1995, the year in which the facility was transferred to Kern County Water Agency and subsequently to the Kern Water Bank Authority and the districts that make up that authority.

As John had just mentioned, the Water Code Section 11258 provides DWR with authorization to develop groundwater storage projects south of the Delta. But that -- that section has two conditions. I think John mentioned one. That a -- that the DWR

had to negotiate a -- an agreement with the entity within which the bank was to be located. The other condition found in 11258 is that the director of DWR has to determine that it was feasible to pursue a project within that -- as identified.

The land known as the Kern Fan Element of the Kern Water Bank consists of about approximately 20,000 acres located on the Kern Fan and is bisected by the Kern River originally offered to the department by Tenneco, who was in the process of selling all of their landholdings in Kern County, and as a result of the -- of the pressure at the time, DWR bought the property prior to completing any detailed feasibility studies with the agreement among DWR and the state contractors that it would be disposed of if it was not feasible to develop that property.

DWR faced significant physical and institutional legal challenges in attempting to develop the water bank. And DWR encountered difficulties in convincing the agency -- Kern County Water Agency and the districts surrounding the 20,000-acre property that its operation would not adversely affect them.

Consequently, a Section 11258 agreement was never entered into with the Kern County Water Agency.

The Department of Water Resources discovered they would encounter significant environmental problems, including the problem encountered as a result of the 1991 drought when farming operations were terminated on the property. The land thereafter left fallow, and various species of endangered species moved in, prevented the development of the property without substantial permits and restrictions on its use from wildlife agencies.

DWR never determined that it was feasible to develop a

water bank on the property. And, in fact, in 1994, prior to the Monterey Agreement DWR reported, quote, "design and planning activities for the Kern Water Bank facilities had been discontinued," end quote. Thereafter, leading up to the Monterey Agreement, the 20,000 acres was really surplus land which DWR wasn't sure what to with, and in consideration of the other elements of the Monterey Agreement, including retirement of the 45,000 acre-feet of water of the state project entitlement, was willing to transfer this property as part of the overall settlement.

From our perspective, acquiring the 20,000 acres and developing it into a water bank was a key consideration in going along with the Monterey Agreement. My district, for example, gave up Table A amounts for my district that amounted to approximately 25 percent of the 45,000 acre-feet or about 11,000 acre-feet. And we acquired through participation in the Kern Water Bank the ability to make up Table A amounts in exchange for supplies available in dry years at a local water bank.

It is noted that the transfer of the 20,000 acres was consistent with state policy of encouraging local control of groundwater banking projects, including the 2000 CALFED Record of Decision stating "CALFED agencies will facilitate and support locally supported, managed and controlled groundwater and conjunctive use projects."

As you are aware, following the trial court's decision in the PCL litigation, in accordance with the Monterey Amendments, the 20,000 acres was transferred to Kern County Water Agency, and then to the Kern Water Bank Authority, a joint powers authority made up of water agencies in Kern and Kings counties which wanted to

participate in the project.

Kern Water Bank Authority prepared an Addendum EIR and Environmental Assessment under NEPA for construction, development and operation of the Kern Water Bank, which was not challenged, and based on these documents, permits were issued by the wildlife agencies as part of a comprehensive habitat conservation plan and construction proceeded.

In developing the Kern Water Bank, we had to employ a different approach than DWR was originally contemplating in order to accommodate the needs of wildlife and satisfy the wildlife agencies that any take of endangered species would be minimized. As a general matter, spreading ponds were less formal than originally contemplated and as used in other local banking programs, with most areas left in their natural state.

The development of the Kern Water Bank under the Habitat Conservation Plan has allowed for conjunctive use of the property for water management facilities, reestablishment of historical reparian habitat and preservation of exceptional upland habitat.

To date, 77 new species have been identified on the property, including an increase from ten to 26 sensitive species observed since 1996.

We also had to develop an agreement with the surrounding water districts to insure that they would not challenge development and operation of the project, but to provide mechanisms to insure that there would not be significant adverse impacts on groundwater levels of neighboring wells as a result of operation of the project. This agreement was the 1995 Memorandum of Understanding with the surrounding districts.

We were able to develop this agreement while DWR had previously encountered difficulties in part because it was a prerequisite for the Monterey Agreement being implemented locally.

The Kern Water Bank Authority members have invested over 30 million dollars to develop the Kern Water Bank since acquiring the 20,000 acres from DWR.

Our members and their landowners and residents have become reliant on the Kern Water Bank. For example, in my district, in part because the Kern Water Bank is available as a dry year "insurance policy" providing approximately 50,000 acre-feet in a dry year, lands previously in row crops have been developed to permanent crops. If for any reason this supply is not available, significant economic and environmental impacts would occur.

Thank you.

GARY BUCHER: My name is Gary butcher. I'm the Water Resources Manager with the Kern County Water Agency. I'm gonna outline some of the major benefits to our agency and our districts as a result of the Monterey Amendment.

Of course, as was mentioned earlier, the amendment eliminated the Ag First Shortage provisions. And since the amendment, we've had two significant shortages, one in 2001 and one in 2002. Under the amendment in 2001, our ag entitlement allocation was 39 percent, which is about 342,000 acre-feet, and in 2002, our allocation was 70 percent, and for the ag portion, that was about 613,000, and together, those years -- those two numbers added up to 955,000.

If we had not had the Monterey Amendment during that time, the Ag First Shortage provision would have been applied, and our

2001 supply would have been about four percent or about 40,000 acre-feet, and our 2002 supply would have been 35 percent or about 352. The sum of those two years under the old contract would have been 392,000, and the difference between that and under Monterey, the total's 563,000 acre-feet for those two years. And of that number, 70 percent of it would have been lost to the non-groundwater areas of the county, and -- which would have probably resulted in something over a hundred and thirty thousand acre-feet -- or acres going out of production unless alternative supplies could have been found. Those kinds of shortages would have severely impaired or eliminated our ability to enter into some of these flexible water management agreements with other contractors that we've entered into, which we'll talk about a little later, banking for urban areas as an example.

The next item that was of major benefit was the reduced risk of bankruptcies.

Prior to the Monterey Amendment, because the fixed costs had to be paid independent of water supply, a shortage of 50 percent would double the unit rate for agricultural water from say $50 to a hundred dollars. And that created that kind of a variation in the unit cost of -- for agricultural was non-sustainable.

Under the Monterey Amendment, we have made available the ag and M&I Rate Management Funds. And these funds are used to pay for the fixed costs for water that's not delivered. And, of course, this has worked out very well. In 2000 and 2001, the unit rate that the farmer paid was the same unit rate he would have paid with a hundred percent supply. And the monies that they would have had to pay for water they couldn't get is money they have available to

enter into these banking programs and use that as an alternative source of water.

Another huge benefit to the -- our agency was the turnback pool. That was a way of -- of better allocating the water on a more timely manner. And what had happened prior to Monterey is the department had taken the position that al locate -- shortages should be allocated on request not on entitlement. And so that caused some contractors to request full entitlement even though their demands were less. And that was to avoid being cut or allocated more of a shortage. And in some cases, some contractors would get allocated water that they couldn't use, and they wouldn't return it in a timely way, and so it created additional shortages for us contractors that could take all of our entitlement.

So the Monterey Amendment solved that problem, one, by all of us agreeing to allocate shortages based on entitlement, but also by creating a turnback pool. And this is where contractors could identify their excess entitlement early, offer it back for purchase, and do that early in the year so that we can plant crops with it and put it to beneficial use. Since '96, our districts have purchased over 305,000 acre-feet of that kind of water. That simply wasn't available prior to Monterey.

We also expanded the carryover program under Monterey. There was an existing carryover program that allowed pre-irrigation water to be delayed and groundwater recharge to be delayed and carry over the following year. Monterey added to that what we call extended carryover, which allows particularly urban areas that need to insure their following year supply is firm will take some of their excess entitlement and request it a year in advance to carry

it over. And that has been a very successful program, particularly for Metropolitan, the largest contractor. Our member units since '96 have carried over about a hundred and forty-five thousand acre-feet.

The recent EWA program under CALFED, which came after Monterey, has been in operation since 2000 -2001, and that program, of course, protects the state entitlement from being reduced under ESA actions and that protects all the contractors' entitlement. Well, that program has been at the -- the water for that program -- a good portion of it has come from Kern County, and it's largely because of the local development of the Kern Water Bank. Without that facility, the EWA program would not have been as successful as it is.

In addition, we've had urban contractors, such as MWD, Metropolitan Water District, Santa Clara, Alameda, Zone 7, Castaic -- have all entered into banking arrangements with Semitropic and Arvin-Edison, and to date, they have stored collectively over 930,000 acre-feet in those two facilities, and that provides those urban areas with additional dry protection that was not possible prior to Monterey.

In addition, the expanded storage and recovery facilities in these two districts, Arvin and Semitropic, are also used by the districts for their own landowners when the urban agencies aren't using them. So we're able to use those facilities to further reduce the overdraft and to recover water when the facilities aren't needed by the urban contractors.

Lastly, as earlier pointed out, there have been permanent transfers of water from Kern under the Monterey Amendment. And at

the time of the negotiations, there were certain urban contractors who had demands that were increasing, so they were interested in purchasing additional entitlement. We were not willing to allow some of our contractors or our member units to sell entitlement because we knew the county was water short, and it didn't make a whole lot of sense. However, because of Monterey and the management tools that it provided, we were able to increase our water supplies from where it was, one, by eliminating the Ag First Shortages, and, two, by ability to bank wet year waters, being the water bank and other facilities. And those two positives were far greater than the negative of -- of allowing the hundred and thirty thousand to be sold. And because of the pieces of those benefits of Monterey, we were willing to do that.

The benefit of selling that hundred and thirty thousand allowed our -- our districts to downsize their -- or reduce their entitlement down to their new demand level, because they had permanently lost acreage and landowners. Most of the money from those sales went to cover the cost of the landowners that had gone bankrupt, and that helped stabilize and reduce the cost of the remaining landowners to stop the death spiral, as we called it.

And, again, without the Monterey Amendments, our agency was not -- was not in the position of being able to approve any of those transfers.

Thank you.

BARBARA McDONNELL: Can we have copies of your statements, please?

GARY BUCHER: Here you go.

BARBARA McDONNELL: That was easy.

JOHN DAVIS: The last card I have is Robert Kunde. I hope I pronounced your name correctly.

ROBERT KUNDE: That's very close. Much better than what I hear often on the phone in my office.

Is this on? Oh, good.

My name is Robert Kunde. I am a Registered Agricultural Engineer. I have practiced that profession since 1987. And I've worked in Kern County directly in agriculture for -- since 1983. My specialty is irrigation water supply and non-farm water management. I also serve as -- on the board of directors of the Kern County Farm Bureau, although I'm here tonight speaking on my own behalf.

I would like to emphasize the importance of the Monterey Amendments and their implementation to farmers and agriculture in Kern County. Many of the points have been made by other speakers. For instance, in 1991, Kern County Water Agency received no water from the State Water Project under the pre-Monterey Amendment condition and, also, directly as a result of the Ag First Shortage provisions under the old contracts.

In, addition, shortages were also suffered in other years, which had direct effects on agriculture, both -- not only through a reduced water supply but through increased costs, because as one of the speakers noted earlier, the fixed costs of the State Water Project remain the same in water-short years thereby driving up the unit cost of water received to very high levels in shortage periods.

The beneficial effect of the Monterey Amendment has been in three primary areas for the farmers for whom I work; providing an adequate supply of water, making sure that it is reliable and that

it is also affordable.

As an example, Gary Bucher referred to the Ag Trust Fund, which is a mechanism for ensuring stability of water rates during periods of shortage. This is a critical component for agricultural production in this county because wildly fluctuating rates, particularly in the Kern farm economy, and even in times when the economy is better, are very difficult to budget and obtain financing for in order to maintain operations.

Another point is that local conjunctive use, which has greatly expanded as a direct result of the implementation of the Monterey Amendments, Kern Water Bank and other local projects mentioned by the agency speakers, have resulted in an increasing reliability of supplies. That has come at the expense of transfer of some water supplies out of Kern County to other sources, but that is -- both of those are actually a benefit to farmers. The transfer of excess supplies which could not be utilized by farmers has -- had the effect of reducing their costs, and participation in local conjunctive-use banking projects as part of the Monterey Amendment package has improved the reliability of supplies for agricultural purposes.

The elimination of the Ag First Shortage clearly has been a benefit to agriculture in improving reliability of supplies necessary for agricultural production. The -- one of the items mentioned in the initial presentation was Article 18(a) and 18(b) under the contracts.

It is worth pointing out that if Article 18(b) were invoked, which would declare a permanent shortage on the State Water Project, that would have negative effects on the water supply, its

adequacy, reliability and affordability for farmers and agriculture in Kern County, because the supply would be reduced under that provision if the adequacy of the supply would be detrimentally affected. The reliability of the supply because of the reduced Table A amounts would be reduced, and because there may or may not be -- but I am assuming pre-Monterey without an Ag Trust Fund -- the affordability of the supply would become less as the fixed costs of the State Water Project would have to be spread across fewer acre-feet.

The environmental baseline was mentioned in the initial presentation. And I'd like to comment that I believe it is entirely appropriate for that environmental baseline to be based on conditions that are post Monterey Amendment. Farmers in Kern County have been relying on the implementation of those amendments for over six years, and those, therefore, represent the appropriate baseline of conditions from which to measure impacts.

Finally, I would urge the department not to reinvent the wheel where it's already been invented. There is an EIR, as you are well aware, already developed. Many of the points were not disputed in the PCL litigation. And I would urge you to take advantage of those and not -- and devote the resources to the incremental requirements of the PCL settlement rather than trying to reinvent the wheel and reevaluate impacts that have already been adequately evaluated.

Thank you for the opportunity to comment.

JOHN DAVIS: That was the last of the cards that I had, and I wondered if there's anyone else who has any comments tonight.

We appreciate the ones that you've made. It's very helpful

for us to hear from you at the beginning of the project when we can still shape our work to respond to your suggestions. So I want to thank you for coming tonight.

Did you have anything you wanted to add?

BARBARA McDONNELL: I just wanted to make a plea. I got Gary's comments. If I can have the others as well. Because I know you can go home and print them out again. Right? So if you could leave those with -- maybe with Delores on your way out, because -- and then we can get them fully into the record as well. So I'd really appreciate that. These were excellent comments from all of you tonight. They will be helpful to us in the analysis.

So thank you very much.

--ooOoo--

STATE OF CALIFORNIA)
) ss.
COUNTY OF KERN)

. I, Tya Hudspeth, a Certified Shorthand Reporter for the State of California, hereby certify that I was present and reported in stenotypy all the proceedings in the foregoing-entitled matter; and I further certify that the foregoing is a full, true, and correct statement of such proceedings and a full, true, and correct transcript of my stenotype notes thereof.

Dated at Bakersfield, California, on Wednesday, February 26, 2003.

Tya Hudspeth, CSR No. 7565

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SCOPING MEETING

THURSDAY, FEBRUARY 13, 2002

520 MAIN STREET

QUINCY, CALIFORNIA

Environmental Impact Report for Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources (Sch No. 20030118)

Reported by: Deirdre Hernandez, CSR No. 11737

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THURSDAY, FEBRUARY 13, 2003

CATHERINE McEFEE: I would like to welcome you all. This is the scoping meeting. And I'm going to read this because it's such a long title, for the Monterey Amendment to the State Water Project Contracts, (including Kern Water Bank Transfer) and Other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League versus Department of Water Resources Environmental Impact Report.

Today's meeting is to allow the public to provide input on what issues they would be interested in seeing evaluated in the EIR.

If you have not done so already, I would like to ask you before you leave to sign in on our sign in form.

Also, I want to make sure everyone has a handout because we're having a little audio/video difficulty. So we're going to ask you to follow along with the presentation in the handout.

I think the gentleman -- did you just arrive? Did you get -- do we need another? One more?

Before we begin with opening up the meeting for public comment we're going to have a presentation. But I also want to ask that if you are interested in speaking

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at today's meeting, that we do have cards we want you to fill out. If you've got one, please hand it to me.

And, now, I would like to go ahead and introduce Delores Brown, who is the chief of the

Mitigation and Restoration Branch, Division of Environmental Services for the Department of Water Resources, who will go through the formal presentation on the project and the process.

And with that, Delores.

DELORES BROWN: Thank you, Cathy. And thanks again for all of you for attending our scoping meeting. This is one of our larger crowds, so we certainly appreciate your coming.

Do I need to use a mic? Okay, great.

If you turn to your second slide, it asks the question: Why an EIR?

As required by the California Environmental Quality Act, the Department of Water Resources will prepare an environmental impact report for the Monterey Amendment to the State Water Project Contract, including the Kern Water Bank Transfer and other contract amendments and associated actions as a part of a proposed settlement agreement in the planning and conservation league versus the Department of Water Resources.

The Department will conduct five scoping

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meetings throughout the state -- and this is the fifth scoping meeting -- to obtain the views of agencies and other interested parties about the scoping content of the environmental information and analysis relevant to the agency's statutory responsibilities and stakeholder interest in the project.

I would like to review some of the background information that lead up to the Monterey Amendment EIR. And this would be the first EIR.

The state water project contract dates from the early 1960's. Each contract has been amended many times over the intervening years. As water management in California has changed over the years, issues arose between the department and the contractors, that the contracts had some provisions that ran counter to good financial and water management practice.

The Monterey Amendment is a set of 14 principles agreed to by the Department and representatives of the State Water Project contractors in 1994 to remedy some of these problems. The Monterey Amendment is the amendment made to the contract as a result of the Monterey principles.

The amendment resolved long term water allocation issues and established a new water management strategy for the SWP. The water allocation issues

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focused on Article 18 of the state water contracts.

Article 18 addresses the allocation and shortages in water supply and under what circumstances the initial reductions to agricultural use should be imposed before reducing allocations to urban contractors.

The contentious portion of the water shortage contract provision dealt with Article 18(b), which dealt specified types of permanent shortages of the supply of project water and stated that the Department would reduce

10 entitlement in the event of a permanent shortage, but
11 Article 18 has never been invoked.
12 Article 18(b), which deals with cuts to
13 agricultural contractors first during droughts and other
14 types of temporary shortages has been invoked.
15 The Monterey agreement's statement of
16 principles arrived at in December of 1994 resolved the
17 allocation issues by proposing contract provisions that
18 eliminated the initial agricultural use cutbacks and
19 specified that all project water would be allocated based
20 on contractor's annual Table A amounts. Thereby,
21 eliminating the need for different shortage provisions.
22 In May, 1994, the Central Coast Water
23 Authority, serving as the lead agency, prepared a draft
24 EIR to address the effects of implementing the Monterey
25 Agreement statement of principles.
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1 The final EIR was completed in October, 1995,
2 and subsequently used by the Department to support its
3 decision to amend certain state water contract water
4 supply provisions.
5 Since 1995, 27 of the 29 contractors had
6 executed the Monterey Amendment. The only contractors
7 who did not execute the amendment were Empire Westside
8 Irrigation District and Plumas Flood Control and Water
9 Conservation District.
10 In December of 1995, Planning and Conservation
11 League sued the Department on the basis that the
12 Department should have been the lead agency preparing the
13 EIR, and that the lack of an analysis with respect to the
14 leading Article 18(b) was a fatal flaw.
15 The lower courts ruled in the Department's
16 favor, but the decision was overturned by the Third Court
17 of Appeal. This court ruled that the Department had the
18 statutory duty to serve as a lead agency and the EIR
19 failed to adequately analyze the effects of the leading
20 Article 18(b).
21 The Department and most of the State Water
22 Project contractors have been in a settlement process
23 with the plaintiffs since 2000. This process is nearing
24 completion and will be included in the basis for the
25 proposed project.
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1 I should mention that the Planning and
2 Conservation League was joined in the lawsuit by Plumas
3 County Flood Control and Water Conservation District and
4 the Citizen's Planning Association of Santa Barbara,
5 collectively called the plaintiffs.
6 So that brings us to today and the reason for
7 the scoping meeting. We are now starting a brand new
8 CEQA process. DWR will be the lead agency.
9 The proposed project includes the original
10 Monterey Amendment provisions, as well as other contract
11 amendments and actions to be carried out by the
12 Department as a result of the proposed settlement
13 agreement.
14 The objective of this project is to improve the

15 operation and management of the State Water Project's
16 supply through the Monterey Amendment and other contract
17 amendments and to carry out other associated PCL versus
18 DWR proposed settlement agreement.
19 The new EIR will evaluate potential
20 environmental effects of the following five elements.
21 The allocation changes for the State Water Project water
22 supplies, transfer of Table A amounts and land, water
23 management provisions, financial restructuring, and
24 potential additional actions.
25 The first four elements represent a compilation
0008
1 of the first 14 principles. The last element will
2 address the additional actions required to implement the
3 proposed settlement agreement. I will review these
4 elements individually.
5 The allocation changes for the State Water
6 Project water supplies include allocate all water
7 supplies in proportion to each contractor's annual
8 Table A amount, eliminate initial supply reduction to
9 agricultural contractors in years of shortage, replace
10 certain categories of water with a single category called
11 interruptible water that is allocated on the basis of
12 annual Table A amounts. The final one is to eliminate
13 the current permanent shortage provision.
14 The second element, transfer of Table A amounts
15 and land would permanently retire 45,000 acre feet of
16 agricultural Table A amounts annually, make 130,000 acre
17 feet per year of agricultural Table A amounts available
18 for permanent sale to urban contractors, transfer Kern
19 Fan Element properties to local control.
20 The Kern Fan Element of the Kern Water Bank was
21 initially described in an EIR written in December of
22 1996. DWR owned the Kern Fan Bank, but transferred the
23 property to local control as part of the Monterey
24 Amendment.
25 For those of you who are not familiar with this
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1 program, the Kern Water Bank is located southwest of
2 Bakersfield in Kern County.
3 The next slide shows the Table A permanent
4 water transfer buyers under the Monterey Agreement.
5 Those purchasers include Mojave Water Agency, Castaic
6 Lake Water Agency, Palmdale Water Agency, Alameda County
7 Flood Control and Water Conservation District Zone 7,
8 Solano County Water Agency and Napa County Flood Control
9 and Water Conservation District.
10 So far 111,781 acre feet have been transferred
11 and another 18,219 acre feet remains to be transferred.
12 Now the water management provisions as an
13 element would enable voluntary water marketing, ground
14 water banking and improved use of existing State Water
15 Project facilities. It would allow ground water or
16 surface water storage of SWP water outside contractor's
17 service area for later use within a service area. It
18 would also expand the contractor's ability to store water
19 in San Luis Reservoir when space is available.

20 Additionally, the water management provisions
21 would permit contractors to withdraw and later restore
22 water from the SWP terminal reservoirs. The terminal
23 reservoirs are Castaic Lake and Lake Perris. This
24 program provides greater coordination and management of
25 local and SWP supplies.
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1 Additionally, it would clarify terms for
2 transport of contractor's non-project water and create a
3 Turnback Pool for the annual sale of unneeded SWP water
4 supplies to other contractors.
5 The financial restructuring element would use
6 SWP funds to establish an SWP operating reserve. It
7 would also establish a water rate managed program when
8 SWP cash flow permitted.
9 The potential additional actions included
10 establishing a Plumas Watershed Forum for watershed
11 restoration, amending the Plumas State Water Project
12 contract regarding shortages, imposing additional
13 restrictions on use of the Kern Water Bank lands and
14 amending the State Water contracts to substitute Table A
15 amounts for entitlement. The last element would address
16 provisions from the proposed settlement agreement.
17 Other actions under the potential additional
18 actions includes developing new procedures for disclosure
19 of SWP delivery capabilities. This process has begun and
20 a draft report on the SWP delivery capabilities has been
21 under public review for months.
22 A final report is scheduled to be released
23 later this month. This report will be updated every two
24 years and we would hope that you would look at the DWR
25 home page for any updates.
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1 The location of the proposed project includes
2 the State Water Project facilities (including conveyance
3 facilities in the Sacramento-San Joaquin Delta), the
4 State Water Project service area (including the Kern
5 Water Bank) and the State Water Project contracted
6 service areas.
7 Depending on the SWP contract actions under the
8 proposed project location, the area of influence could
9 extend beyond the SWP contractor's service areas.
10 As required by CEQA an EIR must include a
11 description of the physical environmental conditions in
12 the vicinity of the project as they exist at the time the
13 notice of preparation is published.
14 The environmental setting normally constitutes
15 the baseline physical conditions by which a lead agency
16 determines whether an impact is significant. Normally,
17 the environmental baseline is the same as the existing
18 conditions. In the case of the Monterey Amendment the
19 two are different.
20 We have not yet identified the reasonable range
21 of alternatives to be evaluated. However, to comply with
22 the court's instructions we do know we will be evaluating
23 the No Project Alternative with and without invoking
24 Article 18(b), the permanent shortage provision.

This EIR will analyze all resource categories

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that could be impacted by the proposed project. The proposed project's physical changes include re-operation of water deliveries (with and without Article 18(b), and reservoir operations, water storage in service areas, watershed actions in Plumas County, and other actions.

At this time, I would like to turn the meeting back over to Cathy McEfee who will discuss our CEQA schedule and the format for the rest of the meeting.

CATHERINE McEFEE: Thank you, Delores.

This is just the beginning of the public input portion of the CEQA process. And as noted earlier, and as Delores talked about, this is when we are asking for input on to the scope of the environmental impact report both from the public and both from agencies.

There are a couple ways that that can be achieved. If at today's meeting if you wish to speak, we are recording all comments that will be provided. We also have cards, if you don't want to speak, you can fill out. Or as noted in your handout, you can mail your comments to Delores, and the address is provided for you, or you can e-mail them to her.

We want to make sure if you have any comments, any input you want on the scope of the EIR we give you many opportunities to do that.

If you turn to the next page, it outlines the

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actual CEQA process. And as you can see we're up here. We're at the very beginning of the process where we issued the notice of preparation and we're taking comments on the scope.

The goal is to have a draft environmental impact report published in the Spring of 2004. And at that time, there will be another time when the public can provide input on the content and the adequacy of the analysis in the draft EIR. And we will have some hearings during that time, similar to these, where you can come and provide your comments. And you will be able to mail them or e-mail them in.

When we're done with the draft EIR, we've collected the comments that everyone provides us, we will provide written responses to all of the comments and publish what's call a final EIR. That document will provide the responses, and also identify if there are any changes to the text in the draft EIR. Then it will go to the Department for their consideration for certification.

At this time, I would like to just ask if there are any questions on Delores' presentation or on the CEQA process before I open it up for public comment.

Yes, sir.

TOM HUNTER: One of the items was amend Plumas County's regarding shortages. Could you enunciate a

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little bit on that?

DELORES BROWN: We have several people here from SWPAO that can speak to that better than I.

NANCY QUAN: That's part of the proposed settlement agreement. And right now because it's still confidential, we're not saying anything about it yet until it is settled.

TOM HUNTER: Okay. So in a month or so you can talk about it?

NANCY QUAN: Yes.

MICHAEL JACKSON: But the scoping is over.

TOM HUNTER: What's that?

MICHAEL JACKSON: But the scoping is over.

NANCY QUAN: Even if the scoping process has ended, we still welcome comments if you want to send them to us -- or to Delores, actually, when the process has ended.

CATHERINE McEFEE: Okay. I've received one speaker card. Is there anyone else who would like to fill one out?

Michael, would you like to go ahead and start? I've got your card first. If you could -- I don't know if you want to go and use this microphone here or --

And if I could ask you to go ahead and give your name and spell it for our reporter, that would be

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great.

MICHAEL JACKSON: My name is Michael Jackson, spelled J-A-C-K-S-O-N.

And I thank you for the opportunity to testify in the scoping meeting. I understand from the presentation that these oral comments will be turned into a written form and will be part of the transcript of the record of this hearing.

CATHERINE McEFEE: Correct.

MICHAEL JACKSON: Thank you. This particular document, first of all, needs to take into account the timed period that has passed since the original EIR was written. Most of the data in the original EIR is out of date and I think would be completely inapplicable as you begin to scope your way through a 2003-2004 time frame instead of the original decade ago.

Much has changed in the delta, and much has changed -- that is, which makes the State Water Project and it's operation under it's contracts critical. As your background information says, in 1994, DWR and the representatives of the State Water Project contractors agreed to a set of principles known as the Monterey Agreement.

Those principles in the context of 2004 are capable of causing much more environmental damage than

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they were originally believed to cause.

First, there's many more people in California at the present time. And there's many more competitions for water supplies. And the State Water Project is key to regional water supplies around the State of California because it presently has the only existing available capacity to pump more water from the Sacramento-San Joaquin Delta, that is likely to be

9 available for the next decade or two.
10 That capacity has been allocated a number of
11 times. It's been allocated to the environmental water
12 account of the Cal Fed program. Approximately 380,000
13 acre feet of additional capacity promised by Cal Fed and
14 DWR to the Cal Fed program. That capacity narrows the
15 windows that are available for the transfer of State
16 Water Project water, whether it be entitlement water or
17 whether it be interruptible water.
18 And so it seems critical that the Monterey
19 Agreement EIR take a look at the physical capacity of the
20 State Water Project system to deliver additional water
21 anywhere south of Clifton Court Forebay, anywhere on the
22 California Aqueduct system.
23 As the court made clear, it is very important
24 that we not be transferring paper water to land use
25 agencies throughout the urban areas of California that
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1 would use that paper entitlement to build houses for
2 which water might be unavailable given both the natural
3 drought system, the expanding population, and the limited
4 capacity at the state pumps.
5 I'm very happy to see that you've identified
6 Article 18(a) and Article 18(b) as important parts of the
7 existing state contract which are to be dealt with in
8 this environmental impact report.
9 The question of the Monterey Agreement
10 principle that deletes the agriculture first use cutback
11 in the face of the drought is even more important in 2003
12 and four than it was in 1993 and four when this
13 particular -- when the first EIR was being drafted.
14 It makes no sense, logically, to talk about the
15 substantial amounts of ag water that is going to be
16 transferred to urban uses for growth in California.
17 An example being the Colorado River transfer,
18 the Sacramento Valley transfer, the substantial number of
19 ag to urban transfers at the same time the state project
20 and the State of California are going in completely
21 opposite directions. Which is that in a drought, under
22 the existing rules before the Monterey Agreement,
23 agriculture would be cut back first so that cities would
24 have water for industrial and urban uses, municipal uses.
25 This EIR needs to look carefully at 18(a)
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1 because it seems on its face to be consistent with where
2 California is going in the year 2003. It requires that
3 ag suffer first and that urban and industrial uses have a
4 preference. And that seems to be consistent with Water
5 Code Section 109 and with a long process of California
6 law.
7 In regard to 18(b) -- thank you very much for
8 agreeing to take a good hard look at that as the court
9 ordered. 18(b), as it existed pre-Monterey Agreement,
10 was a preference for northern California water users,
11 both the ones that are present today and the ones that
12 have a right under the area of origin law to apply to the
13 state project for water rights in the future.

Those water rights are secured to the people of the Sacramento and San Joaquin drainage, but in particular the Sacramento drainage, by Water Code Section 11460 through 11464, by Water Code Section 10505 and 10505.5, by Water Code Section 1215 through 1220. All of which give a preference to in-basin users, and yet the Monterey Agreement removes the contract preference for the people of northern California.

So as that is analyzed, it would be very important to take a look at what the growth expectations are in the area above the Clifton Court Forebay pumps. What's going to be needed for the environment, what's

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going to be needed for the water quality. There are new water quality standards in the delta since the Monterey Agreement was drafted the first time and those standards ought to be looked at closely.

There are a number of endangered species which have been listed in all of the streams in the Sacramento and San Joaquin drainage and those critters need water.

And so the question of entitlement or interruptible water should be looked at with today's standards, not the standards from the original 1994 agreement.

Since that time, there have been laws passed at both the federal and state level that give guidance as to how much water is needed in terms of biological opinions for these critters. There is the Vernalis Adaptive Management Plan which has dedicated a certain amount of water to the fisheries as part of a program required by the State Water Board in Draft 1641.

There are substantial arrangements by State Water Project users to purchase non-State Water Project water. The Sacramento Valley Water Agreement is one source of that water. An approximate 200,000 acre feet that one of the State Water Project contractors is expecting to transfer this year.

And even though it is only a temporary one-year

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transfer, because of the problems in the Colorado River and the way they relate to the operations of the State Water Project facilities it would be important to take a look at all State Water Project contractors water sources whether they be from the state project or from alternative projects.

It's also important that in an examination of articles 18(a) and 18(b), that the document pays particular attention to the elimination of the permanent shortage provision.

It was a very wise provision originally in that Governor Edmond Brown and Adolph Moschcowitz and the others who designed the State Water Project placed in the contracts. And to simply remove it when water is more and more short, simply seems to go against state policy.

In terms of the transfer of Table A amounts and land, the document will, I understand, look at the transfer of Kern Fan Element to Kern County Water Agency

and to the -- what is now the Tulare Basin Ground Water Management Group.

That group is 47 percent owned by private parties and is using state public water and reselling it.

The question of whether or not that's legal is something that needs to be looked at. The state project bonds have not been retired. The vote on the State Water

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Project was secured by the bond -- by the placing of the master contract into the record before the voters.

The real question in the transfer of the 45,000 acre feet of agricultural Table A amounts, the 130,000 acre feet of agricultural Table A amount for permanent sale to urban contractors, and the transfer of the Kern Fan Element properties to local control is whether or not a gift of public funds is taking place from the State of California to a group of contractors.

And so this document ought to take a look at the history, and at the legislative history in particular, at a case called Goodman versus Riverside in which the question of the import of the master contract and the bonding would have on any ability to move land and water around.

In regard to the water management provisions, it's very good that the presentation today, straightforwardly pointed out that this is -- this project, this amendment -- Monterey Amendment, will enable voluntary water marketing, ground water banking, and improved -- it says on this thing -- use of existing State Water Project facilities.

Again, I've talked about the fact that State Water facilities are overburdened at the present time, but this document is going to mock some of that to find

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out whether or not there's water available.

I would like the document to take into account the recent report done for Senator Machado's committee by the California Research Bureau that points out that the present CALSIM monitoring is not consistent with reality.

In other words, the present CALSIM monitoring generally overstates the amount of water available for transfer, the amount of water available for ground water banking, and the amount of water available for any use of the capacity of the State Water Project facilities as about a million acre feet per year overstated.

This is a new form of paper water, not the form that the judge -- that the judges were talking about in the Third District Court of Appeals.

And the recent report to Senator Machado's Agriculture and Water Committee would provide a good place to start in your analysis for the Draft Environmental Impact Report.

The question of allowing ground water or surface water storage of State Water Project water outside of a contractor's area for later use within its service area should be examined completely.

You should look at the potential directions

where that water goes. At how often it would be used in a place. How often it would be used for a purpose that

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is different than the original State Water Project place of use and purpose of use.

The use of State Water Project contractor's service water was one of the topics that caused the Third District Court of Appeals to talk about paper water, because water gets moved in California temporarily. This year you sell it in Zone 7 in Alameda County. Next year you sell it in the Mojave Water District.

What we want to make sure doesn't happen and what the EIS/EIR should take a hard look at is whether or not when the water gets used in one year in Zone 7, they build houses in Alameda County. And then the next year the water is moved to the Mojave, where they build houses. And then the next year it's moved to Santa Barbara, where they build houses.

So the idea of floating water, whether it be paper or actual, is very apt to cause growth that will be damaging to the environment of California because it cannot be permanently sustained with the existing water supply.

In terms of the financial restructuring, I don't have a lot of comment yet, because I understand from the presentation that this is a new part of the Monterey Agreement. Basically, I would like to see the draft environmental document discuss the question of the

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relationship between -- about who owns the project.

Do the people of the State of California own the water and the project? Or do the contractors own the water and the project?

And as you can see, it would make a big difference. Because if there is extra water available in the system the State of California could sell it directly to new users or could sell it directly to users outside of the state water system but who are still citizens of the State of California and who have the same rights as anyone else.

So this document should take a look at the resale of the State's water that is received through their state water contracts, perhaps in years in which they don't need that water.

In other words, our contractors taking interruptible water over and above what they need in any given year for later resale and depriving the People of the State of California of the profit.

I believe that you should look very closely at doing much more than a Plumas County Watershed Forum for Watershed Restoration. The watersheds above the state project reservoir at Oroville are degrading substantially. The amount of holding capacity of the area above the watershed is being lost mainly for two

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reasons. Reason number one is that forest growth and overstocking from fire suppression are causing a

3 tremendous decrease in the amount of runoff.
4 Those of us who live here can see it as streams
5 that used to be perennial become more and more
6 intermittent. The intermittent streams become almost
7 ephemeral in dry years. The cause is the lack of
8 watershed management. And the cause of the lack of
9 watershed management as recounted by the State of
10 California, Mr. William Stewart from the California
11 Forestry Department in the Sierra Nevada Ecosystem
12 Project Report made it very clear that contrary to the
13 timber economy, or what's left of it, the water economy
14 which is 60 percent of the value of the Sierra ecosystem,
15 in terms of goods and services, returns nothing to
16 watershed maintenance.
17 Millions and millions of dollars are spent in
18 the Monterey Agreement on shuffling water around and
19 making infrastructure improvements so that urban and
20 agricultural water users can use the water more
21 efficiently and more economically. And what they are
22 doing is putting the environmental costs of the
23 deteriorating systems that provide the water off account.
24 In other words, they are not costs of the
25 project. If you put concrete in and transfer water, it's
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1 a cost of the project. If you use a river system in a
2 way totally unlike nature, it's not a cost of the
3 project. And so this environmental document should look
4 very closely on a re-re-investment mechanism to keep the
5 natural parts of the State Water Project infrastructure
6 producing the water that everybody wants to argue about
7 when it gets to the pumps.
8 Thank you for allowing me to --
9 Oh, one other thing. In regard to the existing
10 condition. The existing condition should be pre-Monterey
11 Agreement. The existing condition should be updated only
12 in the sense -- not with the Monterey Agreement
13 principles, but only to add D-1641, the Bay Delta Water
14 Quality Hearing, and the findings and principles of that
15 decision and the increased flows required by the
16 ecosystem restoration plan and the environmental water
17 account that are part of the Cal Fed project.
18 Thank you, very much.
19 CATHERINE McEFEE: Thank you.
20 MICHAEL JACKSON: And I have a little outline of
21 the ten points.
22 CATHERINE McEFEE: Thank you, very much.
23 Mr. Shulman.
24 ROBERT SHULMAN: Hello, I'm Rob Shulman, Plumas
25 County Counsel, and my remarks are made on behalf of the
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1 County Board of Supervisors and the Directors of the
2 Flood Control and Water Conservation District.
3 The County and district welcome this new EIR
4 because it will be a much more public and thorough review
5 of the State Water Project. We're the northern terminus
6 of the State Water Project and, of course, we know Perris
7 and Castaic are the terminal reservoirs.

Very few people in the state can describe the State Water Project. It's a tribute to many of you at DWR that you can keep it running and keep track of it. But we feel there's a need for the public, generally, to understand better how California's water is allocated -- not only allocated, but collected.

The collection is up here in the landscape that we live in. And we have a few small project reservoirs Lake Davis, Frenchman Lake, and Antelope Lake that are increasingly important both in our future and in the state's future.

So the Flood Control District of Plumas County, as a contractor, has an increasing stake in the State Water Project and feels that the -- the new contract amendments, which we call Monterey Plus, will be a very great benefit to the county and the flood district.

The Monterey Plus details are still confidential as was explained at the beginning of the

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scoping meeting. Although, it is planned for the Board of Supervisors to take action to approve that settlement next Tuesday.

Unfortunately, it will probably still remain confidential for several more weeks until we have an okay that all settling parties have signed.

So those details cannot be brought out at this time, and I want to talk a little more generally about water supply reliability because that is really what this State Water Project is about.

It's about making a water supply available throughout the service areas of the state and making it reliable. But that's not exactly in accordance with nature's plans because nature naturally causes variability to be the rule of the day. We have wet years. We have dry years. We never know what any particular year is going to be. And none of us know what's going to happen in the next three months.

But even though we have a context of unreliability in nature and a context of overall scarcity of water in this arid state with the growing population, we must all support efforts to provide water where needed in this state.

And to that extent, Plumas County supports efforts to wisely allocate water where needed, to do it

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efficiently -- if that involves market practices or other practices.

And we have confidence that this new Monterey Amendment Project will be explained and be found to be a rational and appropriate move that's in the interest of all people in the state. But, of course, the proof of that will be in the EIR that's completed.

So we, we in Plumas County wish you well and hope that we can make a contribution to this new EIR so that it becomes a foundational document in the water history of the state.

I would like to focus on the time frame of

the -- that the EIR uses. These are the first major amendments, perhaps, since the incipience of the project since the 1960's, and it will probably be the most important modification of the contracts for 20 or 30 years.

I would suggest taking a long time frame when you do your analysis in the EIR. Because of the population growth in California, because of the prospect of global warming which may reduce the Sierra snow pack, and, in general, this is a very significant document which will define the limits within which California has to live in the future.

Now, Plumas County has learned through this --

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the years since Monterey was unveiled that it has a lot in common with its contractor to the south known as Kern County.

Kern County water agency and the Kern County Water Bank have wisely utilized their geographical position and unique geological features to highlight their role as -- I guess I would call it a water switchyard.

Water is coming from the aqueduct, water is coming from the Kern River, and there's the Kern Water Bank and the Cross Valley Canal, it's all right there. And Kern said, look, we locals know maybe how to manage that a little better than the state, and with less threat to private neighbors and ranchers in the area.

So the state deeded fee title to the Kern Fan Element, which is a large flood plain, basically, at the mouth of the Kern River which soaks up water during flood events and it lends itself to replenishment and pumping out of water as needed. So it's an underground -- it's basically like a Lake Almanor under ground, probably a million acre feet capacity.

It is now under local control, and we assume it's being wisely managed. We hope that the EIR details somewhat how it is being managed so that everyone can be reassured that in fact it was an appropriate public

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policy decision to deed the Kern Fan Element from the state to local control.

But the parallel with Plumas is that we are the natural watershed and a natural storage area north of the aqueduct. When rain and runoff occurs, if it goes right out the Feather River into the delta it can be lost unless it's taken up as interruptible water. But it's really to everyone's benefit for as much precipitation as possible to remain stored in the meadows, the aquifers, and the base flow of our streams for timely release over the hot summer into Lake Oroville and then the Feather River.

It's a concept which has, in the past, received relatively little attention and now this EIR is a chance to highlight the potential for that. Even a small percentage of augmentation of supply increases reliability in the State Water Project.

And as you will see, the costs that are being talked about are not extravagant and they are hopefully an investment -- they can be seen as an investment that is wise to make year, after year, after year.

So Plumas is hopeful that the new components of Monterey Plus that deal with Plumas County will become permanent aspects of the State Water Project and will improve its -- the watershed capability above Lake

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Oroville and the Sacramento River watershed system.

It is all one system. And the public needs to know it's all one system. The people in southern California need to know that Plumas County is up here and that their water lands here on properly managed forests, in properly maintained stream channels, in lush meadows, and gradually comes down to them as a gift from above.

So we have fortunately had DWR's longstanding help in our coordinated resources management programs. And we're confident that we can work with DWR in the future on this. We would like to make watershed re-investment a major item in a long time frame involving the State Water Project.

And thank you for allowing me to make these comments.

CATHERINE McEFEE: Thank you. Anyone else like to provide comments?

If not, I'll go ahead and close the public comment portion of this scoping meeting.

And thank you all very much. And if you have any other questions, let us know.

{Scoping meeting concluded.}

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STATE OF CALIFORNIA)
) ss.
COUNTY OF SAN JOAQUIN)

I, Deirdre Hernandez, do hereby certify that I am a licensed Certified Shorthand Reporter, duly qualified and certified as such by the State of California;

That on the 13th of February, 2003, the said proceedings were by me recorded stenographically at the time and place herein mentioned; and the foregoing pages constitute a full, true, complete and correct record of proceedings.

That I am a disinterested person, not being in any way interested in the outcome of said action, or connected with, nor related to any of the parties in said action, or to their respective counsel, in any manner whatsoever.

Dated: February 21, 2003

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24 Certified Shorthand Reporter in and for the
County of San Joaquin, State of California

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IN RE)
)
ENVIRONMENTAL IMPACT REPORT)
SCOPING MEETING)
)
)

Transcript of Proceedings taken at 4080 Lemon Street, Riverside, California, commencing at 7:00 p.m., Tuesday, February 4, 2003, before Brooke Silvas, Certified Shorthand Reporter No. 10988.

BARKLEY
Court Reporters

APPEARANCES:

JOHN DAVIS
NANCY QUAN
DELORES BROWN
CLAIRE LEFLORE
BARBARA MCDOWELL
JERRY RIPPERDA

BARKLEY
Court Reporters

RIVERSIDE, CALIFORNIA; TUESDAY, FEBRUARY 4, 2003

7:00 P.M.

(The meeting was called to order. However, no members of the public appeared. Therefore, the meeting was adjourned at 8:05 p.m.)

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BARKLEY
Court Reporters

STATE OF CALIFORNIA)
) ss.
COUNTY OF RIVERSIDE)

I, Brooke Silvas, Certified Shorthand Reporter, Certificate No. 10988, for the State of California, hereby certify:

I am the person that stenographically recorded the transcript of proceeding held on Tuesday, February 4, 2003.

The foregoing transcript is a true record of said proceedings.

Dated February 17, 2003

Brooke Silvas

BARKLEY
Court Reporters

SCOPING MEETING

Environmental Impact Report for Monterey Amendment to the State Water Project Contracts (including Kern Water Bank Transfer) and Other Contract Amendments and Associated Action as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources (SCH No. 200301118)

Lead Agency: Department of Water Resources

REPORTER'S TRANSCRIPT OF PROCEEDINGS

Held at:

Resources Building Auditorium

1416 Ninth Street, First Floor

Sacramento, California

Monday, February 3, 2003

10:32 a.m. to 10:53 a.m.

Reported by:
CARRIE STOTTLEMEYER, RMR, CRR
CSR No. 4373
Job No. 36329

APPEARANCES

CATHERINE C. McEFEE
BARBARA McDONNELL
DELORES BROWN
NANCY QUAN
PEGGY BERNARDY
KATHERINE SPANOS

AUDIENCE MEMBERS

SACRAMENTO, CALIFORNIA

Monday, February 3, 2003

10:32 a.m.

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MS. McAFEE: I want to first thank all of you who are joining us this morning and just remind you, if you haven't done so, so please go ahead and sign in in the back and, if you were planning on speaking today, to fill out the speaker card, and the purpose of today's meeting is to take comments on the Monterey Amendment -- it's a very long title, so bear with me -- Monterey Amendment to the State Water Project Contracts Including the Kern Wear Bank Transfer and Other Contract Amendments and Associated Actions as Part of the Proposed Settlement Agreement in PCL Versus the Department of Water Resources, and I'd like to now go ahead and introduce Barbara McDonnell, she's the chief of the Environmental Services Branch, and Barbara's going to spend a few minutes telling you a little bit about the project, and then we will open up the meeting for public comment.

MS. McDONNELL: Thank you. And we're trying out our new auditorium setup here with a television monitor, so I'd like to hear some feedback on how that

works from the audience sitting there. Is that good or not? Because obviously we don't have to use those if we don't want to in the future.

Again, thank you for coming. This is our first scoping meeting for this particular project, so you're getting kind of the first run-through on the presentation, and why are we doing EIR? Well, as required by the California Environmental Quality Act, Department of Water Resources will prepare an Environmental Impact Report for the Monterey Amendment to the State Water Project contracts, which includes the Kern Water Bank Transfer and other contract amendments and associated actions, as part of a proposed settlement agreement in the Planning and Conservation League versus Department of Water Resources, and this is a very long title, and what I'm hoping to do this morning is explain that title and, in doing so, actually define the proposed project.

Again, the purpose of the meeting is to obtain your views, both agencies and stakeholders.

We are conducting five scoping meetings throughout the state to obtain the views of agencies and other interested parties about the scope and content of the environmental information and analysis relevant to agency statutory responsibilities and

stakeholder interest in the project.

The State Water Project contracts originally date from as early as the 1960's. Each contract has been amended many times over the intervening years. As water management in California has changed over the years, there were issues between the department and the water contractors that the contracts had some provisions that actually ran counter to good financial and water management practices.

The Monterey agreement is a set of 14 principles agreed to by DWR and representatives of the State Water Project contractors in 1994 to remedy some of these problems.

The Monterey Amendment is the amendment made to the contracts as a result of the Monterey principles. The amendment resolved long-term water allocation issues and established a new water management and financial strategy for the State Water Project.

Okay. As a way of further background information, the water allocation issue focused on Article 18 of the state water contracts.

Article 18 addresses the allocation of shortage in water supply and under what circumstances the initial reductions to agricultural use should be

imposed before reducing allocations to urban contractors.

The contentious portion of Article 18 was Article 18(b) which dealt with specified types of permanent shortages of supply of project water, so the contracts originally had Article 18(a) and 18(b), and so kind of remember that point for the future.

Okay. The Monterey Statement of Principles arrived at in December of 1994 resolved this allocation issue by proposing contract revisions that eliminated the initial agricultural use cutbacks and specifying that all project water would be allocated based upon contractor's annual Table A amounts.

So in essence what the principles did was to agree to sort of collapse 18(a) and 18(b) into a single article.

Okay. Then in May of 1994, the Central Coast Water Authority, serving as the state lead agency, prepared a draft EIR to address the effects of implementing the Monterey Agreement Statement of Principles.

The final EIR was completed in October of 1995 and subsequently used by DWR to support the decision to amend certain State Water Project contract provisions.

Since 1996, 27 of the 29 contractors have executed the Monterey Amendment. The exception to that, the two that have not, are Empire West Side Irrigation District and the Plumas Flood Control and Water Conservation District.

In December of 1995, the Planning and Conservation League sued the department on the basis that DWR should have been the lead agency preparing the EIR and that the lack of an analysis with respect to deleting Article 18(b) was a fatal flaw.

The lower court ruled in the department's favor, but the decision was overturned by the Third District Court of Appeals. The Court ruled that DWR had the statutory duty to serve as the state lead agency and that the EIR failed to adequately analyze the effects of deleting Article 18(b).

The department and most of the State Water Project contractors have been in a settlement process with the plaintiffs since 2000. This process has nearly concluded and is the basis for the proposed project.

We should mention that PCL was joined in a lawsuit by Plumas County Flood Control and Water Conservation District and the Citizens Planning Association of Santa Barbara. We term all three of

these the plaintiffs.

So that brings us to today and the reason for the scoping meeting. We are now starting a brand-new CEQA process with DWR as the lead agency. The proposed project includes the original Monterey Amendment provisions as well as other contract amendments and actions to be carried out by DWR as a result of the settlement agreement.

The objective of this project is to improve the operation and management of the State Water Project water supply through the Monterey Amendment and the other contract amendments and to carry out the associated actions of PCL versus DWR settlement agreement.

The new EIR will evaluate potential environmental effects of the following five elements from the Monterey Amendment and settlement process. I'm going to review each of these individually, and if you remember, we have 14 settlement principles, so we've grouped the principles into these elements, so we've collapsed the 14 down to four, and then the settlement agreement provisions are the fifth.

Okay. First of all, the Monterey Amendment would allocate all water supplies in proportion to each contractor's annual Table A amounts, eliminate

the initial supply reduction to agricultural contractors in years of shortage, replace certain categories of water with a single category called Interruptible Water, allocated again on the basis of Table A amounts, and eliminate the permanent shortage provision, and I wanted to give a definition of "interruptible water." The department may make interruptible water available to contractors when it is not needed for fulfilling contractors' Table A water deliveries or for meeting project operational requirements including reservoir storage goals. Interruptible water has been made available during excess delta conditions.

A second item is the transfer of Table A amounts and land, and the first item is to permanently retire 45,000 acre-feet of agricultural Table A amounts to make 130,000 acre-feet of agricultural Table A amounts available for permanent transfer and sale to urban contractors and to transfer the Kern Fan Element of the Kern Water Bank to local control, and the Kern Water Bank was originally described in EIR back in 1996. DWR at that time owned the lands, but we have now transferred those to local control as part of the Monterey Amendment.

And for those of you who don't know, the Kern

Water Bank is located southwest of Bakersfield in Kern County.

Now these are the permanent water transfers from Kern County Water Agency to urban contractors. So far 111,781 acre-feet have been transferred, 18,219 acre-feet remains to be transferred, so the agencies who have received the water are Mojave Water Agency, Castaic Lake Water Agency, Palmdale Water Agency, Alameda County Flood Control and Water Conservation District, Solano County Water Agency and Napa County Flood Control and Water Conservation District.

We did want to note that the Castaic Lake Water Agency transfer has not been made totally final. A notice of preparation was issued by Castaic Lake Water Agency last week, and they are preparing an independent Environmental Impact Report about this transfer.

Okay. The water management provisions included enabling voluntary water marketing, groundwater banking and improving use of existing State Water Project facilities, allowing groundwater or surface water storage of State Water Project water outside of the state water's -- within its service area and expand the opportunity to store water in the San Luis when space is available.

Additionally it permitted contractors to withdraw and later restore water from the State Water Project terminal reservoirs, clarify the terms for transport of contractor's non-State Water Project water and create a turnback pool for the annual sale of contractor's unneeded State Water Project water supplies to other interested water contractors, and the terminal reservoirs that I mentioned here are Castaic and Perris, and this program provides greater coordination in the management of local and State Water Project supplies.

The financial restructuring provisions were to establish a State Water Project operating reserve and to establish a water rate management program when cash flow permits.

Now for the provisions for the settlement agreement that are included in the proposed project, first is to establish a Plumas watershed forum for watershed restoration, amend Plumas's State Water Project contract regarding shortages, impose additional restriction on use of the Kern Fan Element lands of the Kern Water Bank and amend the State Water Project contractors to eliminate the use of the word "entitlement" in many cases and replace it with the term "Table A amounts."

Other provisions, we're to disclose a new procedure for State Water Project delivery capabilities, issue permanent transfer of Table A amount guidelines, establish a public participation procedure for certain types of contract amendments and provide certain funding to the plaintiffs for multiple purposes including Feather River watershed restoration.

The first item that deals with the delivery capability procedures, there is a draft report that DWR has had under public review for the past several months. A final report is scheduled to be released later this month, and I look for it on the DWR home page. There is a link already established for the draft report and the comments and the response to comments, and the final report will also be posted on that site.

As far as the proposed project location for the environmental document, it would include the State Water Project facilities including the delta conveyance facilities, the State Water Project service areas, including the Kern Fan Element of the Kern Water Bank, and also includes the State Water Project contractor's service areas where those may be larger than State Water Project service area.

Depending upon the particular State Water Project contractor actions under the proposed project, the area of influence could actually extend beyond these areas, and that will be determined during the preparation of the document.

As required by CEQA, the EIR must include a description of the environmental conditions in the vicinity of the project as they exist at the time of the Notice of Preparation. The environmental setting normally constitutes the baseline physical conditions which the lead agency determines against which the impacts may or may not be significant. Normally the environmental baseline and the existing conditions are one and the same. In the case of the Monterey Amendment, since we have some preexisting actions that have taken place, the two are going to be different.

We have not yet identified the reasonable range of alternatives to be included in the EIR; however, we do know that to comply with the Court's instructions, we will be evaluating a no project alternative with and without invoking Article 18(b), shortage provisions of the contracts.

As far as potential environmental effects, we will analyze all resource categories that could be impacted by the proposed project, and these impacts

will arise due to the physical changes such as the re-operation of water deliveries with and without Article 18(b), changes in reservoir operations, water storage in the contractors' service areas and outside their service areas, and watershed actions in Plumas County as well as other actions as part of the settlement agreement.

And with that I'm going to turn it back over to Kathy McEfee from IEP to talk about our schedule.

MS. McAFEE: Thank you. Thank you, Barbara.

First I would just like to again reiterate that one of the purposes of today's meeting is to provide input on issues to be evaluated in the EIR. There are multiple ways to do that. One is to provide verbal testimony today. We have a court reporter here who will record any comments. If you do not want to provide verbal comments today, we have comment cards that can be filled out and left on the back table. We also have some mailers that you can take with you and fill out and mail in, or you can also send by E mail to Delores at water.ca.gov.

I just wanted to now talk a little bit about the schedule. As you know, we are in the midst of the NOP circulation, the comment period closes on February 24th, so you have till that time to provide

the department with any comments on issues to be evaluated in the EIR. We will then spend the next year doing the analysis and developing a draft EIR that will be published in the late spring/early summer of 2004.

The next point at which the public will have input into the process will be during the circulation of the draft EIR, and that will be during the, again, late summer -- or, I'm sorry -- late spring/early summer of 2004. Once we receive those comments, and we will have a public hearing during that time or multiple public hearings as we have multiple public scoping meetings, we will then prepare responses to all comments received with the final EIR being published in the fall of 2004.

Before I open it up for any public comments, I would like to ask if there are any questions in the audience, either on Barbara's presentation or the purpose of today's meeting or the CEQA process.

Okay. With that, I know we did not receive any speaker cards, but is there anyone who would like to speak at today's meeting, like to open it up for public comment?

Okay. Having none, we'll go ahead and close the public comment period of the scoping meeting, and

thank you all very much, and if you have any other questions, we will be here for a little while, so please feel free to ask us. Thank you very much.

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REPORTER'S CERTIFICATE

I certify that the foregoing proceedings in the within-entitled cause were reported at the time and place therein named; that said proceedings were reported by me, a duly Certified Shorthand Reporter of the State of California, and were thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for either or any of the parties to said cause of action, nor in any way interested in the outcome of the cause named in said cause of action.

IN WITNESS WHEREOF, I have hereunto set my hand this _____ day of _____, 2003.

_____
CARRIE STOTTLEMEYER
Certified Shorthand Reporter
State of California
Certificate No. 4373

SCOPING MEETING

Environmental Impact Report for Monterey Amendment to the State Water Project Contracts (including Kern Water Bank Transfer) and Other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources (SCH No. 200301118)

Lead Agency: Department of Water Resources

TRANSCRIPT OF PROCEEDINGS

Ventura, California

Wednesday, February 5, 2003

Reported by:
LYNN ZINK
CSR No. 9466
JOB No. 36331

SCOPING MEETING

Environmental Impact Report for Monterey Amendment to the State Water Project Contracts (including Kern Water Bank Transfer) and Other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources (SCH No. 200301118)

Lead Agency: Department of Water Resources

Transcript of proceedings taken at 800 South Victoria Avenue, Hall of Administration, Board of Supervisors Hearing Room, Ventura, California, beginning at 7:28 p.m. and ending at 7:51 p.m. on Wednesday, February 5, 2003, before LYNN ZINK, Certified Shorthand Reporter No. 9466.

SPEAKERS:

BARBARA McDONNELL
Chief, Division of Environmental Services
Department of Water Resources

JOHN DAVIS, URS and BIP

CLAIRE LaFLORE
Legal Council
Department of Water Resources

NANCY QUAN
Analysis Office
Department of Water Resources
State Water Project

Ventura, California, Wednesday, February 5, 2003
7:28 p.m. - 7:51 p.m.

MS. McDONNELL: I'm going to kind of read a lot of this because, again, the words are so specific, I can't ad lib this stuff. So pardon my kind of reading my script, but I really want to get this correct. And then you can correct me if I'm off base from your perspective.

As required by the California Environmental Quality Act, the Department of Water Resources will prepare an Environmental Impact Report for the Monterey Amendment to the State Water Project Contracts (including the Kern Water Bank Transfer) and other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League versus Department of Water Resources.

The purpose of our meeting is, of course, to solicit your views on the Environmental Impact Report. We are conducting five scoping meetings throughout the State to obtain the views of agencies and other interested parties about the scope and content of the environmental information and analysis relevant to agency statutory responsibilities and stakeholder

interests in the project.

The State Water Project contracts date from the early 1960's. Each contract has been amended many times over the intervening years. As water management in California has changed over the years, there were issues between the Department and the Contractors that the contracts had some provisions that ran counter to good financial and water management practices.

The Monterey Agreement is a set of 14 principles agreed to by DWR and representatives of the State Water Project contractors in 1994 to remedy some of these problems. The Monterey Amendment is the amendment made to the contracts as a result of the Monterey principles. The Amendment resolved long-term water allocation issues and established a new water management strategy for the State Water Project.

The water allocation issue focused on Article 18 of the State Water Project contracts. Article 18 addresses the allocation of shortage in water supply, and under what circumstances the initial reductions to agricultural use should be imposed before reducing allocations to urban contractors.

The contentious portion of the water shortage contract provision dealt with Article 18(b) which dealt with specified types of permanent shortages of supply of

project water and stated that DWR would reduce the entitlement in the event of a permanent shortage. This Article 18(b) has never been invoked to date. Article 18(a), which deals with cuts to agricultural contractors first during droughts and other types of temporary shortages has been invoked.

The Monterey Agreement Statement of Principles arrived at in December of 1994 resolved the allocation issue by: Proposing contract revisions that eliminated initial agricultural use cutbacks, as in 18(a), and specified that all project water would be allocated based on contractor's annual Table A amounts, thereby eliminating the need for different shortage provisions.

QUESTION: So even in the context of this presentation you're already calling it Table A amounts.

MS. McDONNELL: Yes.

In May of 1994 Central Coast Water Authority, serving as Lead Agency, prepared a Draft EIR to address the effects of implementing the Monterey Agreement Statement of Principles. The final EIR was completed in October, 1995 and subsequently used by DWR to support the decision to amend certain State Water Project water supply contract provisions. Since 1995, 27 of the 29 contractors have executed the Monterey Amendment. The two that have not are the Empire West Side Irrigation

District and Plumas County Flood Control and Water Conservation District.

In December of 1995, the Planning and Conservation they sued the Department on the basis that DWR should have been Lead Agency preparing the EIR and that the lack of an analysis with respect to deleting Article 18(b) was a fatal flaw. The lower Court ruled in the Department's favor, but the decision was overturned by the Third District Court of Appeal. The Court ruled that DWR had the statutory duty to serve as Lead Agency, and the EIR failed to adequately analyze the effects of deleting Article 18(b).

The Department and most of the State Water Project Contractors have been in the settlement process with the plaintiffs since 2000. This process is nearing completion and will be included in the basis for the proposed project.

We should mention that PCL was joined in the lawsuit by Plumas County Flood Control and Water Conservation District, which we'll now call Plumas in the rest of the presentation, and the Citizens Planning Association of Santa Barbara. We call all three the plaintiffs.

So that brings us to today and the reason for the scoping meeting. We are now starting a brand new

CEQA process with DWR as Lead Agency. The proposed project includes the original Monterey Amendment provisions as well as other contract amendments and actions to be carried out by DWR as a result of the proposed settlement agreement. The objective of this project is to improve the operation and management of the State Water Project water supply through the Monterey Amendment and other contract amendments, and to carry out associated actions of PCL versus DWR proposed settlement agreement.

The new EIR will evaluate potential and environmental effects in the following five elements from the Monterey Amendment and also potential additional actions. And I had said previously there were 14 principles. So we've collapsed the principles into the first four categories just for ease of presentation, and then we'll talk about the potential additional actions.

So our first action is allocation changes for State Water Project water supplies: To allocate all water supplies in proportion to each contractor's annual Table A amounts, eliminate initial supply reduction to agricultural contractors in years of shortage, replace certain categories of water with a single category (Interruptible Water) allocated on the basis of annual

Table A amounts, and eliminate the permanent shortage provision.

Now, the definition Interruptible Water is pursuant to the water supply contracts, the Department may make Interruptible Water available to contractors when it is not needed for fulfilling contractors' annual Table A water deliveries or for meeting project operational requirements, including reservoir storage goals. Interruptible Water has been made available during excess Delta conditions.

The second element is the transfer of Table A amounts and land. And that is to permanently retire 45,000 acre-feet of agricultural Table A amounts, make 130,000 acre-feet per year of agricultural Table A amounts available for permanent sale to urban contractors, and to transfer the Kern Fan Element properties to local control.

The Kern Fan Element of the Kern Water Bank was originally described in the EIR written in December of 1996. DWR owned the Kern Water Bank but transferred the property to local control as part of the Monterey Amendment. And the Kern Water Bank, if you don't know, is located southwest the Bakersfield in Kern County.

Here are the permanent annual Table A transfer amounts that I spoke of that went to the various urban

contractors. So far 111,781 acre-feet have been transferred; 18,219 acre feet remain to be transferred. So we have water that's been transferred to Mojave Water Agency, Castaic Lake Water Agency, Palmdale Water Agency, Alameda County Flood Control Water Conservation District, Solano County Water Agency and Napa County Flood Control and Water Conservation District.

We want to mention that the asterisk transfer has been completed, but there is a new EIR that's being prepared for that, and notice of preparation has recently been submitted to the State Clearing House and is available to the public.

For the water management provisions, the amendments were to enable voluntary water marketing, groundwater banking, and improved use of existing State Water Project facilities, allow groundwater or surface water storage of State Water Project water outside of the contractor's service area for later use within its service area, and expand contractor's ability to store water in San Luis Reservoir when space is available.

Additionally, permitted contractors to withdraw and later restore water from the State Water Project terminal reservoirs, clarify terms for transport of contractors' non-project water, and create a Turnback Pool for the annual sale of contractors' unneeded State

Water Project water supplies to other interested contractors. And the terminal reservoirs that we speak of are castaic and Perris. This program provides or this element provides greater coordination and management of local and State Water Project supplies.

Financial restructuring included establishing a State Water Project operating reserve, and also establishing a water rate management program when cash flow permits.

Now, for the potential additional actions included in the proposed project description. First was to establish a Plumas watershed forum for watershed restoration with other (inaudible) watershed, amend Plumas' State Water Project contract regarding shortages, impose additional restrictions on use of Kern Water Bank lands, and amend the State Water Project contracts to substitute "Table A amounts" for "entitlement." And as you notice, in the presentations we've been using the word the phrase "Table A amounts" and not using the term "entitlement."

Also as part of the proposed project, could be to disclose new procedures for State Water Project delivery capabilities, issue permanent Table A transfer guidelines, establish a public participation procedure for certain contract amendment negotiations, and a draft

report on the State Water Project delivery capability, which is that first bullet up there, has been under public review for several months.

A final report is scheduled to be posted on the DWR home page web site in late February. So watch for that. And also will be posted all the comment letters and the responses to those comments. In fact, the comment letters may be up already. If you're interested in seeing the comment letters, they're posted. And this report is intended to be updated on a two-year cycle.

So that's the proposed project description. The project location includes the State Water Project facilities, which includes the conveyance facilities in the Sacramento-San Joaquin Delta, the State Water Project service areas including the Kern Water Bank lands and the State Water project contractors' service area. Now, depending upon the actions that are going to be evaluated, the area of influence could extend beyond the contractors' and State Water Project service areas.

As far as the environmental baseline goes, as required by CEQA, an EIR must include a description of the physical environmental conditions in the vicinity of the project as they exist at the time of the notice of preparation. The environmental setting normally constitutes the baseline physical conditions by which a

Lead Agency determines whether an impact is significant. Normally, the environmental baseline is the same as the existing conditions. In the case of the Monterey Amendment, the two are different.

We have not yet identified the reasonable range of alternatives to be evaluated. However, to comply with the Court's instructions, we do know we will be evaluating a no-project alternative with and without invoking Article 18(b) permanent shortage provision.

And the EIR will analyze all resource categories that could be impacted by the proposed project. The proposed project's physical changes include re-operation of water deliveries, with and without Article 18(b), and reservoir operation changes, water storage in service areas, watershed actions in Plumas County and other actions.

And at this time I'd like to turn it over to John Davis, who is our project manager from our consultant team or URS and BIP, to go over the project schedule.

MR. DAVIS: This is where we actually have members of the public and so we go into the CEQA process in more detail. I want to mention to you the schedule is a little different and a little longer than most EIR preparation schedules, and the reason is that we will be

working closely with the EIR committee to review various pieces of the EIR as it's put together.

So our expectation is that the draft will be available by the spring of 2004. It will be published at that point. Then there will be the public comment period. During the summer of 2004 we expect to be responding to comments, putting together the final EIR. And the final EIR would be certified in the fall of 2004. Ultimately the project would be approved in the winter of 2004.

So that's the schedule that we are expecting. At this point we would like to take any questions you might have on the project description. And then once we've responded to those questions, we'd like to hear more comments.

QUESTION: Barbara, I just want to make sure I captured this correctly. You said the project analysis could extend beyond the State Project service area and the contract service areas?

MS. McDONNELL: Yes. What we're trying to say is wherever the analysis takes us is -- you know, we're not going to cut it off at a particular jurisdictional boundary.

I think there's some differences -- and, Claire, maybe you can clarify this. There's some

differences between the State Water Project service area, the contractors' service area, and other areas that might be influenced by actions that go on. We certainly have that in Plumas County in terms of the watershed restoration and things like that. So we're not absolutely positive that all the analysis will stay within particular jurisdictional boundaries just depending upon the actions.

QUESTION: But is that just to allow for the possibility that the upper watershed would get contained in this or are we looking at downstream?

MS. LaFLORE: I don't think we're limiting it to the upper watershed.

MS. McDONNELL: No. We're not.

MS. LaFLORE: And it really depends on where the analysis takes us. We don't want to at this point have an arbitrary cutoff to the service areas because obviously, you know, it could influence the neighboring areas and that sort of thing, especially with these changes and such.

QUESTION: You're not going to be the reverse, that is, arbitrarily expand the area.

MS. LaFLORE: We're not planning to be arbitrary at all.

MR. DAVIS: The idea was to do the analysis, and

the analysis will help us define the affected area.

QUESTION: Could you explain in a little more detail what actions in Plumas County -- what you're trying to achieve there when it says watershed forum, sort of why those have gotten rolled into this. And then also the Kern Water Bank plan. I've just never --

MS. McDONNELL: I'm going to ask -- I should introduce Claire LaFlore from our legal staff and Nancy Quan from our State Water Project analysis office. And those are part of the proposed actions at this point because they're part of the proposed settlement agreement in some form or another. So that's about as much as we can say at this point.

MS. LaFLORE: We're not really at liberty to talk about it at this point, and we're hoping that within the next two weeks we will be at liberty to talk about it. But those are generally some of the proposals that are included in the (inaudible).

QUESTION: Can you talk about just what you're trying to achieve here? Is it just simply to get rid of one of the concerns of one of the litigants, or is there actually some water supply goal that you have here?

MS. LaFLORE: Well, I think, you know, it's really a combination, and the watershed -- it's dependent of the watershed and has to do with the water supply and

the availability for one of our upstream contractors. And so it's really a combination, and I don't really think we can address that much beyond that now. If you have comments on what you think would or would not be appropriate, then you can make that.

QUESTION: Has the Kern Water Bank plan fallen into that same category?

MS. LaFLORE: Well, the Kern Water Bank plan was definitely part of what was challenged in the lawsuit. And so it is part of the settlement.

MS. McDONNELL: The Kern Fan Element provision is -- I don't think we've got to date that that's a water management provision. It is part of the settlement issues.

QUESTION: On the alternatives, so I think I heard you correctly is to say the no-project alternatives will then include with or without Article 18(b) which is what this issue is saying? With or without Article 18(b) --

MS. McDONNELL: Invoked I think is the word that I used.

QUESTION: Does that mean you analyze just the fact that it's in the contract, or you actually conceptualize what would have happened had it been?

MS. McDONNELL: I think we're going to have to go through an analysis of the actual physical changes that

would occur if we invoked Article 18(b). Yeah, I think that's what the Court has instructed us to do. And then we also would evaluate it without ever invoking -- the no-project without invoking --

QUESTION: Which is would be what's happened.

MS. McDONNELL: What has happened, yeah, or what at least happened until the contracts were amended. So, yeah.

Turn it back over to John.

MR. DAVIS: Any other questions, comments? If any of you feel listening to this that you would like to make a comment later, there's a number of cards and things that would on the table at the back that you may fill out. If you have some thoughts later, you want to send us something, please do so.

Anything else? I think we'll close the meeting then. Thank you.

I, the undersigned, a Certified Shorthand Reporter of the State of California, do hereby certify:

That the foregoing proceedings were taken before me at the time and place herein set forth; that any witnesses in the foregoing proceedings, prior to testifying, were placed under oath; that a verbatim record of the proceedings was made by me using machine shorthand which was thereafter transcribed under my direction; further, that the foregoing is an accurate transcription thereof.

I further certify that I am neither financially interested in the action nor a relative or employee of any attorney of any of the parties.

IN WITNESS WHEREOF, I have this date subscribed my name.

Dated:

LYNN ZINK
CSR No. 9466

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SCOPING MEETING

Environmental Impact Report for Monterey Amendment to the State Water Project Contracts (including Kern Water Bank Transfer) and Other Contract Amendments and Associated Actions as Part of a Proposed Settlement Agreement in Planning and Conservation League v. Department of Water Resources (SCH No. 200301118)

Lead Agency: Department of Water Resources

Transcript of proceedings taken at 800 South Victoria Avenue, Hall of Administration, Board of Supervisors Hearing Room, Ventura, California, beginning at 7:28 p.m. and ending at 7:51 p.m. on Wednesday, February 5, 2003, before LYNN ZINK, Certified Shorthand Reporter No. 9466.

SPEAKERS:

BARBARA McDONNELL
Chief, Division of Environmental Services
Department of Water Resources

JOHN DAVIS, URS and BIP

CLAIRE La FLORE
Legal Council
Department of Water Resources

NANCY QUAN
Analysis Office
Department of Water Resources
State Water Project

3435 Wilshire Boulevard
Suite 320
Los Angeles, CA 90010-1904

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www.angeles.sierraclub.org

3-28-03

Ms. Dolores Brown
Chief, Mitigation and Restoration Branch
Dept. of Water Resources
3251 S Street
Sacramento, Ca. 95816

Re: Notice of Preparation for Monterey Agreement EIR

Dear Ms. Brown:

As you are undoubtedly aware, the Sierra Club, Angeles Chapter has been pro-active in its efforts to ensure accurate water reporting in the high growth regions of Los Angeles and Orange Counties. We have litigated on the issue of properly reporting water supplies in Environmental Impact Reports, at the Public Utilities Commission and in Urban Water Management Plans. We are therefore pleased with this opportunity to correct a large portion of the information that has been a source for over-stating water supplies in these various documents. We request that we receive all environmental documents and notification on this process. We are also pleased that the DWR will be the lead agency since this is a project of statewide concern.

We request that you address the following issues:

- the growth-inducing impacts and the conversely linked issue of loss of farm land
- the potential privatization and control, hoarding and manipulation of water resources that may result from the Kern Fan water bank being 48% privately held
- Proper reporting of state water supply and reliability
- An analysis of articles 18(a) and 18(b)

Thank-you for your time. We look forward to participating in this process.

Sincerely,
GORDON LABEDZ, M.D.
Chair
Conservation Committee

Faxed 3-28-03. Hard copy via regular mail.

ROBERT C. WILKINSON
1428 West Valerio
Santa Barbara, California 93101 USA

tel: (1-805) 569-2590 fax: (1-805) 569-2718
E-mail: wilkinso@lifesci.ucsb.edu

3/27/03

Ms. Delores Brown
Chief, Mitigation and Restoration Branch
Department of Water Resources
3251 S Street
Sacramento, CA 95816

By E-mail: delores@water.ca.gov

RE: Comments in Response to DWR's Notice of Preparation for Environmental Impact Report for "Monterey Plus"

Thank you for providing an opportunity for public comment and input on scoping for the Environmental Impact Report (EIR) for "Monterey Plus". I am submitting comments as a concerned citizen. Although these comments are offered as my own, I am a member of the Department of Water Resources' California Water Plan Update (Bulletin 160-03) Advisory Committee. The following comments are submitted in the interest of improved public policy with regard to water resources management.

DWR's Special Responsibility

DWR is both a major purveyor of water in California, and the ostensibly neutral and objective public entity charged with planning and administering water policy in the state in the public interest and public trust. These tasks at times appear to be in conflict. DWR is asking the citizens of the state to place trust in its analysis of the environmental impacts of its project and in its assessment of future water supplies and uses in California. At the same time, DWR is appropriating large amounts of water to sell, and it is making claims with regard to its own capabilities and supply reliability. It is therefore of critical importance that the department strive for objectivity, transparency, and accountability in its conduct of the new EIR process.

As the courts have clearly indicated, DWR failed to provide this important public agency role in its previous EIR effort on the same matter. Objectivity, transparency, and accountability were not in notable evidence. The result was a deeply flawed EIR and costly and time-consuming litigation to correct the deficiencies. The appeals court ruled unanimously that DWR failed to comply with the law.[1] Upon DWR's petition to the

California Supreme Court, not a single justice voted to grant review of the appellate ruling. Having seriously and substantively failed to comply with the California Environmental Quality Act in its first effort, and having been clearly directed by the courts to go back and do it right, DWR is now finally embarking on a second try. As the court admonished DWR in *PCL v DWR*, "CEQA compels process. It is a meticulous process designed to ensure that the environment is protected."[2] The public has a right to expect a very different approach to the analysis this time around.

DWR's burden is in fact more than properly framing this new EIR in the scoping process and then fully and properly analyzing the impacts and alternatives as dictated by CEQA. DWR is the contracting entity on behalf of the citizens of California and the bond-holders for the SWP dating back to the original Burns-Porter Act.[3] As such, DWR's assessment of its own legal rights and capabilities to extract and divert water to sell, and its analysis of the impacts of the "project" as defined in the current scoping process, must be beyond reproach.

To restore and fulfill this public trust, DWR must rise well beyond past performance. The current scoping process is the first test of DWR's recognition of both its legal responsibilities and its obligations.

The Monterey "Agreement" and "Amendments" as a Project

The 1994 Monterey Agreement was in fact a "deal" made in secret meetings in Monterey. DWR met with six contractors in closed and unnoticed sessions to acknowledge the reality that the State Water Project (SWP) could not deliver anything close to its contract or "entitlement" amounts as set forth in "Table A" of the SWP contracts. During the 1980s, the SWP delivered just under 2 million acre feet per year (mafy) on average. (See the SWP deliveries graph below.) During the drought, the SWP's deliveries dropped to a low of about 0.5 mafy against contract "entitlements" of over 4.2 mafy. Farmers and urban agencies were cut short, and the Metropolitan Water District of Southern California (MWD) had its "requests" for SWP water deliver "adjusted" down by DWR.

The appellate court in *PCL v DWR* noted that the contracts (pre-Monterey) provided the mechanism to correct the problem: "Those who negotiated the existing long-term contracts anticipated water shortfalls and incorporated article 18 as a mechanism for resolving both temporary and permanent shortages."[4] Rather that invoke the contract provisions that were designed to deal with this situation (correct the Table A amounts to reflect reality), DWR chose to change the terms of the contracts and eliminate the existing mechanism.

Article 18(b) contract provision was included to deal explicitly with the possibility of the present permanent shortage situation

Article 18(b) was written into the SWP contracts specifically to address the situation, foreseen as a possibility by the contracting parties at the time the contracts were signed and therefore included, that the SWP might not be capable of delivering full entitlement amounts. In the event of a permanent shortage, 18(b) "shall" be invoked. The language is clear; invoking 18(b) is a necessary and required action in the event that the SWP cannot deliver the water.

Both "tests" in paragraph 1 of 18(b) seem to be met:

> *"In the event that ...the State is unable to construct sufficient additional conservation facilities to prevent a reduction in the minimum project yield"*

or, (Note: 18(b) stipulates only "*or*", not "*and*"):

> *"... if for any other reason there is a reduction in the minimum project yield, which, notwithstanding preventative or remedial measures taken or to be taken by the State, threatens a permanent shortage in the supply of project water to be made available to the contractors: ..."*

Under these circumstances, by the terms of the contracts:

> The annual entitlements and the maximum annual entitlements of all contractors, except to the extent such entitlements may reflect established rights under the area of origin statutes, shall, by amendment of Table A included in Article 6(b), and of Article 7(b), respectively, be reduced proportionately by the State to the extent necessary so that the sum of the revised maximum annual entitlements of all contractors will then equal such reduced minimum project yield . . . ." [5]

Note that the language in the contracts indicates a *mandate* that the state correct the contracts to reflect reality. The language is explicit:

> *"…shall … be reduced proportionately by the State* to the extent necessary so that the sum of the revised maximum annual entitlements of all contractors will then equal such reduced minimum project yield . . . ."

In the scoping of the new EIR, it will be important for DWR to include a full examination of the option of correcting the pre-Monterey contracts according to this provision. As the court of appeal noted, this must be included in the EIR's assessment of the "no project" alternative. Correcting the Table A amounts according to the 18(b) provision would not

necessarily change the pre-Monterey provisions for differential pricing and delivery reliability between agricultural and urban users. This should be examined as well.

DWR also sought to transfer real property under state ownership (the Kern Fan) and its water system without public notice and without direct compensation to the state. An indirect deal involving "retirement" of SWP agricultural entitlement volumes was later advanced as due consideration for the state's asset. The "water bank" asset on, and underlying, this Kern Fan and its operation (and profits) were to be transferred under the deal. According to the settlement agreement, the EIR is to include all aspects of the Kern Bank transfer. This should include the various sources of water that find their way into the bank (e.g. San Joaquin River water via the Friant-Kern Canal, Kern River water, SWP water, and other sources), the reliability of and legal rights to those waters, the water extracted and sold from the bank, and other issues relating to the bank.

The deal cut in Monterey in 1994 was originally designed to avert litigation by and between the specific parties involved. It was not necessarily a deal that prioritized or protected the interests of the people of California who own the SWP. The subsequent EIR prepared by one these parties on behalf of the state (CCWA, one of the participating parties in the Monterey meetings) was deemed deficient under CEQA. After nearly a decade of litigation to correct the problem and a lengthy mediation that ultimately produced a proposed settlement, the state has a new opportunity to fulfill its duties, this time with the benefit of input from constituencies who were not invited to the Monterey meetings. The new EIR will, one would hope, make up for the serious failure of DWR in round one.

It is essential from the standpoint of the public interest that DWR clearly identify and frame the new "project" and then proceed with a proper EIR analysis under the requirements of the law. As the court in *County of Inyo v. City of Los Angeles* noted: "an accurate, stable and finite project definition is the *sine qua non* of an informative and legally sufficient EIR."[6]

Specific Elements to be Included in the Scope of the EIR

The scope of the EIR should include the following elements:

DWR Water Rights and "Surplus" Water

The state has legal rights to certain waters from the Feather River watershed, and it pumps "surplus" water out of the delta. Most of the water DWR extracts water from the delta is in fact unclaimed "surplus" water, not Feather River water. Because DWR is a "junior" appropriator relative to most of the other entities with claims to water within the watershed, this surplus water may not exist under a number of circumstances. (We have seen recently what reliance on "surplus" Colorado River water can lead to.)

The EIR should clearly set forth DWR's water rights and the amounts of water DWR is extracting as "surplus". Under pre-Monterey contracts, "surplus" water is accounted for differently than in the proposed project. The EIR should clearly identify the impacts under a no-project option and under the proposed changes. Under both, the EIR needs to clearly identify the basis for assumptions regarding where the "surplus" water (renamed "interruptible" water in the Monterey contracts) is coming from and who else may have senior claims to it (e.g. area of origin users, diverters with water rights senior to DWR, etc.).

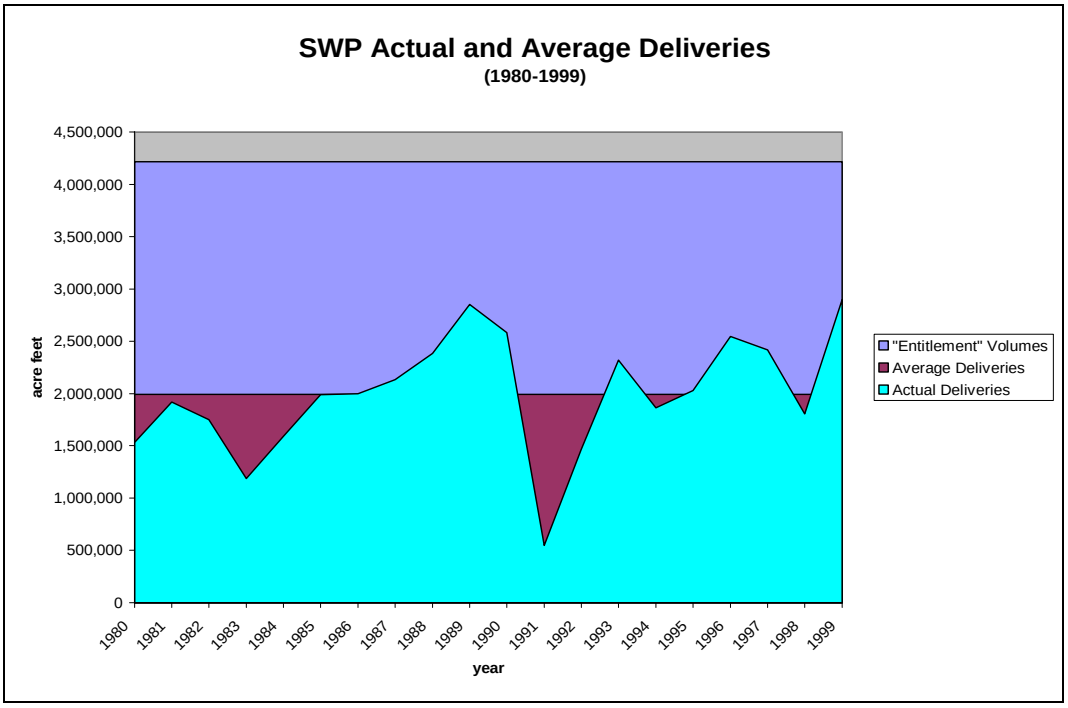
The EIR should also clearly set forth the full range of constraints under law to restore and protect the delta ecosystem and species that rely on it, and it needs to make a reasonable effort to project ahead and consider further constraints. These legal requirements for flows, salinity, temperature, and other factors may seriously limit the old notion that ample "surplus" water is available for extraction from the delta.

If "surplus" water is unavailable to DWR due to uses by more senior appropriators and/or upstream users exercising their legal claims to water, and/or due to water quality, environmental, and other legal requirements, the SWP's ability to deliver water will be impacted. This is unquestionably the case. It would appear that the mid-1900s notions (when the SWP was originally established) of "surplus" water assumed that virtually all water flows were available for diversion and extraction. What was considered "surplus" then may now be understood to be critical flows for threatened and endangered species. The EIR should examine both the definition and the impacts of "surplus" water, or the lack of it, under pre-Monterey conditions and under the proposed project.

The impacts of extracting both surplus water and water to which DWR holds rights should examined in the EIR.

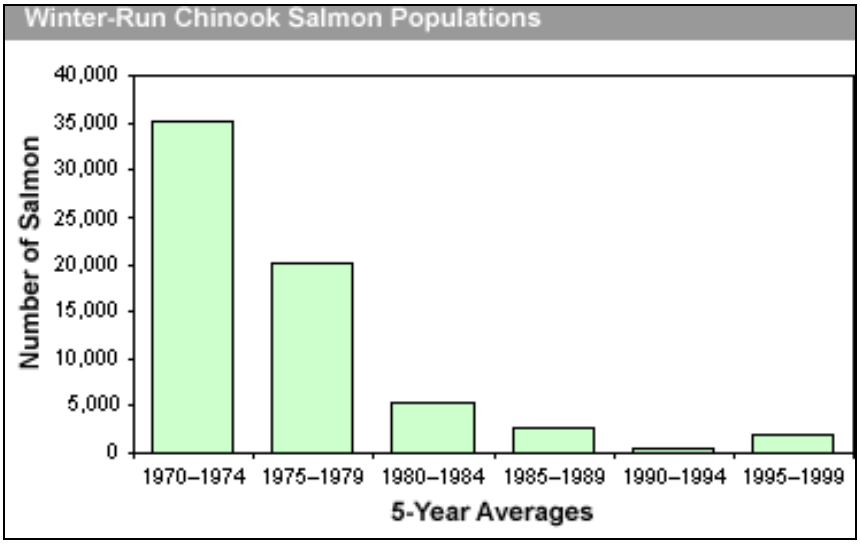
DWR's Assertion of SWP Reliability

DWR released a draft report in 2002 asserting that the SWP can *reliably* extract and deliver – *on average over time* – about 1 million acre feet *more water* than it delivered in the 1980s or the 1990s.[7] During the 1980s, the bay-delta ecosystem was deteriorating and certain fish populations were in serious trouble. In the 1990s, several fisheries collapsed and several species were listed. The following graph indicates the actual and average deliveries of the SWP. Note both the high degree of variability (reliability) in deliveries. Also note the steady average of 2 mafy through the past two decades. (Data for 2000, 2001, and 2002 appear to follow both the trends in variability and averages, though DWR had an all-time high year in these three years.)



Sources: DWR Bulletins 132 from 2001 and 1990.

As noted, during the time represented in the graph, ecosystems were seriously impacted and species declined sharply and were listed. In 1990, the winter run Chinook salmon, an anadramous fish, became the first salmon run to be listed under the *Endangered Species Act* in the United States. The run had declined from 118,000 in 1969 to just 533 adults in 1989. The following graph indicates the decline of the winter run Chinook salmon since the 1970s.



Source: Natural Resources Defense Council, 2001. Based on the California Department of Fish and Game, http://www.nrdc.org/greengate/water/divertedf.asp

A reasonable conclusion is that water extractions are related to environmental impacts and that increased extractions are at least partly responsible for declines in fish populations. The EIR will need to examine the impacts of changes in extractions under both pre-Monterey and proposed project conditions. An increase of 50% in extractions from the delta (from an average of 2 mafy to 3 mafy) as set forth in DWR's draft reliability report, requires careful analysis in the EIR for a wide range of impacts.

Integrated Assessment of the SWP and CVP

The State Water Project and the Central Valley Project extract water from the delta in a coordinated management program – including pumping, storage, and conveyance. Both systems must therefore be examined in an integrated way. The joint operation of the SWP and CVP, together with impacts of extractions, shortages, physical constraints, and legal constraints must be examined. The Bureau of Reclamation has submitted comments in this scoping process requesting that the EIR examine potential impacts on the CVP. Similar comments were submitted by commenters on the SWP reliability draft report prepared by DWR.

Neither the SWP nor the CVP can deliver all the water that users might like to have, or even volumes that have been contracted for. Both systems are constrained by various physical and legal limits, and both are causing serious environmental impacts including impacts on threatened and endangered species.

Given that neither system can deliver the full volumes of water they "promised" to users back in the mid-1900s, the EIR will need to analyze both the limits of the systems and the tradeoffs between them. For example, how can the SWP extract and deliver an additional million acre feet of water per year – reliably and on average over time – without seriously impacting both CVP operations and the environment.

The No Project Alternative

The no project alternative in this EIR needs to include a careful examination of the impacts of managing the limited water supplies in the SWP system under provisions and terms included in the pre-Monterey contracts. The "existing conditions" as described in CEQA are the pre-Monterey contracts. The law also requires that the EIR examine "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services."[8]

The court in *PCL v DWR* provided the following comment on CEQA and the no project alternative: [9]

> "CEQA is a comprehensive scheme designed to provide long-term protection to the environment. [Citation.] In enacting CEQA, the Legislature declared its intention that all public agencies responsible for regulating activities affecting the environment give prime consideration to preventing environmental damage when carrying out their duties. [Citations.] CEQA is to be interpreted 'to afford the fullest possible protection to the environment within the reasonable scope of the statutory language.' [Citation.]" (*Mountain Lion Foundation v. Fish & Game Com.* (1997) 16 Cal.4th 105, 112.)
>
> Both the mandate and the mechanism of CEQA are carefully crafted and well ingrained into the law of this state. (*County of Amador v. El Dorado County Water Agency* (1999) 76 Cal.App.4th 931, 943.) The environmental impact report, with all its specificity and complexity, is the mechanism prescribed by CEQA to force informed decision making and to expose the decision-making process to public scrutiny. (*No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal.3d 68, 86; *Galante Vineyards v. Monterey Peninsula Water Management Dist*. (1997) 60 Cal.App.4th 1109, 1123.) The EIR is, as the courts have said repeatedly, the "'heart of CEQA,'" "an 'environmental "alarm bell,"'" and a "document of accountability." (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 392 (*Laurel Heights*).)
>
> CEQA requires that the no project alternative discussed in an EIR address "existing conditions" as well as "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." (Guidelines, former § 15126, subd. (d)(4), now § 15126.6, subd. (e)(2).)

The settlement agreement indicates that DWR has agreed to include in the new EIR, as part of the no project alternative:[10]

> An analysis of the effect of pre-Monterey Amendment SWP contracts, including implementation of Article 18 therein. This analysis shall address, at a minimum, (a) the impacts that might result from application of the provisions of Article 18(b) of the SWP Contracts, as such provision existed prior to the Monterey Amendments, and (b) the related water delivery effects that might follow from any other provisions of the SWP Contracts.

Implications of Limits and the Requirement for Restoration

In response to environmental damage, Congress, the legislature, administrative agencies, and the courts have established requirements for *restoration* of environmental systems and species.[11] *Restoration* is defined by the National Research Council as:[12]

> Returning an ecosystem to a close approximation of its condition prior to disturbance. Accomplishing restoration means ensuring that ecosystem structure and function are recreated or repaired, and that natural dynamic ecosystem processes are operating effectively again.

The law requires restoration of listed species, not just maintenance at reduced levels. To accomplish this requirement, the EIR must examine the impacts of the proposed project on ecosystems it impacts.

The "Racanelli Decisions" in 1986 (*United States v. State Water Resources Control Board*) broadened the scope of responsibility for restoring the delta to all diverters in the watershed.[13] Judge Racanelli held that all diverters of water flowing into the delta, and extractors from it, were responsible for meeting restoration needs. Water rights of parties should not govern water quality standards for the Delta. The CALFED process is proceeding in accordance with the framework established by the courts in the 1980s and since.

The new EIR will need to take a broad view of the potential impacts of the proposed project and it must proceed under the logic of watershed management developed in the Racanelli decisions and since.

Land-Use Planning and Water for "Average-Intelligence" Growth

The California legislature has addressed the issue of water scarcity and management and promulgated new laws since DWR's first ill-fated EIR effort. In 2001, California finally legislated a meaningful link between water supplies and development. Initially proposed as a one-sentence bill ("No lead agency shall approve a development project unless the applicant identifies a long-term, reliable supply of water to serve the proposed project."[14]), it emerged ten years later as law (with additional verbiage and qualifications).[15]

As of January 1, 2002, projects of 500 units of more must show that adequate water supplies are available for the project. The law amends the code in part as follows:[16]

> The legislative body of a city or county or the advisory agency, to the extent that it is authorized by local ordinance to approve, conditionally approve, or disapprove the tentative map, shall include as a condition in

> any tentative map that includes a subdivision a *requirement that a sufficient water supply shall be available.*
>
> If the public water system fails to deliver the written verification as required by this section, the local agency or any other interested party may seek a writ of mandamus to compel the public water system to comply.

The claims of DWR regarding reliability, and the impacts associated with extraction, diversion, and use of those amounts, must be examined in the new EIR. Land-use decisions are being made based on DWR's assertions of reliability.

Minimizing the Need for Inter-Basin Transfers

The implicit logic of California water policy has been that moving water from one watershed to another is the only way to meet the water "needs" of the state. Often the development and use of local water resources, and especially groundwater, has been neglected due the preoccupation with large interbasin transfers. In 2001, a little-noticed provision in SB 672 regarding urban water management plans requires that the state of California in is state water plan (Bulletin 160-03), examine ways to "*minimize the need to import water from other hydrologic regions*."[17] A new focus, and legal mandate, has been placed on developing *local* water supply sources, including re-use. The specific section of the law is worth quoting:[18]

> The department, as a part of the preparation of the department's Bulletin 160-03, shall include in the California Water Plan a report on the development of regional and local water projects within each hydrologic region of the state, as described in the department's Bulletin 160-98, to improve water supplies to meet municipal, agricultural, and environmental water needs and *minimize the need to import water from other hydrologic regions*.

The legislation then sets forth the range of local supply options to be considered:[19]

> The report shall include, but is not limited to, regional and local water projects that use technologies for desalting brackish groundwater and ocean water, reclaiming water for use within the community generating the water to be reclaimed, the construction of improved potable water treatment facilities so that water from sources determined to be unsuitable can be used, and the construction of dual water systems and brine lines, particularly in connection with new developments and when replacing water piping in developed or redeveloped areas.

The EIR will need to take this new legal requirement into consideration as it examines alternatives to the proposed project. Specifically, the EIR needs to consider alternatives to both existing and proposed levels of extraction of water from the delta.

Summary

DWR's task and responsibilities with regard to this EIR are considerable. The "Monterey Plus" project, and the no project alternative, along with other appropriate project alternatives that may be identified, will require careful analysis. CEQA requires, as noted above, a level of analysis that provides the public and decision-makes with sufficient understanding of the issues and potential impacts to make informed decisions. These decisions will include both water management and land-use decisions, as well as ecosystem restoration decisions.

I look forward to seeing the new and improved EIR process address these issues in the spirit worthy of the public trust.

Sincerely,

Robert C. Wilkinson

Sources

[1] *Planning and Conservation League et al. v. Department of Water Resources* et al. (2000) 83 Cal.App.4th 892) (*PCL v. DWR*)

[2] *Planning and Conservation League et al. v. Department of Water Resources* et al. (2000) 83 Cal.App.4th 892) (*PCL v. DWR*), p.26

[3] See: Water Code, § 12930 et seq.

[4] *Planning and Conservation League et al. v. Department of Water Resources* et al. (2000) 83 Cal.App.4th 892) (*PCL v. DWR*), p.20

[5] The court in *Planning and Conservation League et al. v. Department of Water Resources* et al. (2000) 83 Cal.App.4th 892) cited this contract language at pp.6-7.

[6] *County of Inyo v. City of Los Angeles (III)* (1977) 71 Cal.App.3d 185, 199.

[7] State Water Project Delivery Reliability Report, 2002. http://swpdelivery.water.ca.gov/
[8] See CEQA and 14 Cal. Code Regs. §1512.6(e)(2).

[9] *Planning and Conservation League et al. v. Department of Water Resources* et al. (2000) 83 Cal.App.4th 892) (*PCL v. DWR*), pp.23-25

[10] See: Settlement Agreement at http:// www.montereyamendments.water.ca.gov/

[11] For example, CVPIA, CALFED, http://calfed.water.ca.gov/general/overview.html, *National Audubon Society et al., Petitioners, v. The Superior Court of Alpine County, Respondent; Department of Water and Power of The City of Los Angeles et al., Real Parties in Interest*, 33 Cal.3d 419, S.F. No. 24368. Supreme Court of California. Feb 17, 1983. Available at: http://ceres.ca.gov/theme/env_law/water_law/cases/National_Audubon_v_Sup_Ct.html

[12] National Research Council. 1992. *Restoration of Aquatic Ecosystems*. National Academy Press: Washington D.C.

[13] The Racanelli Decisions, *United States v. State Water Resources Control Board*, (1986) 182 Cal.App.3d 82.

[14] Original Language, AB 455 (In its entirety).

[15] SB 221, Kuehl

[16] Section 66473.7 is added to the Government Code, as amended by SB 221. (Emphasis added.)

[17] SB 672, Machado. California Water Plan: Urban Water Management Plans. (The law amended Section 10620 of, and adds Section 10013 to, the Water Code) SEC. 2. Section 10013 to the Water Code, 10013. (a) SB 672, Machado. California Water Plan: Urban Water Management Plans. September 2001

[18] SEC. 2. Section 10013 to the Water Code, 10013. (a) SB 672, Machado. California Water Plan: Urban Water Management Plans. September 2001, (Emphasis added.)

[19] SEC. 2. Section 10013 to the Water Code, 10013. (a) SB 672, Machado. California Water Plan: Urban Water Management Plans. September 2001.

C. EXAMPLE OF MONTEREY AMENDMENT LONG-TERM WATER SUPPLY CONTRACT

STATE OF CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

WATER SUPPLY CONTRACT

BETWEEN

THE STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES
AND

KERN COUNTY WATER AGENCY

November 15, 1963

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STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND

FOR A WATER SUPPLY

THIS CONTRACT, made this 15th day of November, 1963, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency

a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency".

WITNESSETH, That:

WHEREAS, the State is authorized to construct and operate facilities for the storage and conveyance of water, certain of which facilities will make water available to the Agency; and

WHEREAS, funds will be provided under the California Water Resources Development Bond Act for the construction of said facilities; and

WHEREAS, the Agency is desirous of obtaining a supply of water from the State;

NOW THEREFORE, it is mutually agreed as follows:

A. INTRODUCTORY PROVISIONS

1. DEFINITIONS

When used in this contract, the following terms shall have the meanings hereinafter set forth:

(a) Bond Act

"Bond Act" shall mean the California Water Resources Development Bond Act, comprising Chapter 8 (commencing at Section 12930) of Part 6 of Division 6 of the Water Code.

(b) System

"System" shall mean the State Water Resources Development System as defined in Section 12931 of the Water Code.

(c) Delta

"Delta" shall mean the Sacramento-San Joaquin Delta as defined in Section 12220 of the Water Code on November 8, 1960.

(d) Contractor

"Contractor" shall mean any entity contracting with the State for a dependable supply of water made available by the System, except such water as is made available by the facilities specified in Section 12934(d)(6) of the Water Code.

(e) Project Facilities

"Project facilities" shall mean those facilities of the System which will, in whole or in part, serve the purposes of this contract by conserving water and making it available for use in and above the Delta and for export from the Delta, and by conveying water to the Agency. Said project facilities shall consist specifically of "project conservation facilities" and "project transportation facilities", as hereinafter defined.

(f) Project Conservation Facilities

"Project conservation facilities" shall mean such project facilities as are presently included, or as may be added in the future, under (g) and (h) below.

(g) Initial Project Conservation Facilities

"Initial project conservation facilities" shall mean the following project facilities specified in Section 12934(d) of the Water Code:

(1) All those facilities specified in subparagraph (1) thereof.

(2) Those facilities specified in subparagraph (3) thereof to the extent that they serve the purposes of water conservation in the Delta, water supply in the Delta, and transfer of water across the Delta.

(3) A reservoir near Los Banos in Merced County as specified in subparagraph (2) thereof.

(4) The reach of the San Joaquin Valley-Southern California Aqueduct extending from the Delta to a reservoir near Los Banos in Merced County, to the extent required for water conservation through conveyance of water diverted from the Delta to offstream storage in said reservoir as determined by the State.

(5) Those facilities specified in subparagraph (5) thereof which are incidental to the facilities included under (1), (2), (3), and (4) above.

(6) Those facilities specified in subparagraph (7) thereof which are necessary and appurtenant to the facilities included under (1), (2), (3), (4), and (5) above.

(h) Additional Project Conservation Facilities

"Additional project conservation facilities" shall mean those project facilities provided for in Section 12938 of the Water Code which will serve the purpose of preventing any reduction in the minimum project yield, as hereinafter defined.

(i) Project Transportation Facilities

"Project transportation facilities" shall mean those project facilities:

(1) Specified in Water Code Section 12934(d)(2) which are described in Table H of this contract;

(2) Specified in Water Code Section 12934(d)(5) which are incidental to the facilities included under (1) above;

(3) Specified in Water Code Section 12934(d)(7) which are necessary and appurtenant to the facilities included under (1) and (2) above.

(j) Project Water

"Project water" shall mean water made available for delivery to the contractors by project conservation facilities and the transportation facilities included in the System.

(k) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available, estimated to be 4,000,000 acre-feet per year, said amount to be determined by the State on the basis of coordinated operation studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon:

(1) The estimated relative proportion of deliveries for agricultural use to deliveries for municipal use for the year 1990, and the characteristic distributions of demands for these two uses throughout the year.

(2) An allowable reduction in the agricultural use portion of the minimum project yield, due to drought, of not to exceed fifty percent (50%) in any one year, nor a total of one hundred percent (100%) of one year's supply in any series of seven consecutive years.

(3) Agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the diversion or utilization of waters of the Delta or streams tributary thereto.

(l) Annual Entitlement

"Annual entitlement" shall mean the amount of project water to be made available to a contractor during the respective year, at the delivery structures provided for such contractor, under the terms of its contract with the State.

(m) Maximum Annual Entitlement

"Maximum annual entitlement" shall mean the maximum amount of project water to be made available to a contractor in any one year, at the delivery structures provided for such contractor, under the terms of its contract with the State.

(n) Supplemental Conservation Facilities

"Supplemental conservation facilities" shall mean those facilities provided for in Section 12938 of the Water Code which will serve the purpose of supplying water in addition to the minimum project yield, and for meeting local needs.

(o) Supplemental Water

"Supplemental water" shall mean water made available by supplemental conservation facilities, in excess of the minimum project yield.

(p) Year

"Year" shall mean the 12-month period from January 1 through December 31, both dates inclusive.

(q) Year of Initial Water Delivery

"Year of initial water delivery" shall mean the year when project water will first be available for delivery to a contractor pursuant to its contract with the State.

(r) Project Interest Rate

"Project interest rate" shall mean the weighted average of the interest rates paid by the State on bonds issued under the Bond Act without regard to any premiums received on the sale thereof. Until bonds are issued and sold under the Bond Act, the project interest rate shall be four percent (4%) per annum, and after said bonds have been issued said rate shall be computed as a decimal fraction to five places.

(s) Capital Costs

"Capital costs" shall mean all costs incurred subsequent to authorization of a facility for construction by the Legislature or by administrative action pursuant to Section 11290 of the Water Code and to the Bond Act, including those so incurred prior to the beginning of the project repayment period as herein defined and any accrued unpaid interest charges thereon at the rates specified herein, which are properly chargeable to the construction of and the furnishing of equipment for the facilities of the System, including the costs of surveys, engineering studies, exploratory work, designs, preparation of construction plans and specifications, acquisition of lands, easements and rights-of-way, relocation work, and essential administrative work in connection therewith, all as shown upon the official records of the Department of Water Resources.

(t) Project Repayment Period

"Project repayment period" shall mean that period of years commencing on January 1, 1961, and extending until all bonds secured by the pledge of revenues provided for by the Bond Act have been repaid.

(u) Municipal Use

"Municipal use" shall mean all those uses of water common to the municipal water supply of a city, town, or other similar population group, including uses for domestic purposes, uses for the purposes of commerce, trade or industry, and any other use incidental thereto for any beneficial purpose.

(v) Manufacturing Use

"Manufacturing use" shall mean any use of water primarily in the production of finished goods for market.

(w) Agricultural Use

"Agricultural use" shall mean any use of water primarily in the production of plant crops or livestock for market, including any use incidental thereto for domestic or stock-watering purposes.

(x) Subject to Approval by the State

"Subject to approval by the State" shall mean subject to the determination and judgment of the State as to acceptability.

(y) Area of Origin Statutes

"Area of origin statutes" shall mean Sections 10505 and 11460 through 11463 of the Water Code as now existing or hereafter amended.

2. TERM OF CONTRACT

This contract shall become effective on the date first above written and shall remain in effect throughout the project repayment period, or for seventy-five (75) years, whichever period is longer.

3. VALIDATION

Within one (1) year after the effective date of this contract, the Agency shall submit this contract to a court of competent jurisdiction for determination of its validity by a proceeding in mandamus or other appropriate proceeding or action, which proceeding or action shall be diligently prosecuted to final decree or judgment. In the event that this contract is determined to be invalid by such final decree or judgment, the State shall make all reasonable efforts to obtain validating legislation at the next session of the Legislature empowered to consider such legislation, and within six (6) months after the close of such session, if such legislation shall have been enacted, the Agency shall submit this contract to a court of competent jurisdiction for redetermination of its validity by appropriate proceeding or action, which proceeding or action shall be diligently prosecuted to final decree or judgment.

4. OPTION FOR CONTINUED SERVICE

By written notice to the State at least six (6) months prior to the expiration of the term of this contract, the Agency may elect to receive continued service after expiration of said term under the following conditions unless otherwise agreed to:

(1) Service of water in annual amounts up to and including the Agency's maximum annual entitlement hereunder.

(2) Service of water at no greater cost to the Agency than would have been the case had this contract continued in effect.

(3) Service of water under the same physical conditions of service, including time, place, amount and rate of delivery, as are provided for hereunder.

(4) Retention of the same chemical quality objective provision as is set forth herein.

(5) Retention of the same options to utilize the project transportation facilities as are provided for in Articles 18(b) and 18(c), to the extent such options are then applicable.

Other terms and conditions of the continued service shall be reasonable and equitable and shall be mutually agreed upon. In the event that said terms and condi-

tions provide for continued service for a limited number of years only, the Agency shall have the same option to receive continued service here provided for upon the expiration of that and each succeeding period of continued service.

5. PLEDGE OF REVENUES

This contract is entered into for the direct benefit of the holders and owners of all general obligation bonds issued under the Bond Act, and the income and revenues derived from this contract are pledged to the purposes and in the priority set forth in that act.

B. WATER SERVICE PROVISIONS

6. ANNUAL ENTITLEMENTS

(a) Year of Initial Water Delivery

The year of initial water delivery to the Agency is presently estimated to be 1968. To the extent practicable, the State shall notify the Agency of any change in this estimate.

(b) Agency's Annual Entitlements to Water

Commencing with the year of initial water delivery to the Agency, the State each year shall make available for delivery to the Agency the amounts of project water designated in Table A of this contract, which amounts are referred to in this contract as the Agency's annual entitlements.

(c) Obligation of State to Complete Facilities

Subject to the availability of funds, the State shall make all reasonable efforts consistent with sound fiscal policies, reasonable construction schedules, and proper operating procedures to complete the project facilities necessary for delivery of project water to the Agency in such manner and at such times that said delivery can commence in or before the year specified in subdivision (a) of this article, and continue in the amounts designated in Table A of this contract.

7. CHANGES IN ANNUAL ENTITLEMENTS; MAXIMUM ANNUAL ENTITLEMENT

(a) Changes in Annual Entitlements

The Agency may, at any time or times during the term of this contract, by timely written notice furnished to the State, request that project water be made available to it thereafter in annual amounts greater or less than the annual entitlements designated in Table A of this contract. Subject to approval by the State of any such request, the State's construction schedule shall be adjusted to the extent necessary to satisfy the request, and the requested increases or decreases in said annual entitlements shall be incorporated in said Table A by amendment thereof: *Provided,* That no such change shall be approved if in the judgment of the State it would impair the financial feasibility of the project facilities.

(b) Maximum Annual Entitlement of Agency

The maximum amount of project water to be made available to the Agency in any one year under this contract shall be that specified in Table A of this contract and in said table designated as the Agency's "Maximum Annual Entitlement." In no event shall such maximum amount of project water to be made available to the Agency be increased over this amount, except as is otherwise provided in this contract.

8. OPTION TO INCREASE MAXIMUM ANNUAL ENTITLEMENT

In the event that the maximum annual entitlements under all contracts executed by the State on or before December 31, 1963, do not aggregate the amount of the minimum project yield as herein defined, the State shall immediately notify the Agency and all other contractors, and the Agency may elect to become entitled to the uncontracted for portion of the minimum project yield in or up to an amount which bears the same ratio to such uncontracted for portion as the Agency's maximum annual entitlement bears to the total of the maximum annual entitlements of all contractors as of that date: *Provided,* That such option may be exercised only to the extent that the water involved can be put to beneficial use within a reasonable period of time. Such option shall become effective on the date that the Agency receives said notice from the State and shall remain in effect through September 30, 1964. If the full amount of such uncontracted for portion of the minimum project yield is not preempted by the Agency under this option and by other contractors through the exercise of similar options on or before September 30, 1964, the Agency may request that it become entitled to any amount of such water not so preempted. Such request shall be subject to approval by the State and shall be considered in the light of all similar requests from other contractors. The State shall approve such request only to the extent that the water involved can be put to beneficial use within a reasonable period of time. Upon the exercise of such option or upon the approval of such request the Agency's maximum annual entitlement in Table A of this contract shall be increased by the amount of the additional entitlement thereby obtained by amendment of that table, and the Agency shall become obligated and hereby agrees to pay to the State a proportionate share of the costs attributable to such increase in accordance with cost allocation principles and procedures set forth in this contract. The service of and payment for said increased entitlement shall in all respects be subject to the terms and conditions of this contract.

9. DELIVERY POINTS

Project water made available to the Agency pursuant to Article 6 shall be delivered to the Agency by the State at the delivery structures established in accordance with Article 10.

10. DELIVERY STRUCTURES

(a) Determination of Size and Location of Delivery Structures

Project water made available to the Agency pursuant to this contract shall be delivered to the Agency at such locations and times and through delivery structures of such capacities as are requested by the Agency and approved by the State.

(b) Agency Requests as to Initial Delivery Structures

Pursuant to subdivision (a) of this article, the Agency shall furnish to the State on or before February 1, 1964, its written requests as to:

(1) The location of delivery structures for delivery of project water to it.

(2) The time at which project water is first to be delivered through each such delivery structure.

(3) The maximum instantaneous flow capacity in cubic feet per second to be provided in each such delivery structure.

(4) The maximum amount of water in acre-feet to be delivered in any one month through each such delivery structure.

(5) The total combined maximum instantaneous flow capacity in cubic feet per second to be provided by all such delivery structures.

(6) The total maximum amount of water in acre-feet to be delivered in any one month through all such delivery structures.

(c) Requests by Agency for Additional Delivery Structures

From time to time the Agency may request delivery structures in addition to those requested pursuant to subdivision (b) of this article.

(d) Agency to Advance Funds for Delivery Structures

The Agency shall pay all of the costs of delivery structures for the delivery of project water to it, and shall deposit with the State, prior to the commencement of construction of any such delivery structure, an amount of money estimated by the State to be sufficient to cover the costs thereof.

11. MEASUREMENT OF WATER DELIVERED

(a) Measurement by State

The State shall measure all project water delivered to the Agency and shall keep and maintain accurate and complete records thereof. For this purpose, the State shall install, operate, and maintain at all delivery structures for delivery of project water to the Agency such measuring devices and equipment as are satisfactory and acceptable to both parties. Said devices and equipment shall be examined, tested, and serviced regularly to insure their accuracy. At any time or times, the Agency or any other contractor may inspect such measuring devices and equipment, and the measurements and records taken therefrom.

(b) Agency to Advance Funds for Measuring Devices

The Agency shall pay all of the costs of acquiring and installing the measuring devices and equipment provided for in subdivision (a) of this article, and shall deposit with the State, prior to such acquisition and installation, an amount of money estimated by the State to be sufficient to cover such costs.

12. DELIVERY SCHEDULES

(a) Procedure for Determining Water Delivery Schedule

The amounts, times, and rates of delivery of project water to the Agency during any year shall be in accordance with a water delivery schedule for that year, such schedule to be determined in the following manner:

(1) On or before October 1 of each year, the Agency shall submit in writing to the State a preliminary water delivery schedule, subject to the provisions of this article and Articles 6(b), 7(b), 10 and 17, indicating the amounts of water desired by the Agency during each month of the succeeding five (5) years.

(2) Upon receipt of a preliminary schedule the State shall review it and, after consultation with the Agency, shall make such modifications in it as are necessary to insure that the amounts, times, and rates of delivery to the Agency will be consistent with the State's overall delivery ability, considering the then current delivery schedules of all contractors. On or before December 1 of each year, the State shall determine and furnish to the Agency the water delivery schedule for the next succeeding year which shall show the amounts of water to be delivered to the Agency during each month of that year.

(3) A water delivery schedule may be amended by the State upon the Agency's written request. Proposed amendments shall be submitted by the Agency within a reasonable time before the desired change is to become effective, and shall be subject to review and modification by the State in like manner as the schedule itself.

(b) Limit on Peak Deliveries of Water

In no event shall the State contract to deliver to any contractor from the project transportation facili-

ties downstream from Pumping Plant VI (Tehachapi Pumping Plant) in any one month of any year a total amount of project water greater than eleven percent (11%) of such contractor's annual entitlement for that year; or to deliver to any contractor from the project transportation facilities upstream from said Pumping Plant VI in any one month of any year a total amount of project water greater than the sum of eighteen percent (18%) of that portion of such contractor's annual entitlement for that year to be put to agricultural use, as determined by the State, and eleven percent (11%) of that portion of such contractor's annual entitlement for that year to be put to municipal use, as determined by the State: *Provided*, That if the State delivers project water to any contractor through delivery structures both downstream and upstream from said Pumping Plant VI, the foregoing limitations shall be based on an appropriate apportionment of such contractor's annual entitlement for the respective year to the respective portions of such contractor's service area to which delivery is made from the project transportation facilities downstream from said Pumping Plant VI and from the project transportation facilities upstream therefrom: *Provided further*, That the percentages set forth hereinabove may be revised for a particular contractor by amendment of this subdivision after submission to the State of that contractor's requests with respect to maximum monthly deliveries, such revision being subject to approval by the State and subject to advancement to the State by the contractor of funds sufficient to cover any additional costs of the project transportation facilities occasioned thereby, the amount of such funds to be determined pursuant to Article 24(d).

(c) Limit on Rate of Delivery to Agency

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding 2820 cubic feet per second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

(d) Delivery of Water Not Delivered in Accordance With Schedule

If in any year the State, as a result of causes beyond its control, is unable to deliver any portion of the Agency's annual entitlement for such year under Table A of this contract as provided for in the delivery schedule established for that year, the Agency may elect to receive the amount of water which otherwise would have been delivered to it during such period at other times during the year or succeeding years, to the extent that such water is then available and such election is consistent with the State's overall delivery ability, considering the then current delivery schedules of all contractors.

13. RESPONSIBILITIES FOR DELIVERY AND DISTRIBUTION OF WATER

(a) State Not Liable for Operation Beyond Delivery Structures

Neither the State nor any of its officers, agents, or employees shall be liable for the control, carriage, handling, use, disposal, or distribution of project water supplied to the Agency after such water has passed the delivery structures established in accordance with Article 10; nor for claim of damage of any nature whatsoever, including but not limited to property damage, personal injury or death, arising out of or connected with the control, carriage, handling, use, disposal or distribution of such water beyond said delivery structures; and the Agency shall indemnify and hold harmless the State and its officers, agents, and employees from any such damages or claims of damages.

(b) Agency Not Liable for Operation Upstream From Delivery Structures

Neither the Agency nor any of its officers, agents, or employees shall be liable for the control, carriage, handling, use, disposal, or distribution of project water before such water has passed the delivery structures established in accordance with Article 10; nor for claim of damage of any nature whatsoever, including but not limited to property damage, personal injury or death, arising out of or connected with the control, carriage, handling, use, disposal, or distribution of such water before it has passed said delivery structures.

14. CURTAILMENT OF DELIVERY FOR MAINTENANCE PURPOSES

(a) State May Curtail Deliveries

The State may temporarily discontinue or reduce the delivery of project water to the Agency hereunder for the purposes of necessary investigation, inspection, maintenance, repair, or replacement of any of the project facilities necessary for the delivery of project water to the Agency. The State shall notify the Agency as far in advance as possible of any such discontinuance or reduction, except in cases of emergency, in which case notice need not be given.

(b) Agency May Receive Later Delivery of Water Not Delivered

In the event of any discontinuance or reduction of delivery of project water pursuant to subdivision (a) of this article, the Agency may elect to receive the amount of water which otherwise would have been delivered to it during such period under the water delivery schedule for that year at other times during the year or succeeding years to the extent that such water is then available and such election is consistent with the State's overall delivery ability, considering the then current delivery schedules of all contractors.

15. AREA SERVED BY AGENCY

(a) State Approval of Sale of Water by Agency Outside Boundaries

Project water delivered to the Agency pursuant to this contract shall not be sold or otherwise disposed of by the Agency for use outside the Agency without the prior written consent of the State.

(b) State Approval of Change in Boundaries or Organization of Agency

While this contract is in effect no change shall be made in the Agency either by inclusion or exclusion of lands, by partial or total consolidation or merger with another district, by proceedings to dissolve, or otherwise, except with the prior written consent of the State or except by act of the Legislature.

(c) Map of Agency

The Agency shall provide the State with a map satisfactory to the State indicating the major existing distribution facilities and the boundaries of the Agency at the time the contract is signed and supplementary maps whenever a boundary change is made.

16. CONTINUITY AND DEPENDABILITY OF WATER SUPPLY

(a) Limit on Total of all Maximum Annual Entitlements

The Agency's maximum annual entitlement hereunder, together with the maximum annual entitlements of all other contractors, shall aggregate no more than the minimum project yield as defined herein and in no event more than 4,000,000 acre-feet of project water.

(b) State to Perfect Water Rights

The State shall make all reasonable efforts to perfect and protect water rights necessary for the System and for the satisfaction of water supply commitments under this contract.

(c) State to Report on Ability to Meet Future Water Demands

Commencing within two (2) years from the year of initial project water delivery to the Agency, the State shall submit to the agency at not more than five-year intervals a report on the State's ability to meet future demands for project water and for supplemental water, and on the State's plans for constructing additional project conservation facilities and supplemental conservation facilities. Such reports shall include all estimates, projections, and other data which the State deems relevant thereto.

(d) Construction of Additional and Supplemental Conservation Facilities

Bond funds required to be expended for the construction of additional facilities of the System under the provisions of Section 12938 of the Water Code shall be expended only for construction of additional project conservation facilities as defined herein, and related, appurtenant facilities necessary and desirable to meet local needs: *Provided*, That if at any time after 1985 the State finds that a part or all of such bond funds are not then required for the above purpose, and will not be so required within the next succeeding ten (10) years, such bond funds may be used, to the extent permitted in the Bond Act, to construct supplemental conservation facilities as defined herein.

(e) Furnishing of Supplemental Water

In planning and designing supplemental conservation facilities the State shall give consideration to the requirements and demands for supplemental water of the Agency and others who have contracted for project water. Entitlements to supplemental water shall be obtained, and repayment therefor shall be arranged, in contracts separate from contracts for project water.

17. CONSTRUCTION OF PROJECT FACILITIES

(a) Determination of Aqueduct Capacities

Subject to the rights of the Agency under subdivision (b) of this article and the other provisions of this contract, the State shall provide in each aqueduct reach of the project transportation facilities such maximum monthly delivery capability for the transport and delivery of project water to the Agency as, in the judgment of the State, will best serve the interests of the Agency and all other contractors entitled to delivery of project water from or through said facilities: *Provided*, That within three (3) months after the effective date of this contract the Agency shall furnish to the State a written request specifying such maximum monthly delivery capabilities, and the State shall give full consideration to such request in planning and designing said facilities.

(b) Criteria for Determining Capacity of Transportation Facilities

Subject to Article 45, the State shall design and construct the project transportation facilities so as to provide in each reach thereof, including reservoirs, the capacity necessary to enable delivery of project water in each year to the Agency and to other contractors in the maximum monthly amounts and at the locations, times, and maximum rates specified or provided for in their respective contracts for such year, and shall include in each such reach such capacity as is economically justified in the judgment of the State to compensate for scheduled outages for purposes of necessary investigation, inspection, maintenance, repair or replacement of project facilities, and for losses of water due to evaporation, leakage, seepage, or other causes: *Provided*, That regulatory storage reservoirs included

in the project transportation facilities may be utilized in conjunction with conveyance capacity provided in said facilities for delivery to the Agency of the foregoing monthly amounts.

(c) Inspection of Project Plans and Specifications

The Agency shall have a reasonable opportunity to inspect and study the State's plans and specifications for all project facilities and may make comments and recommendations thereon to the State. Such privilege shall also extend to any plans and specifications in connection with the use by the State, in conjunction with the project facilities, of facilities owned by an entity other than the State. The State shall not enter into any such agreement which would impair the State's ability to perform fully its obligations under this contract.

(d) Restriction on Bond Sales

No bonds shall be sold nor funds expended under the authority of the Bond Act for the construction of any aqueduct or appurtenance thereto included in the System unless and until contracts are executed which will insure the recovery by the State of at least seventy-five percent (75%) of those capital costs of the particular aqueduct and any appurtenances thereto which shall be reimbursable by the contractors as determined by the State; nor shall any bonds be sold or funds expended under the authority of the Bond Act for the construction of any project conservation facility or supplemental conservation facility, unless and until contracts are executed which, together with estimated revenues from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities and supplemental conservation facilities, will insure the recovery by the State of at least seventy-five percent (75%) of those capital costs of the particular facility which shall be reimbursable by the contractors as determined by the State: *Provided*, That the foregoing limitations shall not apply with respect to: (1) surveys, engineering studies, exploratory work, designs, preparation of construction plans and specifications, acquisition of lands, easements and rights of way, relocation work, and essential administrative work in connection therewith; (2) construction for which appropriations had been made prior to approval of the Bond Act by the voters of the State of California; and (3) construction of facilities pursuant to an agreement between the State and the United States.

(e) Failure to Complete Facilities

In the event that the State fails or is unable to complete construction of any portion or portions of the project transportation facilities necessary to deliver water to the Agency as provided in this contract, and gives the Agency written notice thereof, or by reason of such failure or inability construction of said facilities has ceased for a period of two and one-half (2½) years, the Agency, if it be not then in default and without exclusion of such other rights as it may have under this contract, may exercise the following options:

(1) The Agency may provide funds to the State in such amounts and at such times as may be necessary to enable the State to complete construction of such incompleted portion or portions of the project transportation facilities to the extent necessary for the transport and delivery of water to the Agency as provided for in this contract: *Provided*, That the State shall be and remain the owner of such project transportation facilities or portions thereof constructed in whole or in part with funds provided by the Agency, and shall be and remain obligated to operate, maintain, repair and replace such facilities to the full extent contemplated in this contract: *Provided further*, That the amount of any funds so provided by the Agency shall be credited by the State against the Agency's payment obligation under the capital cost component of the Transportation Charge, but the Agency shall be and remain obligated to pay its share of any capital costs of the above-described facilities not paid for with such funds, together with its proportionate share of the operation, maintenance, power and replacement costs of such facilities.

(2) The Agency may at its own expense, and on a joint venture basis if such an arrangement is made with other contractors having similar options, connect to the project transportation facilities constructed by the State for the purpose of receiving project water to which it is entitled under this contract. In such event and notwithstanding any other provisions of this contract, the structures for delivery of project water to the Agency pursuant hereto shall thereafter be deemed to be located at such point of connection. Specific arrangements for acquiring, constructing, operating, maintaining and replacing the Agency's facilities at the point of connection thereof with the State's facilities shall be in accordance with terms and conditions mutually agreed upon by the parties: *Provided*, That the State shall be and remain the owner of all facilities constructed by it to said point of connection, and the Agency shall be and remain obligated to pay its proportionate share of the costs thereof.

18. SHORTAGE IN WATER SUPPLY

(a) Temporary Shortages; Delivery Priorities

In any year in which there may occur a shortage due to drought or other temporary cause in the supply of project water available for delivery to the contractors, with the result that such supply is less than the total of the annual entitlements of all contractors for that year, the State shall, before reducing deliveries

of project water to all contractors, reduce the delivery of project water to each contractor using such water for agricultural purposes by a percentage, not to exceed fifty percent (50%) in any one year or a total of one hundred percent (100%) in any series of seven consecutive years, of that portion of the contractor's annual entitlement for the respective year which is to be put to agricultural use as determined by the State: *Provided*, That such percentage shall be the same for all such contractors. The maximum total reduction in deliveries allowable under the above provision shall be made before any reduction is made in project water deliveries for other uses. Any necessary reduction in deliveries of project water beyond said maximum total reduction allowable under the foregoing provision shall be apportioned among all contractors irrespective of the uses to which such water is to be put. In such event, the State shall reduce deliveries to each contractor in an amount which bears the same proportion to the total amount of such necessary further reduction that the contractor's annual entitlement bears to the total of the annual entitlements of all contractors for that year, all as determined by the State: *Provided*, That the State may apportion on some other basis if such is required to meet minimum demands for domestic supply, fire protection, or sanitation during the year. The foregoing provisions of this subdivision shall be inoperative to the extent that a contractor's annual entitlement for the respective year reflects established rights under the area of origin statutes precluding a reduction in deliveries to such contractor.

(b) Permanent Shortage; Reduction of Entitlements

In the event that the State is unable to construct sufficient additional conservation facilities to prevent a reduction in the minimum project yield, or if for any other reason there is a reduction in the minimum project yield, which, notwithstanding preventive or remedial measures taken or to be taken by the State, threatens a permanent shortage in the supply of project water to be made available to the contractors:

(1) The annual entitlements and the maximum annual entitlements of all contractors, except to the extent such entitlements may reflect established rights under the area of origin statutes, shall, by amendment of Table A of this contract, be reduced proportionately by the State to the extent necessary so that the sum of the revised maximum annual entitlements of all contractors will then equal such reduced minimum project yield: *Provided*, That appropriate adjustment in the contractors' respective financial obligations to the State under the Transportation Charge shall be made in accordance with such reduced entitlements if such reductions have not been strictly proportionate throughout.

(2) The Agency, at its option, shall have the right to use any of the project transportation facilities which by reason of such reduction in the minimum project yield are not required for delivery of project water to the Agency, to transport water procured by it from any other source: *Provided*, That such use shall be within the limits of the capacities provided in the project transportation facilities for service to the Agency under this contract: *Provided further*, That except to the extent such limitation in Section 12931 of the Water Code be changed, the Agency shall not use the project transportation facilities under this option to transport water the right to which was secured by the Agency through eminent domain unless such use be approved by the Legislature by concurrent resolution with a majority of the members elected to each house voting in favor thereof.

(c) Permanent Shortage; Contracts for Areas-of-Origin

In the event that the State, because of the establishment by a party of a prior right to water under the provisions of Sections 11460 through 11463 of the Water Code, enters into a contract with such party for a dependable supply of project water, which contract will cause a permanent shortage in the supply of project water to be made available to the Agency hereunder:

(1) The State shall: (i) equitably redistribute the costs of all transportation facilities included in the System among all contractors for project water, taking into account the diminution of the supply to the Agency and other prior contractors and the payments theretofore made by the Agency and other prior contractors in accordance with the terms of their contracts, and (ii) revise the Agency's annual entitlements and maximum annual entitlement, by amendment of Table A of this contract, to correspond to the reduced supply of project water to be made available to the Agency: *Provided*, That such redistribution of costs of transportation facilities shall not be made until there has been reasonable opportunity for the Agency to exercise the option provided for in (2) below, and for other prior contractors to exercise similar options.

(2) The Agency, at its option, shall have the right to use any of the project transportation facilities which by reason of such permanent shortage in the supply of project water to be made available to the Agency are not required for delivery of project water to the Agency, to transport water procured by it from any other source: *Provided*, That such use shall be within the limits of the capacities provided in the project transportation facilities for service to the Agency under this contract: *Provided further*, That, except to the extent such limitation

in Section 12931 of the Water Code be changed, the Agency shall not use the project transportation facilities under this option to transport water the right to which was secured by the Agency through eminent domain unless such use be approved by the Legislature by concurrent resolution with a majority of the members elected to each house voting in favor thereof. This option shall terminate upon a redistribution of costs of transportation facilities by the State pursuant to (1) above. In the event that this option is exercised, the State shall take such fact into account in making such redistribution of costs, and shall offset such use as is made of the project transportation facilities pursuant thereto against any reduction in the Agency's payment obligation hereunder resulting from such redistribution of costs.

(d) Reinstatement of Entitlements

If after any revision of annual entitlements and maximum annual entitlements pursuant to subdivisions (b) or (c) of this article, circumstances arise which, in the judgment of the State, justify a revision upward of the same, the State shall, with the consent of the affected contractor, reinstate proportionately the previously reduced entitlements of such contractor to the extent deemed justified, and shall equitably redistribute the costs of the project transportation facilities if inequities would otherwise occur as a result of such reinstatement of entitlements.

(e) Advance Notice of Delivery Reductions

The State shall give the Agency written notice as far in advance as possible of any reduction in deliveries to it under subdivision (a) of this article and, to the extent possible, shall give the Agency written notice five (5) years in advance of any reduction in its annual entitlements and maximum annual entitlement under subdivisions (b) or (c) of this article. Reports submitted to the Agency pursuant to Article 16 (c) may constitute such notices.

(f) No Liability for Shortages

Neither the State nor any of its officers, agents, or employees shall be liable for any damage, direct or indirect, arising from shortages in the amount of water to be made available for delivery to the Agency under this contract caused by drought, operation of area of origin statutes, or any other cause beyond its control.

19. WATER QUALITY

(a) Table of Water Quality Objectives

It shall be the objective of the State and the State shall take all reasonable measures to make available, at all delivery structures for delivery of project water to the Agency, project water of such quality that the following constituents do not exceed the concentrations stated as follows:

Constituent	*Unit*	*Monthly Average*	*Average for any 10-year Period*	*Maximum*
Total Dissolved Solids	ppm.	440	220	—
Total Hardness	ppm.	180	110	—
Chlorides	ppm.	110	55	—
Sulfates	ppm.	110	20	—
Boron	ppm.	0.6	—	—
Sodium Percentage	%	50	40	—
Fluoride	ppm.	—	—	1.5
Lead	ppm.	—	—	0.1
Selenium	ppm.	—	—	0.05
Hexavalent Chromium	ppm.	—	—	0.05
Arsenic	ppm.	—	—	0.05
Iron and Manganese together	ppm.	—	—	0.3
Magnesium	ppm.	—	—	125
Copper	ppm.	—	—	3.0
Zinc	ppm.	—	—	15
Phenol	ppm.	—	—	0.001

(b) Records of Water Quality

The State shall regularly take samples of water at each delivery structure for delivery of project water to the Agency, and shall make chemical and physical analyses and tests of such samples. The State shall keep accurate and complete records of all such analyses and tests, which records shall be available for inspection by the Agency at any time or times.

(c) No Liability for Failure to Meet Quality Objectives

If through no negligence of the State or its officers, agents, or employees, the State is unable to attain the quality objectives set forth in subdivision (a) of this article, neither the State nor any of its officers, agents, or employees shall be liable in any manner whatsoever for such deviation from said quality objectives.

20. SUSPENSION OF SERVICE UPON DEFAULT

In the event of any default by the Agency in the payment of any money required to be paid to the State hereunder, the State may, upon not less than six months' notice to the Agency, suspend deliveries of water under this contract for so long as such default continues: *Provided,* That during such period the Agency shall remain obligated to make all payments required under this contract. Action taken pursuant to this article shall not deprive the State of or limit any remedy provided by this contract or by law for the recovery of money due or which may become due under this contract.

21. SALE OF SURPLUS WATER

If during any year the supply of project water, after appropriate allowance for holdover storage, exceeds the total of annual entitlements of all contractors for that year, the State shall offer to sell and deliver such

surplus water for periods expiring not later than the end of such year, without right of renewal, and in a manner and at prices which will return to the State the largest net revenues practicable, and at the minimum, revenues equal to the variable operation, maintenance and power costs incurred in such service of surplus water: *Provided*, That such service of surplus water shall not interfere with the delivery of their respective annual entitlement to those contractors which do not receive surplus water in such year: *Provided further*, That not until a contractor either pays or incurs a payment obligation for its annual entitlement in accordance with the payment provisions of its contract, shall surplus water be sold to such contractor at prices less than those which would result under the application of the payment provisions of its contract: *Provided further*, That if, in the judgment of the State, the annual entitlement of a contractor desiring to purchase surplus water is unrealistically low for the year in which such purchase is to be made, the State shall, for the purpose of pricing such water in accordance with the second proviso above, consider such annual entitlement to be an increased amount determined by the State to accurately correspond to such contractor's actual requirements for project water in that year. All net revenues from the service of surplus water shall be applied in such manner that all contractors which contribute to the payment of the costs of any System facilities by which surplus water was conserved and transported in connection with such service will receive credit for a share of such net revenues in the proportion that each such contractor contributes to payment of such costs. The service of surplus water shall, in every case, be subject to the paramount right and obligation of the State to discontinue the same, in whole or in part, when required for service of project water to contractors.

C. PAYMENT PROVISIONS

22. DELTA WATER CHARGE

(a) Payment of Reimbursable Costs of Project Conservation Facilities

The payments to be made by each contractor for project water shall include an annual charge designated as the Delta Water Charge. This charge, together with the total revenues derived during the project repayment period from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities, shall return to the State during the project repayment period all costs of the project conservation facilities including capital, operation, maintenance, power, and replacement costs, which are allocated to the purpose of water conservation in, above, and below the Delta pursuant to subdivision (e) of this article during the project repayment period. Wherever reference is made, in connection with the computation or determination of the Delta Water Charge, to the costs of any facility or facilities included in the System, such reference shall be only to those costs of such facility or facilities which are reimbursable by the contractors as determined by the State.

(b) Delta Water Rate Until 1970; Components of Rate Thereafter

For each contractor receiving project water in any year through December 31, 1969, the Delta Water Charge shall be the product of $3.50 and the contractor's annual entitlement to project water for the respective year. After that date, the Delta Water Charge shall consist and be the sum of the following components as these are computed in accordance with subdivisions (c) and (d) of this article: a capital cost component; a minimum operation, maintenance, power, and replacement component; and a variable operation, maintenance, power and replacement component.

(c) Computation of the Components of the Delta Water Rate

The capital cost, the minimum operation, maintenance, power, and replacement, and the variable operation, maintenance, power, and replacement components of the Delta Water Charge, together with that portion of the revenues derived during the project repayment period from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities which is allocated by the State to repayment of the respective category of costs, shall return to the State during the project repayment period, respectively, the following categories of the costs allocated to the purpose of water conservation in, above, and below the Delta pursuant to subdivision (e) of this article: (1) capital costs; (2) operation, maintenance, power, and replacement costs incurred irrespective of the amount of project water delivered to the contractors; and (3) operation, maintenance, power, and replacement costs incurred in an amount which is dependent upon and varies with the amount of project water delivered to the contractors: *Provided*, That each of the above categories of costs shall be inclusive of the appropriate costs properly chargeable to the generation and transmission of electrical energy in connection with operation of project conservation facilities. Each component of the Delta Water Charge shall be computed on the basis of a rate which, when charged during the project repayment period for each acre-foot of the sum of the yearly totals of annual entitlements of all contractors, will be sufficient, together with that portion of the revenues derived during the project repayment period from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities which is allo-

cated by the State to repayment of the respective category of costs, to return to the State during the project repayment period all costs included in the respective category of costs covered by that component. Each such rate shall be computed in accordance with the following formula:

$$\frac{(c_1 - r_1)(1 + i)^{-1} + (c_2 - r_2)(1 + i)^{-2} + \ldots + (c_n - r_n)(1 + i)^{-n}}{e_1(1 + i)^{-1} + e_2(1 + i)^{-2} + \ldots + e_n(1 + i)^{-n}}$$

Where:

i = The project interest rate.

c = The total costs included in the respective category of costs for the respective year of the project repayment period.

r = That portion of the revenues derived from the sale or other disposal of electrical energy allocated by the State to repayment of the costs included in the respective category for the respective year of the project repayment period.

1, 2, and n appearing below c and r = The respective year of the project repayment period for which costs are included in the respective category, n being the last year of the project repayment period.

e = With respect to the capital cost and minimum operation, maintenance, power, and replacement components, the total of annual entitlements to project water of all contractors for the respective year of the project repayment period.

e = With respect to the variable operation, maintenance, power, and replacement component, the total of the amounts of project water delivered to all contractors for the respective year of the expired portion of the project repayment period, together with the total of annual entitlements to project water of all contractors for the respective year of the unexpired portion of the project repayment period.

1, 2, and n appearing below e = The respective year of the project repayment period in which the annual entitlements or project water deliveries occur, n being the last year of the project repayment period.

n used as an exponent = The number of years in the project repayment period.

(d) Application of Component Rates

The capital cost and minimum operation, maintenance, power, and replacement components of the Delta Water Charge shall be the product of the appropriate rate computed under subdivision (c) of this article, and the contractor's annual entitlement to project water for the respective year. The variable operation, maintenance, power, and replacement component of the charge shall be the product of the appropriate rate computed under subdivision (c) of this article and the number of acre-feet of project water delivered to the contractor during the respective year: *Provided,* That when project water has been requested by a contractor and delivery thereof has been commenced by the State, and, through no fault of the State, such water is wasted as a result of failure or refusal by the contractor to accept delivery thereof, said variable component during such period shall be the product of said rate per acre-foot and the sum of the number of acre-feet of project water delivered to the contractor and the number of acre-feet wasted.

(e) Allocations to Project Purposes

Prior to the time that additional project conservation facilities or supplemental conservation facilities are constructed, the Delta Water Charge shall be determined on the basis of an allocation to project purposes, by the separable cost-remaining benefits method, of all projected costs of all those initial project conservation facilities located in and above the Delta, and upon an allocation to the purposes of water conservation and water transportation, by the proportionate use of facilities method, of all projected costs of the following project facilities located below the Delta: The aqueduct intake facilities at the Delta, Pumping Plant I (Delta Pumping Plant), the aqueduct from the Delta to San Luis Forebay, San Luis Forebay, and San Luis Reservoir: *Provided,* That all of the projected costs properly chargeable to the generation and transmission of electrical energy in connection with operation of project conservation facilities shall be allocated to the purpose of water conservation in, above, and below the Delta: *Provided further,* That allocations to purposes the costs of which are to be paid by the United States shall be as determined by the United States. Commencing in the year in which the State first incurs capital costs for construction of additional project conservation facilities, the Delta Water Charge shall be determined on the basis of the foregoing allocations and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to the foregoing provisos, of all projected costs of such additional project conservation facilities.

(f) Yearly Recomputation of Rates After 1970

The rates to be used in determining the components of the Delta Water Charge pursuant to subdivision (d) of this article and to become effective on January 1, 1970, shall be computed by the State in accordance with subdivision (c) of this article prior to that date. Such computation shall include an adjustment which shall account for the difference, if any, between revenues received by the State under the Delta Water Charge prior to January 1, 1970, and revenues which would have been received under the charge prior to that date had it been computed and charged in accordance with subdivisions (c) and (d) of this article. Upon such computation, a document establishing such rates shall be prepared by the State and attached to this contract as an amendment of this article. The State shall recompute such rates each year thereafter, and each such recomputation shall take account of and reflect increases or decreases from year to year in projected costs, outstanding reimbursable indebtedness of the State incurred to construct the project conservation facilities described in subdivision (e) of this article, annual entitlements, deliveries of project water, project interest rate, revenues from the sale or other disposal of electrical energy, and all other factors which are determinative of such rates. In addition, each such recomputation shall include an adjustment of the rates for succeeding years which shall account for the differences, if any, between projections of costs used by the State in determining said rates for all preceding years, and actual costs incurred by the State during such years. Upon each such recomputation, an appropriately revised copy of the document establishing such rates shall be prepared by the State and attached to this contract as an amendment of this article.

(g) Supplemental Conservation Facilities

Upon the construction of supplemental conservation facilities, the Delta Water Charge shall be paid by all contractors for supplemental water, as well as by contractors for project water, and, together with revenues derived from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities and supplemental conservation facilities, shall return to the State, in addition to those costs of the project conservation facilities allocated to the purpose of water conservation in, above, and below the Delta pursuant to subdivision (e) of this article, all costs of such supplemental conservation facilities, including capital, operation, maintenance, power, and replacement costs, which are allocated to the purpose of water conservation in, above, and below the Delta pursuant hereto. Commencing in the year in which the State first incurs capital costs for construction of supplemental conservation facilities, the Delta Water Charge shall be determined on the basis of the allocations made pursuant to subdivision (e) of this article, and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to provisos corresponding to those contained in said subdivision (e), of all projected costs of such supplemental conservation facilities. Commencing in the same year, the computation of the rates to be used in determining the components of the Delta Water Charge shall include the annual entitlements to water under all contracts for supplemental water. If the repayment period of any bonds sold to construct supplemental conservation facilities extends beyond the project repayment period, the Delta Water Charge shall be determined and redetermined on the basis of such extended repayment period as the State determines to be appropriate.

23. TRANSPORTATION CHARGE

The payments to be made by each contractor entitled to delivery of project water from the project transportation facilities shall include an annual charge under the designation Transportation Charge. This charge shall return to the State during the project repayment period those costs of all project transportation facilities necessary to deliver project water to the contractor including capital, operation, maintenance, power, and replacement costs, which are allocated to the contractor during the project repayment period in accordance with the cost allocation principles and procedures herein after set forth. Wherever reference is made, in connection with the computation, determination, or payment of the Transportation Charge, to the costs of any facility or facilities included in the System, such reference shall be only to those costs of such facility or facilities which are reimbursable by the contractors as determined by the State. The Transportation Charge shall consist of a capital cost component; a minimum operation, maintenance, power, and replacement component; and a variable operation, maintenance, power, and replacement component, as these components are defined in and determined under Articles 24, 25, and 26, respectively. For the purpose of allocations of costs pursuant to said articles, the project transportation facilities shall be segregated into such aqueduct reaches as are determined by the State to be necessary for such allocations of costs. Subject to such modifications as are determined by the State to be required by reason of any request furnished by the Agency to the State pursuant to Article 17(a) of this contract, or by reason of contracts entered into by the State with other contractors, the aqueduct reaches of the project transportation facilities are established as set forth in Table I of this contract: *Provided,* That those costs of the aqueduct reaches from the Delta through the outlet of San Luis Reservoir which are allocated to the purpose of water conservation in, above, and below the Delta for the purpose of determining the Delta Water Charge, as hereinbefore set forth, shall not be included in the Transportation Charge.

24. TRANSPORTATION CHARGE—CAPITAL COST COMPONENT

(a) Method of Computation

The capital cost component of the Transportation Charge shall be sufficient to return to the State those capital costs of the project transportation facilities necessary to deliver water to the contractor which are allocated to the contractor pursuant to subdivision (b) of this article. The amount of this component shall be determined in two steps as follows: (1) an allocation of capital costs to the contractor, and (2) a computation of annual payment of such allocated capital costs and interest thereon, computed at the project interest rate and compounded annually, to be made by the contractor.

(b) Allocation of Capital Costs Among Contractors

In the first step, the total amount of capital costs of each aqueduct reach to be returned to the State shall be allocated among all contractors entitled to delivery of project water from or through the reach by the proportionate use of facilities method of cost allocation and in accordance with (1) and (2) below. The measure of the proportionate use of each contractor of each reach shall be the average of the following two ratios: (i) the ratio of the contractor's maximum annual entitlement to be delivered from or through the reach to the total of the maximum annual entitlements of all contractors to be delivered from or through the reach; and (ii) the ratio of the capacity provided in the reach for the transport and delivery of project water to the contractor to the total capacity provided in the reach for the transport and delivery of project water to all contractors served from or through the reach. Allocations of capital costs to the Agency pursuant hereto shall be on the basis of relevant values which will be set forth in Table B of this contract by the State as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach of the project transportation facilities for the transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided,* That these values shall be subject to redetermination by the State in accordance with Article 28: *Provided further,* That the principles and procedures set forth in this subdivision shall be controlling as to allocations of capital costs to the Agency.

(1) The total amount of capital costs allocated to a contractor shall be the sum of the products obtained when there is multiplied, for each aqueduct reach necessary to deliver water to the contractor, the total amount of the capital costs of the reach to be returned to the State under the Transportation Charge by the average of the two foregoing ratios for such reach as said average is set forth in the appropriate table included in its contract.

(2) In the event that excess capacity is provided in any aqueduct reach for the purpose of making project water available in the future to an agency or agencies with which the State has not executed contracts at the time of any allocation of costs pursuant to this subdivision, the prospective maximum annual entitlement or entitlements to be supplied by such excess capacity, as determined by the State, shall be deemed to be contracted for by said agency or agencies for the purpose of such allocation of costs, to the end that the capital costs of providing such excess capacity are not charged to any contractor entitled by virtue of an executed contract to the delivery of project water from or through that aqueduct reach at the time of such allocation. Where additional capacity is provided in any aqueduct reach to compensate for loss of water due to evaporation, leakage, seepage, or other causes, or to compensate for scheduled outages for purposes of necessary investigation, inspection, maintenance, repair or replacement of the facilities of the project facilities, then, for the purpose of any allocation of costs pursuant to this subdivision: (i) the maximum annual entitlement to be delivered from or through the reach of each contractor entitled to delivery of project water from or through the reach shall be increased by an amount which bears the same proportion to the maximum annual delivery capability provided by such additional capacity that the contractor's maximum annual entitlement to be delivered from or through the reach bears to the total of the maximum annual entitlements to be delivered from or through the reach under all contracts; and (ii) the capacity provided in the reach for each contractor entitled to delivery of project water from or through the reach shall be increased in the same proportion that the contractor's maximum annual entitlement to be delivered from or through the reach is increased pursuant to (i) above.

(3) The projected amounts of capital costs to be allocated annually to the Agency under the capital cost component of the Transportation Charge shall be determined by the State in accordance with the cost allocation principles and procedures set forth in this subdivision, which principles and procedures shall be controlling as to allocations of capital costs to the Agency. Such amounts will be set forth in Table C of this contract by the State as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be

provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided*, That these amounts shall be subject to redetermination by the State in accordance with Article 28.

(c) Annual Payments of Allocated Capital Costs

In the second step, the Agency's annual payment of its allocated capital costs and interest thereon, computed at the project interest rate and compounded annually, shall be determined in accordance with a payment schedule established by the State and determined in accordance with the principles set forth in (1), (2), and (3) below, which principles shall be controlling as to the Agency's payment of its allocated capital costs. The Agency's payment schedule will be set forth in Table D of this contract by the State as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided*, That the amounts set forth in Table D shall be subject to redetermination by the State, pursuant to Article 28.

(1) The Agency's annual payment shall be the sum of the amounts due from the Agency on the Agency's allocated capital costs for the then current year and for each previous year where each such amount will pay, in not more than fifty (50) equal annual installments of principal and interest, the Agency's allocated capital costs for the respective year and interest thereon, computed at the project interest rate and compounded annually.

(2) The Agency may make payments at a more rapid rate if approved by the State.

(3) Such annual payments shall cease when all allocated capital costs and interest thereon, computed at the project interest rate and compounded annually, are repaid.

(d) Payment in Advance for Excess Peaking Capacity

In the event that any contractor, pursuant to Article 12(b), requests delivery capacity in any aqueduct reach which will permit maximum monthly deliveries to such contractor in excess of the percentage amounts specified in said Article 12(b) for the uses designated therein, such contractor shall furnish to the State, in advance of the construction of such aqueduct reach, funds sufficient to cover the costs of providing such excess capacity, which funds shall be in an amount which bears the same proportion to the total capital costs of such reach, including the costs of providing such excess capacity, as such excess capacity bears to the total capacity of such reach, including such excess capacity. For the purpose of any allocation of costs pursuant to subdivision (b) of this article, the total capital costs of such aqueduct reach shall be allocated among all contractors entitled to delivery of project water from or through the reach in the following manner:

(1) The costs which would have been incurred for such reach had no such excess capacity been provided shall be estimated by the State and allocated among all such contractors in the manner provided in said subdivision (b); and

(2) The amount of the difference between said estimated costs and the projected actual costs of such reach shall be allocated to the contractor or contractors for which such excess capacity is provided.

Where such excess capacity is provided for more than one contractor, the costs allocated to them under (2) above shall be further allocated between or among them in amounts which bear the same proportion to the total of said allocated costs as the amount of such excess capacity provided for the respective contractor bears to the total of such excess capacity provided in such reach. In the event that the funds advanced by a contractor pursuant to this subdivision are more or less than the costs so allocated to such contractor under (2) above, the account of such contractor shall be credited or debited accordingly.

(e) Costs Incurred Prior to Date of Contract

The Agency's allocated capital costs for the year preceding the year of initial payment of the capital component of the Transportation Charge, pursuant to subdivision (c) of this article, shall consist of the sum of the Agency's allocated capital costs for each year through such year preceding the year of initial payment, and interest thereon, computed at the project interest rate and compounded annually.

25. TRANSPORTATION CHARGE—MINIMUM OPERATION, MAINTENANCE, POWER, AND REPLACEMENT COMPONENT

(a) Method of Computation

The minimum operation, maintenance, power, and replacement component of the Transportation Charge shall return to the State those costs of the project transportation facilities necessary to deliver water to the contractor which constitute operation, maintenance, power, and replacement costs incurred irrespective of the amount of project water delivered to the contractor and which are allocated to the contractor pursuant to (b) below: *Provided*, That to the extent permitted by law, the State may establish reserve funds to meet anticipated minimum replacement costs; and deposits in such reserve funds by the State: (1) shall be made in such amounts that such reserve funds will be adequate to meet such anticipated costs as they are incurred, and (2) shall be deemed to be a part of the minimum replacement costs for the year in which such deposits are made.

(b) Allocation of Costs

The total projected minimum operation, maintenance, power, and replacement costs of each aqueduct reach of the project transportation facilities for the respective year shall be allocated among all contractors entitled to delivery of project water from said facilities by the proportionate use of facilities method of cost allocation, in the same manner and upon the same bases as are set forth for the allocation of capital costs in Article 24: *Provided*, That such minimum operation, maintenance, power, and replacement costs as are incurred generally for the project transportation facilities first shall be allocated to each aqueduct reach in an amount which bears the same proportion to the total amount of such general costs that the amount of the costs incurred directly for the reach bears to the total of all direct costs for all aqueduct reaches.

(c) Payment Table

The amount to be paid each year by the Agency under the minimum operation, maintenance, power, and replacement component of the Transportation Charge shall be determined in accordance with subdivision (b) of this article on the basis of the relevant values to be set forth for the respective aqueduct reaches in Table B of this contract: *Provided*, That these values shall be subject to redetermination by the State in accordance with Article 28. Such amounts and any interest thereon shall be set forth by the State in Table E of this contract as soon as designs and cost estimates have been prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided*, That the amounts set forth in Table E shall be subject to redetermination by the State in accordance with Article 28.

26. TRANSPORTATION CHARGE—VARIABLE OPERATION, MAINTENANCE, POWER, AND REPLACEMENT COMPONENT

(a) Method of Computation

The variable operation, maintenance, power, and replacement component of the Transportation Charge shall return to the State those costs of the project transportation facilities necessary to deliver water to the contractor which constitute operation, maintenance, power, and replacement costs incurred in an amount which is dependent upon and varies with the amount of project water delivered to the contractor and which are allocated to the contractor pursuant to (1) and (2) below: *Provided*, That to the extent permitted by law, the State may establish reserve funds to meet anticipated variable replacement costs; and deposits in such reserve funds by the State: (1) shall be made in such amounts that such reserve funds will be adequate to meet such anticipated costs as they are incurred, and (2) shall be deemed to be a part of the variable replacement costs for the year in which such deposits are made. The amount of this component shall be determined as follows:

(1) There shall be computed for each aqueduct reach of the project transportation facilities a charge per acre-foot of water which will return to the State the total projected variable operation, maintenance, power, and replacement costs of the reach for the respective year. This computation shall be made by dividing said total by the number of acre-feet of project water estimated to be delivered from or through the reach to all contractors during the year.

(2) The amount of the variable component shall be the sum of the products obtained when the charges per acre-foot of water, determined under (1) above, for each aqueduct reach necessary to deliver water to the contractor are multiplied by the number of acre-feet of project water delivered to the contractor from or through that reach during the year: *Provided*, That when project water has been requested by a contractor and delivery thereof has been commenced by the State, and, through no fault of the State, such water is wasted as a result of failure or refusal by the contractor to accept delivery thereof, the amount of said variable component to be paid by such contractor during such period shall be the product of the above sum and the sum of the number of acre-feet of project water delivered to the contractor and the number of acre-feet wasted.

(b) Revenue From Aqueduct Power Recovery Plants

There shall be credited against the amount of the variable component to be paid by each contractor, as determined pursuant to subdivision (a) of this article, a portion of the projected net value of any power recovered during the respective year at project aqueduct power recovery plants located upstream on the particular aqueduct from the delivery structures for delivery of project water to the contractor. Such portion shall be in an amount which bears the same proportion to said projected net value that the number of acre-feet of project water delivered to the contractor through said plants during the year bears to the number of acre-feet of project water delivered to all contractors through said plants during the year.

(c) Payment Table

The amount to be paid each year by the Agency under the variable operation, maintenance, power, and

replacement component of the Transportation Charge shall be determined in accordance with subdivision (a) of this article for the respective aqueduct reaches in Table B of this contract. Such amounts and any interest thereon shall be set forth by the State in Table F of this contract as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided*, That the amounts set forth in Table F shall be subject to redetermination by the State in accordance with Article 28.

27. TRANSPORTATION CHARGE—PAYMENT SCHEDULE

The amounts to be paid by the Agency for each year of the project repayment period under the capital cost and minimum operation, maintenance, power, and replacement components of the Transportation Charge, and under the variable operation, maintenance, power, and replacement component of said charge on the basis of then estimated deliveries, shall be set forth by the State in Table G of this contract as soon as designs and cost estimates have been prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach for transport and delivery of project water to the Agency, pursuant to Article 17(a). Table G of this contract shall constitute a summation of Tables D, E, and F of this contract: *Provided*, That each of the amounts set forth in Table G shall be subject to redetermination by the State in accordance with Article 28: *Provided further*, That the principles and procedures set forth in Articles 24, 25, and 26 shall be controlling as to such amounts. Such amounts shall be paid by the Agency in accordance with the provisions of Article 29.

28. TRANSPORTATION CHARGE—REDETERMINATION

The State shall redetermine the values and amounts set forth in Tables B, C, D, E, F and G of this contract in the year following the year in which the State commences construction of the project transportation facilities and each year thereafter in order that the Transportation Charge to the Agency and the components thereof may accurately reflect increases or decreases from year to year in projected costs, outstanding reimbursable indebtedness of the State incurred to construct the project transportation facilities described in Table I of this contract annual entitlements, estimated deliveries, project interest rate, and all other factors which are determinative of such charges. In addition, each such redetermination shall include an adjustment of the components of the Transportation Charge to be paid by the Agency for succeeding years which shall account for the differences, if any, between projections of costs used by the State in determining the amounts of said components for all preceding years and actual costs incurred by the State during such years. Upon each such redetermination, appropriately revised copies of Tables B, C, D, E, F and G shall be prepared by the State and attached to this contract as amendments of those tables.

29. TIME AND METHOD OF PAYMENT

(a) Initial Payment—Delta Water Charge

Payments by the Agency under the Delta Water Charge shall commence in the year of initial water delivery to the Agency.

(b) Initial Payment—Transportation Charge: Capital Component

Payments by the Agency under the capital cost component of the Transportation Charge shall commence in the year following the year in which the State commences construction of the project transportation facilities. If such construction has already commenced when this contract is executed, such payments shall begin in the year following the year of execution.

(c) Initial Payment—Transportation Charge: Minimum Component

Payments by the Agency under the minimum operation, maintenance, power, and replacement component of the Transportation Charge shall commence for each aqueduct reach in the year following the year in which construction of that reach is completed.

(d) Initial Payment—Transportation Charge: Variable Component

Payments by the Agency under the variable operation, maintenance, power, and replacement component of the Transportation Charge shall commence in the year of initial water delivery to the Agency.

(e) Statement of Charges

The State shall, on or before July 1 of each year, commencing with the year preceding the year in which payment of the respective charge is to commence pursuant to this article, furnish the Agency with a written statement of: (1) the charges to the Agency for the next succeeding year under the capital cost and minimum operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge; (2) the unit charges to the Agency for the next succeeding year under the variable operation, maintenance, power, and replacement components of said Delta Water Charge and Transportation Charge; and (3) the total charges to the Agency for the preceding year under the variable operation, maintenance, power, and replacement components of said Delta Water Charge and Transportation Charge: *Provided*, That through December 31,

1969, the Delta Water Charge shall be based upon a unit rate of $3.50 per acre-foot and shall be paid by the contractors on the basis of their respective annual entitlements to project water, as provided in Article 22(b): *Provided further,* That the first such statement shall be provided by the State as soon after the execution of this contract as is feasible. All such statements shall be accompanied by the latest revised copies of the document amendatory to Article 22 and of Tables B, C, D, E, F and G of this contract, together with such other data and computations used by the State in determining the amounts of the above charges as the State deems appropriate. The State shall, on or before the fifteenth day of each month of each year, commencing with the year of initial water delivery to the Agency, furnish the Agency with a statement of the charges to the Agency for the preceding month under the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge. Such charges shall be determined by the State in accordance with the relevant provisions of Articles 22 and 26 of this contract, upon the basis of metered deliveries of project water to the Agency, except as otherwise provided in those articles.

(f) Times of Payment—Capital Components

The Agency shall pay to the State, on or before January 1 of each year, commencing with the year in which payment of the respective charge is to commence pursuant to this article, one-half (½) of the charge to the Agency for the year under the capital cost component of the Delta Water Charge and one-half (½) of the charge to the Agency for the year under the capital cost component of the Transportation Charge, as such charges are stated pursuant to subdivision (e) of this article; and shall pay the remaining one-half (½) of each of said charges on or before July 1 of that year.

(g) Times of Payment—Minimum Components

The Agency shall pay to the State, on or before the first day of each month of each year, commencing with the year of initial water delivery to the Agency, one-twelfth (1/12) of the sum of the charges to the Agency for the year under the minimum operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge, respectively, as such charges are stated pursuant to subdivision (e) of this article.

(h) Times of Payment—Variable Components

The Agency shall pay to the State on or before the fifteenth day of each month of each year, commencing with the year of initial water delivery to the Agency, the charges to the Agency under the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge, respectively, for which a statement was received by the Agency during the preceding month pursuant to subdivision (e) of this article, as such charges are stated in such statement.

(i) Contest of Accuracy of Charges

In the event that the Agency contests the accuracy of any statement submitted to it pursuant to subdivision (e) of this article, it shall give the State notice thereof at least ten (10) days prior to the day upon which payment of the stated amounts is due. To the extent that the State finds the Agency's contentions regarding the statement to be correct, it shall revise the statement accordingly, and the Agency shall make payment of the revised amounts on or before the due date. To the extent that the State does not find the Agency's contentions to be correct, or where time is not available for a review of such contentions prior to the due date, the Agency shall make payment of the stated amounts on or before the due date, but may make the contested part of such payment under protest and seek to recover the amount thereof from the State.

30. SURCHARGE FOR PROJECT WATER USED ON EXCESS LAND

(a) Definitions: "Surcharge"; "Excess Land"

As used herein the term "surcharge" shall mean an amount equivalent to the power credit per acre-foot of water, as such credit is determined under and established by subdivision (b) of this article, to be charged to water users other than the United States or the State of California, as hereinafter provided and to the extent permitted by law, for each acre-foot of project water put to agricultural or manufacturing use on excess land. As used herein the term "excess land" shall mean that part of any land held in single beneficial ownership within a contractor's boundaries, or, where project water is delivered to water users by a retail agency as hereinafter defined, that part of any such land within the service area of such retail agency, which is in excess of 160 acres; or in the case of joint ownership by husband and wife that part of any such land which is in excess of 320 acres.

(b) Definition: "Power Credit"

As used herein, the term "power credit" shall mean the net value accruing to the State from revenues derived from the sale or other disposal of electrical energy generated in connection with operation of initial project conservation facilities after deducting from said revenues the amount necessary to repay the investment properly chargeable to energy generation and for operation, maintenance, and replacement of the electrical generation facilities. The power credit

per acre-foot of water shall be computed in accordance with the following formula:

$$\frac{c_1(1+i)^{-1}+c_2(1+i)^{-2}+\ldots+c_n(1+i)^{-n}}{e_1(1+i)^{-1}+e_2(1+i)^{-2}+\ldots+e_n(1+i)^{-n}}$$

Where:

i = The project interest rate.

c = The projected annual power credit accrued during the respective year of the project repayment period.

1, 2, and n appearing below c = The respective year of the project repayment period during which the power credit is accrued, n being the last year of the project repayment period.

e = The total of annual entitlements to project water of all contractors for the respective year of the project repayment period.

1, 2, and n appearing below e = The respective year of the project repayment period in which the annual entitlements occur, n being the last year of the project repayment period.

n used as exponent = The number of years in the project repayment period.

The power credit per acre-foot of water is hereby established as $2 until all of the facilities for generation of electrical energy in connection with operation of initial project conservation facilities are installed and in operation. The State shall redetermine the power credit per acre-foot of water each year thereafter in order that it may accurately reflect increases or decreases from year to year in the power credit as defined herein. Each such redetermination shall be in accordance with the method of computation set forth in this subdivision, and upon each such redetermination, a document showing the revised amount of the power credit per acre-foot of water shall be attached to this contract as an amendment of this subdivision.

(c) Definition: "Retail Agency"

As used herein the term "retail agency" shall mean any agency which delivers directly to the users thereof, project water made available by, through, or under a contractor.

(d) Payment of Surcharge

Each contractor, to the extent that it delivers project water directly to the users thereof, shall require on behalf of the State that each such user on or before June 1 of each year, commencing with the year following the year of initial water delivery: (1) certify in writing to the contractor on forms prescribed and furnished by the State the description of the excess land owned by such user upon which project water is put to agricultural or manufacturing use, and the amount of project water put to agricultural or manufacturing use on such land during the preceding year; and (2) pay to the contractor for the account of the State a surcharge for the amount of water so certified. Each contractor, to the extent that it delivers project water to a retail agency or to another agency by, through, or under which such water is delivered to a retail agency, shall require on behalf of the State that each water user served by such retail agency be required to, on or before May 1 of each year, commencing with the year following the year of initial water delivery: (1) certify in writing to the retail agency on forms prescribed and furnished by the State the description of the excess land owned by such user upon which project water is put to agricultural or manufacturing use and the amount of project water put to agricultural or manufacturing use on such land during the preceding year; and (2) pay to the retail agency for the account of the State a surcharge for the amount of project water so certified. Each contractor and retail agency shall be entitled to rely upon the certifications furnished them by water users pursuant to this subdivision, unless notified by the State as to the inaccuracy of any such certification. Payments made to the contractor pursuant to this subdivision, together with the certifications supporting such payments, shall be forwarded to the State on or before July 1 of the year in which they are received. Payments made to a retail agency pursuant to this subdivision, together with the certifications supporting such payments, shall on behalf of the State be required to be forwarded to the contractor, which shall in turn forward them to the State on or before July 1 of the year in which they are received; except that where project water has been delivered to the retail agency by, through, or under an agency or agencies other than the contractor, such payments and certifications shall on behalf of the State be required to be forwarded by the retail agency to the agency from which it received project water and by that agency, et seq., to the contractor, which shall forward them to the State on or before July 1 of the year in which they are received.

(e) Commingling of Project and Nonproject Water

In the event that a contractor, retail agency, or water user commingles project water with water from another source in a common distribution system, the contractor shall, in complying with the provisions of this article, adhere to the following rules, and, where project water is delivered by it to a retail agency or to another agency by, through or under which project water is delivered to a retail agency, as contemplated in subdivision (d) of this article, shall require on behalf of the State that such retail agency adhere or be required to adhere to the same rules.

(1) If the amount of nonproject water applied in any year within the area served with project

water by the contractor or retail agency is equal to or greater than the amount of water put to agricultural or manufacturing use on all excess land within that area during such year, it shall be presumed that the water put to agricultural or manufacturing use on such excess land is nonproject water, and there shall be no surcharge to water users in that area.

(2) If the amount of nonproject water applied in any year within the area served with project water by the contractor or retail agency is less than the amount of water put to agricultural or manufacturing use on all excess land within that area during such year, it shall be presumed, for the purpose of determining the payments to be made under the surcharge by water users in that area, that the amount of project water put to agricultural or manufacturing use on excess land of a particular ownership within that area during such year bears the same proportion to the total amount of water so used on that excess land during such year as the total amount of project water applied within that area during such year bears to the total amount of water applied within that area during such year.

(3) Project water which reaches the underground prior to delivery to or pumping by a water user shall not be subject to a surcharge under this article.

(f) Failure of Retail Agency to Perform Obligations

Subject to subdivision (g) of this article, a contractor shall not be liable for the failure of any retail agency or other agency to perform the obligations imposed upon it in accordance with subdivision (d) of this article.

(g) State May Enforce Surcharge

In the event that any retail agency or other agency by, through or under which project water is delivered to a retail agency, fails to perform the obligations imposed upon it in accordance with subdivision (d) of this article, the State may take such action in a court of competent jurisdiction, in the name of the contractor and/or agency or agencies by, through or under which project water is delivered to such retail agency, as it deems necessary to compel the performance of such obligations, and in such action the State shall be subrogated to the rights of such contractor and/or such other agency or agencies against such retail agency or other agency. In the event that any certification furnished by a water user in accordance with subdivision (d) of this article is found by the State to inaccurately represent facts of water use or land ownership, with the result that such user is avoiding payment under the surcharge provided for herein, the State may take such action in a court of competent jurisdiction, in the name of the contractor and/or the retail agency and/or any other agency or agencies by, through, or under which project water is delivered to such water user, as it deems necessary to collect full payment under the surcharge from such water user and to compel the performance of all obligations imposed upon such water user in accordance with said subdivision (d), and in such action the State shall be subrogated to the rights of such contractor and/or such retail agency and/or such other agency or agencies against such water user. Where project water is delivered by a contractor to a retail agency or to another agency by, through, or under which project water is delivered to a retail agency, as contemplated in subdivision (d) of this article, the contractor shall require on behalf of the State that such retail agency or other agency and all agencies by, through, or under which project water is delivered to a retail agency permit or be required to permit the State to bring the foregoing actions in their respective names and be subrogated to their respective rights as set forth above.

(h) State to Defend and Indemnify Against Claims

Should the application of any of the provisions of this article in the manner provided for herein result in claims of any nature against a contractor, retail agency, or other agency by, through, or under which project water is delivered to a retail agency, the State shall defend the contractor, retail agency, or other agency against such claims, and shall indemnify them for any liability with respect thereto arising from activities required by the State under this article.

(i) Separability

This article shall be separable from all other provisions in this contract, and in the event that any or all of the provisions of this article are in any manner or to any extent held to be invalid by final judgment or decree of a court of competent jurisdiction, such holding and such invalidity shall in no way affect the validity of, or make invalid, any other provision of this contract.

31. ADJUSTMENT FOR OVERPAYMENT OR UNDERPAYMENT

If in any year, by reason of errors in computation or other causes, there is an overpayment or underpayment to the State by the Agency of the charges provided for herein, which overpayment or underpayment is not accounted for and corrected in the annual redetermination of said charges, the amount of such overpayment or underpayment shall be credited or debited, as the case may be, to the Agency's account for the next succeeding year and the State shall notify the Agency thereof in writing.

32. DELINQUENCY IN PAYMENT

(a) Agency to Provide for Punctual Payment

The governing body of the Agency shall provide for the punctual payment to the State of payments which become due under this contract.

(b) Interest on Overdue Payments

Upon every amount of money required to be paid by the Agency to the State pursuant to this contract which remains unpaid after it becomes due and payable, interest shall accrue at the rate of one-half (½) of one (1) percent per month of the amount of such delinquent payment from and after the due date until it is paid, and the Agency hereby agrees to pay such interest: *Provided*, that no interest shall be charged to or be paid by the Agency unless such delinquency continues for more than thirty (30) days.

33. OBLIGATION OF AGENCY TO MAKE PAYMENTS

(a) Refusal of Water Does Not Affect Obligation

The Agency's failure or refusal to accept delivery of project water to which it is entitled under Article 6(b) shall in no way relieve the Agency of its obligation to make payments to the State as provided for in this contract. The State, however, shall make reasonable efforts to dispose of any water made available to but not required by the Agency and any net revenues from such disposal shall be credited pursuant to Article 21.

(b) Character of Obligation

The Agency as a whole is obligated to pay to the State the payments becoming due under this contract, notwithstanding any individual default by its constituents or others in the payment to the Agency of assessments, tolls, or other charges levied by the Agency.

34. OBLIGATION OF AGENCY TO LEVY TAXES AND ASSESSMENTS

(a) When Obligated

If in any year the Agency fails or is unable to raise sufficient funds by other means, the governing body of the Agency shall levy upon all property in the Agency not exempt from taxation, a tax or assessment sufficient to provide for all payments under this contract then due or to become due within that year.

(b) Enforcement by Officers of Agency

Taxes or assessments levied by the governing body of the Agency pursuant to subdivision (a) of this article shall be enforced and collected by all officers of the Agency charged with the duty of enforcing and collecting taxes or assessments levied by the Agency.

(c) Deposit in Separate Fund

All money collected for taxes or assessments under this article shall be kept in a separate fund by the treasurer or other officer of the Agency charged with the safekeeping and disbursement of funds of the Agency, and, upon the written demand of the State, the treasurer or other officer shall pay over to the State all such money in his possession or control then due the State under this contract, which money shall be applied by the State to the satisfaction of the amount due under this contract.

(d) Enforcement of Levy

In the event of failure, neglect, or refusal of any officer of the Agency to levy any tax or assessment necessary to provide payment by the Agency under this contract, to enforce or to collect the tax or assessment, or to pay over to the State any money then due the State collected on the tax or assessment, the State may take such action in a court of competent jurisdiction as it deems necessary to compel the performance in their proper sequence of all such duties. Action taken pursuant hereto shall not deprive the State of or limit any remedy provided by this contract or by law for the recovery of money due or which may become due under this contract.

D. GENERAL PROVISIONS

35. REMEDIES NOT EXCLUSIVE

The use by either party of any remedy specified herein for the enforcement of this contract is not exclusive and shall not deprive the party using such remedy of, or limit the application of, any other remedy provided by law.

36. AMENDMENTS

This contract may be amended at any time by mutual agreement of the parties, except insofar as any proposed amendments are in any way contrary to applicable law. The State shall promptly furnish the Agency with copies of all contracts now or hereafter executed by the State for a dependable supply of project water, and of any amendments thereof.

37. AGENCY NOT ESTOPPED TO CHALLENGE STATE LAWS

Nothing herein contained shall be construed as estopping or otherwise preventing the Agency or any person, firm, association, corporation, or public body or agency claiming by, through, or under the Agency from contesting by litigation or other lawful means the validity, constitutionality, construction or application of any law of this State, including laws referred to in the Bond Act, or as preventing or prejudicing the amendment or repeal of any such law, and each contract executed by the State for a dependable supply of

project water shall contain a similar reservation with respect to State laws.

38. OPINIONS AND DETERMINATIONS

Where the terms of this contract provide for action to be based upon the opinion, judgment, approval, review, or determination of either party hereto, such terms are not intended to be and shall never be construed as permitting such opinion, judgment, approval, review, or determination to be arbitrary, capricious, or unreasonable.

39. CONTRACTING OFFICER OF THE STATE

The contracting officer of the State shall be the Director of Water Resources of the State of California and his successors, or their duly authorized representatives. The contracting officer shall be responsible for all discretionary acts, opinions, judgments, approvals, reviews, and determinations required of the State under the terms of this contract.

40. SUCCESSORS AND ASSIGNS OBLIGATED

This contract and all of its provisions shall apply to and bind the successors and assigns of the parties hereto.

41. ASSIGNMENT

No assignment or transfer of this contract or any part hereof, rights hereunder, or interest herein by the Agency shall be valid unless and until it is approved by the State and made subject to such reasonable terms and conditions as the State may impose.

42. WAIVER OF RIGHTS

Any waiver at any time by either party hereto of its rights with respect to a default or any other matter arising in connection with this contract, shall not be deemed to be a waiver with respect to any other default or matter.

43. NOTICES

All notices that are required either expressly or by implication to be given by one party to the other under this contract shall be signed for the State by its contracting officer, and for the Agency by such officer as it may, from time to time, authorize in writing to so act. All such notices shall be deemed to have been given if delivered personally or if enclosed in a properly addressed envelope and deposited in a United States Post Office for delivery by registered or certified mail. Unless and until formally notified otherwise, all notices shall be addressed to the parties at their addresses as shown on the signature page of this contract.

44. MAINTENANCE AND INSPECTION OF BOOKS, RECORDS, AND REPORTS

During regular office hours, each of the parties hereto and their duly authorized representatives shall have the right to inspect and make copies of any books, records, or reports of the other party pertaining to this contract or matters related hereto. Each of the parties hereto shall maintain and make available for such inspection accurate records of all of its costs, disbursements and receipts with respect to its activities under this contract and the Bond Act.

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printed in CALIFORNIA STATE PRINTING OFFICE

45. SPECIAL PROVISIONS

(a) Capacity in Transportation Facilities.

The State shall provide sufficient capacity in the transportation facilities, subject to the provisions of Article 17(b), to deliver 18 percent of the portion of the Agency's annual entitlement to be put to agricultural use in any month and to deliver 11 percent of the portion of the Agency's annual entitlement to be put to municipal use in any month.

(b) Payment of Capital Cost Component of the Transportation Charge.

The Agency shall completely pay its total allocated capital cost component of the Transportation Charge, together with interest thereon, within the project repayment period.

(1) The projected portions of the Agency's annual entitlement which will be put to agricultural use and that will be put to municipal use during each year of the project repayment period shall be determined by the State and set forth in Table A(1) of this contract: Provided, That the amounts set forth in Table A(1) shall be subject to redetermination by the State pursuant to Article 28. The projected amounts of capital costs to be attributed annually to agricultural use and to municipal use under the capital cost component of the Transportation Charge shall be determined by the State by the method utilized in Article 24(b) for the allocation of such capital costs between contractors and shall be set forth in Table C of this contract: Provided, That the amounts set forth in Table C shall be subject to redetermination by the State pursuant to Article 28.

(2) Notwithstanding any conflicting provisions in

Articles 24(c), 24(e), and 29(b), the Agency's payments under that portion of the capital cost component of the Transportation Charge which is attributed by the State to agricultural use of project water shall be determined as follows: the State shall determine a unit rate per acre-foot which, when paid for the projected portion of the Agency's annual entitlement to be put to agricultural use, will return to the State, during the project repayment period, the portion of the capital cost component of the Transportation Charge allocated to the Agency that has been attributed to agricultural use and interest thereon, computed at the project interest rate and compounded annually: Provided, That all unpaid interest shall be accumulated at the project interest rate, compounded annually, and added to the Agency's allocated capital costs. The Agency's annual payment for such portion of the capital cost component shall be the product of the unit rate and the projected portion of the Agency's annual entitlement to be put to agricultural use. The Agency's repayment schedule for the portion of the capital cost component attributed to agricultural use and the unit rate shall be set forth in Table D of this contract: Provided, That the amounts set forth in Table D shall be subject to redetermination by the State pursuant to Article 28. Payments by the Agency under the capital cost component of the Transportation Charge attributed to agricultural use shall commence in the year of initial water delivery.

(3) The portion of the capital cost component of the Transportation Charge for the Agency attributed to municipal use shall be determined and paid in accordance with Articles 24 and 29 of this contract and the repayment schedule for such portion

shall also be set forth in Table D of this contract: Provided, That the amounts set forth in Table D shall be subject to redetermination by the State pursuant to Article 28: Provided further, That payments by the Agency under the capital cost component of the Transportation Charge attributed to municipal use shall commence in 1965.

(c) Surplus Water.

Notwithstanding other provisions of this contract, surplus water for agricultural and ground water replenishment use shall be offered to contractors on the following basis. Before surplus water is sold for other than agricultural and ground water replenishment use, each contractor shall have the right, subject to the ability of the State to deliver such water, to contract for agricultural and ground water replenishment use for a portion of the total amount of surplus water available in any year, in an amount which bears the same ratio to the total amount of surplus water available in that year as the sum of the annual entitlements, set forth in Table A of this contract, delivered to the contractor for agricultural and ground water replenishment use during the preceding three years bears to the total amount of such annual entitlements delivered for agricultural and ground water replenishment use during the preceding three years of all contractors requesting surplus water: Provided, That if its proportion of such surplus water is not required by or cannot be delivered to any contractor, such amount of additional surplus water shall be offered to other contractors for agricultural and ground water replenishment use. During the first three years in which project water is delivered to a contractor, the State shall determine the amount of

surplus water which the contractor may obtain based on the contractor's maximum annual entitlement and the estimated percentage of its annual entitlement to be delivered for agricultural and ground water replenishment use; but quantities so determined shall not exceed the contractor's annual entitlement for that year. For the purpose of computing the portion of the surplus water for agricultural and ground water replenishment use to which each contractor is entitled, the State shall determine the amounts of water used for agricultural and ground water replenishment use by each contractor in each year: Provided, That each contractor shall furnish certified copies of such records and data concerning the use of water within its boundaries as the State may request.

Surplus water for agricultural and ground water replenishment use shall be furnished at prices which will return to the State the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge incurred in such service of surplus water as determined by the State. A surcharge shall be added to the rate for surplus water furnished to excess land in an amount and under the conditions specified in Article 30 of this contract. Contracts made pursuant to this subdivision may exceed one year in duration.

Except as herein modified, the provisions of Article 21 of this contract are hereby confirmed, and all surplus water not specifically allocated pursuant to this subdivision shall be sold under the provisions of Article 21.

As used in this subdivision "ground water replenishment use" shall mean the use of project water exclusively by direct

application to spreading basins, streambeds, or through other means of direct artificial recharge for the purpose of replenishing overdrawn ground water basins.

(d) Surcharge Credit.

Notwithstanding other provisions of this contract, the State may include provisions in water supply contracts allowing a credit to a contractor not to exceed the surcharge to be paid by such contractor: Provided, That such credit shall be utilized to reduce the cost of water for agricultural use on other than excess land at a uniform rate per acre-foot not to exceed two dollars ($2) per acre-foot. Any contract including provisions pursuant to this subdivision shall assure that the reductions in the contractors' obligations authorized by this subdivision are made available exclusively for the benefit of agricultural use on land other than excess land and are not directly or indirectly made available for the benefit of agricultural use on excess land.

For the purpose of this contract, the surcharge credit shall be determined and applied in the following manner:

(1) The Agency or any retail agency shall reduce the toll for each acre-foot of project water put to agricultural use on other than excess land by a surcharge credit which shall be determined by dividing the total amount of the surcharge collected by the agency in any year by the total number of acre-feet of project water put to agricultural use on other than excess land within the agency: Provided, That the surcharge credit shall not exceed two dollars ($2).

(2) For the purpose of preventing any reduction in the cost of project water put to use on excess land the tolls charged by the Agency or any retail agency for project water put to agricultural use on other than excess land shall be less than the tolls charged for project water put to use on excess land by an amount equal to the sum of the surcharge and the surcharge credit, and the Agency agrees not to take any action with respect to the taxing or assessment of property which will nullify or tend to nullify the differential in tolls required by this subdivision.

(3) In the event that a water user commingles project water with water from other sources or receives a commingled water supply from the Agency or a retail agency that has commingled project water with water from another source, the quantity of water upon which the surcharge credit is to be determined shall be the product of the amount of water used by the water user from the commingled supply and the ratio of the amount of project water in the commingled supply to the total amount of commingled water, from which product shall be subtracted the amount of project water, if any, for which the water user is required to make payment of a surcharge under the provisions of Article 30(e)(2) of this contract.

(4) Article 30(d) of this contract is modified to read as follows:

The Agency, to the extent that it delivers project water directly to the users thereof, shall require on behalf of the State that each such user on or before February 1 of each year, commencing with the year following the year of initial water

delivery: (i) certify in writing to the Agency on forms prescribed and furnished by the State the description of the excess land owned by such user upon which project water is put to agricultural or manufacturing use, and the amount of project water put to agricultural or manufacturing use on such land during the preceding year; (ii) pay to the Agency for the account of the State a surcharge for the amount of water so certified; and (iii) certify in writing to the Agency on forms prescribed and furnished by the State the description of the land other than excess land owned by such user upon which project water is put to agricultural use, and the amount of project water put to agricultural use on such land during the preceding year. The Agency to the extent that it delivers project water to a retail agency or to another agency by, through, or under which such water is delivered to a retail agency, shall require on behalf of the State that each water user served by such retail agency be required to, on or before January 15 of each year, commencing with the year following the year of initial water delivery: (i) certify in writing to the retail agency on forms prescribed and furnished by the State the description of the excess land owned by such user upon which project water is put to agricultural or manufacturing use and the amount of project water put to agricultural or manufacturing use on such land during the preceding year; (ii) pay to the retail agency for the account of the State a surcharge for the amount of project water so certified; and (iii) certify in writing to the Agency on forms prescribed and furnished by the State the description of the land other than excess land owned by such user upon which project water is put to

agricultural use, and the amount of project water put to agricultural use on such land during the preceding year. The Agency and retail agency shall be entitled to rely upon the certifications furnished them by water users pursuant to this subdivision, unless notified by the State as to the inaccuracy of any such certification. Payments made to the Agency pursuant to this subdivision, together with the certifications supporting such payments, shall be forwarded to the State on or before March 1 of the year in which they are received. Payments made to a retail agency pursuant to this subdivision, together with the certifications supporting such payments, shall on behalf of the State be required to be forwarded to the Agency, which shall in turn forward them to the State on or before March 1 of the year in which they are received; except that where project water has been delivered to the retail agency by, through, or under an agency or agencies other than the Agency, such payments and certifications shall on behalf of the State be required to be forwarded by the retail agency to the agency from which it received project water and by that agency, et seq., to the Agency, which shall forward them to the State on or before March 1 of the year in which they are received.

(5) Commencing with the year following the year of initial water delivery, the State shall include in the written statement of charges furnished to the Agency for the succeeding year a reduction of charges equal to the total amount of the surcharge credit to which water users within the Agency were entitled during the year preceding the year in which such statement is made. After receiving such statement, the Agency shall credit the

accounts of or make refunds to the water users of one-half of the surcharge credit due them effective not later than February 1 of the succeeding year and the balance not later than August 1 of that year.

(6) The remedies provided in Article 30(g) of this contract shall also be available to the State for the enforcement of this subdivision as against any retail agency or other agency by, through, or under which project water is delivered to a retail agency, or any water user.

(7) Where project water is delivered by the Agency to a retail agency or to another agency by, through, or under which project water is delivered to a retail agency, the Agency shall include the provisions of this subdivision 45(d) in any such contract and shall require its inclusion by any such agency in contracts under which it furnishes water to other agencies to the end that such provisions shall be included in any contract through which project water is furnished to a retail agency.

(8) This subdivision 45(d) shall be separable from all other provisions in this contract, and in the event that any or all of the provisions of this subdivision are in any manner or to any extent held to be invalid by final judgment or decree of a court of competent jurisdiction, such holding and such invalidity shall in no way affect the validity of, or make invalid, any other provision of this contract.

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year	Total Annual Amount in Thousands of Acre-feet
1	87.0
2	95.7
3	145.1
4	159.6
5	232.3
6	264.5
7	293.3
8	324.1
9	363.8
10	406.9
11	449.9
12	491.9
13	534.8
14	584.0
15	630.2
16	682.4
17	730.2
18	776.9
19	822.5
20	870.1
21	921.2
22	958.9
23	1,000.0
and each succeeding year thereafter, for the term of this contract as a Maximum Annual Entitlement:	1,000.0

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY

Year	Agricultural Use	Municipal Use
1		
2		
3		
4		
5		
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22		
23		

TABLE B

ALLOCATED PROPORTION OF COSTS OF PROJECT TRANSPORTATION FACILITIES

KERN COUNTY WATER AGENCY

Aqueduct Reach	Total for project transportation facilities				Agency participation				
	Total of maximum annual entitlements of all contractors, thousands of acre-feet per year 1/	Total of maximum capacities, cubic feet per second 1/	Total capital cost, thousands of dollars	Minimum annual operating cost, thousands of dollars 2/	Maximum annual entitlement, thousands of acre-feet per year 1/	Ratio of maximum annual entitlement to total of maximum annual entitlements	Maximum capacity, cubic feet per second 1/	Ratio of maximum capacity to total capacity	Average ratios
CALIFORNIA AQUEDUCT									
Delta to Discharge Delta Pumping Plant: 3/									
Discharge Delta Pumping Plant to San Luis Forebay: 3/									
San Luis Forebay: 3/									
San Luis Forebay to Kettleman City:									
Kettleman City to Avenal Gap:									
Avenal Gap to Buena Vista Pumping Plant:									
Buena Vista Pumping Plant to Wheeler Ridge Pumping Plants I and II:									
Wheeler Ridge Pumping Plants I and II to Tehachapi Pumping Plant:									
Tehachapi Pumping Plant to North Portal Tehachapi Tunnel No. 1									
COASTAL AQUEDUCT									
Avenal Gap to Discharge Pumping Plant C-3:									
Discharge Pumping Plant C-3 to Pumping Plant C-4:									
Pumping Plant C-4:									

1/ As increased by an allowance to compensate for losses as provided in Article 24(b) (2).

2/ Based on values as of the end of the construction period.

3/ Costs allocated to water transportation.

4/ State capacity only.

TABLE C

PROJECTED ALLOCATIONS OF CAPITAL
COST OF PROJECT TRANSPORTATION FACILITIES TO
KERN COUNTY WATER AGENCY
(In thousands of dollars)

Year	Agricultural Use	Municipal Use	Total
1*			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
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19			
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26			
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29			
30			
31			

* Year in which State commenced construction of project transportation facilities, 1959.

TABLE D

TRANSPORTATION CHARGE-CAPITAL COST COMPONENT
KERN COUNTY WATER AGENCY
(In thousands of dollars)

Year	Municipal Use		Agricultural Use*		Total Annual Payment by Agency
	Annual Payment of Principal	Annual Interest Payment	Annual Payment of Principal	Annual Interest Payment	
1**					
2					
3					
4					
5					
6					
7***					
8					
9					
10****					
11					
12					
13					
14					
15					
16					
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32					
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36					
37					
38					
39					
40					
41					
42					

TABLE D (Continued)

TRANSPORTATION CHARGE-CAPITAL COST COMPONENT
KERN COUNTY WATER AGENCY
(In thousands of dollars)

Year	Municipal Use		Agricultural Use		Total Annual Payment by Agency
	Annual Payment of Principal	Annual Interest Payment	Annual Payment of Principal	Annual Interest Payment	
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
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70					
71					
72					
73					
74					
75					
76					
77					
78					
79					
80					

* Unit rate: $_____.

** Year in which State commenced construction of project transportation facilities, 1959.

***: Year of first payment, municipal use.

**** Year of first payment, agricultural use.

TABLE E
TRANSPORTATION CHARGE - MINIMUM OPERATION
MAINTENANCE, POWER, AND REPLACEMENT COMPONENT
KERN COUNTY WATER AGENCY

Year	Total Annual Payment by Agency* (In thousands of dollars)
1**	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
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31	
and each succeeding year thereafter, for the term of this contract.	

* Payment shall start with respect to each aqueduct reach in the year following the year in which the State completes construction of the respective reach.

** Year in which the State commenced construction of the project transportation facilities, 1959.

TABLE F

TRANSPORTATION CHARGE - ESTIMATED VARIABLE OPERATION, MAINTENANCE, POWER, AND REPLACEMENT COMPONENT
KERN COUNTY WATER AGENCY

Year	Total Annual Payment by Agency* (In thousands of dollars)
1**	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
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25	
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30	
31	
and each succeeding year thereafter, for the term of this contract.	

* Payments start with year of initial water delivery.

** Year in which State commenced construction of project transportation facilities, 1959.

TABLE G

PAYMENT SCHEDULE
KERN COUNTY WATER AGENCY
(In thousands of dollars)

Year	Transportation Charge			
	Capital Cost Component	Minimum Component	Variable Component	Total
1*				
2				
3				
4				
5				
6				
7**				
8				
9				
10***				
11				
12				
13				
14				
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36				
37				
38				
39				
40				
41				
42				

TABLE G (Continued)

PAYMENT SCHEDULE
KERN COUNTY WATER AGENCY
(In thousands of dollars)

Year	Transportation Charge			
	Capital Cost Component	Minimum Component	Variable Component	Total
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
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57				
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77				
78				
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80				

* Year in which State commenced construction of project transportation facilities, 1959.

** Year of first payment, capital cost component, municipal use.

*** Year of first payment, capital cost component, agricultural use.

TABLE I

AQUEDUCT REACHES
KERN COUNTY WATER AGENCY

Aqueduct Reach	Major Features of Reach
Delta to Discharge Delta Pumping Plant:	Intake Canal Fish Protective Facilities Delta Pumping Plant (Pumping Plant I)
Discharge Delta Pumping Plant to San Luis Forebay:	Aqueduct
San Luis Forebay:	San Luis Foreby and Forebay Dam
San Luis Forebay to Kettleman City	Aqueduct Mile 18 Pumping Plant
Kettleman City to Avenal Gap:	Aqueduct
Avenal Gap to Buena Vista Pumping Plant	Aqueduct
Buena Vista Pumping Plant to Wheeler Ridge Pumping Plants I and II:	Buena Vista Pumping Plant Aqueduct
Wheeler Ridge Pumping Plants I and II to Tehachapi Pumping Plant:	Wheeler Ridge Pumping Plant I Wheeler Ridge Pumping Plant II Aqueduct
Tehachapi Pumping Plant to North Portal Tehachapi Tunnel No. 1:	Tehachapi Pumping Plant (Pumping Plant VI)
COASTAL AQUEDUCT	
Avenal Gap to Discharge Avenal Pumping Plant:	Aqueduct Avenal Pumping Plant (Pumping Plant C-3)
Discharge Avenal Pumping Plant to Pyramid Pumping Plant:	Aqueduct
Pyramid Pumping Plant	Pyramid Pumping Plant (Pumping Plant C-4)

TABLE H
PROJECT TRANSPORTATION FACILITIES
KERN COUNTY WATER AGENCY

A San Joaquin Valley-Southern California Aqueduct extending to the North Portal of Tehachapi Tunnel No. 1, to the extent such aqueduct is determined by the State to be required for water transportation.

A Coastal Aqueduct extending to the Discharge Pumping Plant C-4 to the extent such Aqueduct is determined by the State to be required for water transportation.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

P. G. Toner
Chief Counsel
Department of Water
P. O. Box 388
Sacramento, California

Attest:

Edna M. Purvines
Secretary
Kern County Water Agency
1100 26th Street
Bakersfield, California

Approved as to form:

Farley V. Kroeck
Counsel

Approved:

Del Ogilvie
Engineer-Manager

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By William E. Warne
Director

Edmund G. Brown
Governor

KERN COUNTY WATER AGENCY

By David M. Bryant Jr.
President

By Allen Bottoroff
Director

By Jack G. Thomson
Director

By Robert Cuneo
Director

By Pete Giacomelli
Director

By Kenneth M. Smith
Director

By _____
Director

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 1 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 28th day of September 1964, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency,"

WITNESSETH, That:

WHEREAS, the State is authorized to construct and operate facilities for the storage and conveyance of water, certain of which facilities will make water available to the Agency; and

WHEREAS, the State and the Agency have entered into a water supply contract, dated November 15, 1963, providing that the State shall supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the maximum annual entitlements under all contracts executed by the State on or before December 31, 1963, did not aggregate the amount of the minimum project yield as defined in such water supply contract; and

WHEREAS, the Agency has elected to become entitled to a certain amount of the uncontracted for portion of the minimum project yield under the provisions of Article 8 of the above-mentioned contract and the State has determined that the Agency can put the water involved to beneficial use within a reasonable period of time; and

WHEREAS, the State and the Agency are desirous of making certain other changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (k) of Article 1 is amended to read as follows:

(k) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available, estimated to be 4,230,000 acre-feet per year, said amount to be determined by the State on the basis of coordinated operation studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon:

(1) The estimated relative proportion of deliveries for agricultural use to deliveries for municipal use for the year

1990, and the characteristic distribution of demands for these two uses throughout the year.

(2) An allowable reduction in the agricultural use portion of the minimum project yield, due to drought, of not to exceed fifty percent (50%) in any one year, nor a total of one hundred percent (100%) of one year's supply in any series of seven consecutive years.

(3) Agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the diversion or utilization of waters of the Delta or streams tributary thereto.

2. Table A entitled "Annual Entitlements Kern County Water Agency" is amended to read as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year	Total Annual Amount in Acre-Feet
1	87,000
2	95,700
3	145,100
4	190,300
5	270,700
6	310,500
7	347,000
8	385,500
9	432,800
10	483,600
11	534,300
12	583,900
13	634,500
14	691,400
15	745,300
16	805,100
17	860,600
18	915,000
19	968,200
20	1,023,500
21	1,074,600
22	1,112,300
23	1,153,400
and each succeeding year thereafter, for the term of this contract:	1,153,400

3. Subdivision (c) of Article 12 is amended to read as follows:

(c) Limit on Rate of Delivery to Agency

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding three thousand two hundred seventy seven (3,277) cubic feet per second, except as this rate of flow may be revised by amendment of this article after

submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

4. Subdivision (a) of Article 16 is amended to read as follows:

(a) Limit on Total of all Maximum Annual Entitlements

The Agency's maximum annual entitlement hereunder, together with the maximum annual entitlements of all other contractors, shall aggregate no more than the minimum project yield as defined herein and in no event more than 4,230,000 acre-feet of project water.

5. Subdivision (c) of Article 45 is amended to read as follows:

(c) Surplus Water

Notwithstanding other provisions of this contract, surplus water for agricultural and ground water replenishment use shall be offered to contractors on the following basis. Before surplus water is sold for other than agricultural and ground water replenishment use, each contractor shall have the right, subject to the ability of the State to deliver such water and to the provisions of the next succeeding paragraph, to contract for agricultural and ground water replenishment use for a portion of the total amount of surplus water available in any year, in an amount which bears the same ratio to the total amount of surplus water available in that year as the sum of the annual entitlements set forth in Table A of this contract, delivered to the contractor for agricultural and ground water replenishment use during the preceding three years bears to the total amount of such annual

entitlements delivered for agricultural and ground water replenishment use during the preceding three years of all contractors requesting surplus water: Provided, That if its proportion of such surplus water is not required by or cannot be delivered to any contractor, such amount of additional surplus water shall be offered to other contractors for agricultural and ground water replenishment use. During the first three years in which project water is delivered to a contractor, the State shall determine the amount of surplus water which the contractor may obtain based on the contractor's maximum annual entitlement and the estimated percentage of its annual entitlement to be delivered for agricultural and ground water replenishment use; but quantities so determined shall not exceed the contractor's annual entitlement for that year. For the purpose of computing the portion of the surplus water for agricultural and ground water replenishment use to which each contractor is entitled, the State shall determine the amounts of water used for agricultural and ground water replenishment use by each contractor in each year: Provided, That each contractor shall furnish certified copies of such records and data concerning the use of water within its boundaries as the State may request.

The provisions of this paragraph shall be applicable only to contractors in the San Joaquin Valley Service Area, contractors in the Southern California Service Area, and contractors in the Central Coastal Service Area. Before surplus water is sold for other than agricultural and ground water replenishment use, each contractor shall have the right, subject to the ability of the State to deliver such water, to contract for agricultural

and ground water replenishment use in accordance with the following formula: contractors in the San Joaquin Valley Service Area shall have a right to contract for sixty-nine percent (69%) of the surplus water available at the Mile 18 Pumping Plant; contractors in the Southern California Service Area shall have a right to contract for twenty-nine percent (29%) of such water; and contractors in the Central Coastal Service Area shall have a right to contract for two percent (2%) of such water: Provided, That within each of these service areas, each contractor shall have the right to contract for agricultural and ground water replenishment use for a portion of the total amount of surplus water available to that service area in any year, in an amount which bears the same ratio to the total amount of surplus water available to the service area in that year as the sum of the annual entitlements, set forth in Table A of this contract, delivered to the contractor for agricultural and ground water replenishment use during the preceding three years bears to the total amount of such annual entitlements delivered for agricultural and ground water replenishment use during the preceding three years of all contractors in that service area requesting surplus water: Provided, further, That if its proportion of such surplus water is not required by or cannot be delivered to any contractor, such amount of additional surplus water shall be offered to other contractors for agricultural and ground water replenishment use. During the first three years in which project water is delivered to a contractor, the State shall determine the amount of surplus water which the contractor may obtain based on the contractor's maximum annual entitlement and the estimated percentage of its annual entitlement

to be delivered for agricultural and ground water replenishment use; but quantities so determined shall not exceed the contractor's annual entitlement for that year. As used in this paragraph, "contractors in the San Joaquin Service Area" shall mean: Devil's Den Water District, Dudley Ridge Water District, Empire West Side Irrigation District, Hacienda Water District, Kern County Water Agency, and Tulare Lake Basin Water Storage District; "contractors in the Southern California Service Area" shall mean: Antelope Valley-East Kern Water Agency, City of West Covina, Coachella Valley County Water District, Crestline-Lake Arrowhead Water Agency, Desert Water Agency, Littlerock Creek Irrigation District, Mojave Water Agency, Palmdale Irrigation District, San Bernardino Valley Municipal Water District, San Gabriel Valley Municipal Water District, San Gorgonio Pass Water Agency, The Metropolitan Water District of Southern California, Upper Santa Clara Valley Water Agency, and Ventura County Flood Control District; "contractors in the Central Coastal Service Area" shall mean: San Luis Obispo County Flood Control and Water Conservation District and Santa Barbara County Flood Control and Water Conservation District.

The provision of this paragraph shall be applicable only to a contractor to which the delivery of project water for municipal use as of 1990 is estimated by the State to be in excess of fifty percent (50%) of such contractor's maximum annual entitlement. For the purpose of fixing such contractor's right to delivery of surplus water, water from a watershed not tributary to the

contractor's area which is delivered within the contractor's boundaries for agricultural or ground water replenishment use shall be deemed to be part of the contractor's annual entitlement delivered for such use in computing the quantity of surplus water to which the contractor is entitled under this subdivision: Provided, That the contractor shall not be deemed to have used more than its annual entitlement, as set forth in Table A, for such use. Surplus water shall be deemed to be used by the contractor for agricultural or ground water replenishment use if an equal quantity of water imported from a watershed not tributary to the contractor's area is delivered within the contractor's boundaries for such use.

In providing for the delivery of surplus water to contractors pursuant to this subdivision, the State shall refuse to deliver such surplus water to any contractor to the extent that the State determines that such delivery would tend to encourage the development of an economy within the area served by such contractor which would be dependent upon the sustained delivery of water in excess of the contractor's maximum annual entitlement. In no event shall the quantity of surplus water made available in any year prior to 1986 to any contractor under this subdivision exceed the difference between its annual entitlement for that year and its maximum annual entitlement, except that, subject to provisions of the immediately preceding sentence, with respect to any contractor which under Table A of its contract is scheduled to receive its maximum annual entitlement prior to 1978, the

quantity of surplus water made available in any year prior to 1986 under this subdivision may exceed such difference by not more than 3,000 acre-feet.

Surplus water for agricultural and ground water replenishment use shall be furnished at prices which will return to the State the variable operation, maintenance, power, and replacement components of the Delta Water Charge and Transportation Charge incurred in such service of surplus water as determined by the State. Surplus water delivered under this subdivision shall be limited to the quantity of water which can be delivered without adversely affecting the reliability, or increasing the cost, of service to meet annual entitlements. A surcharge shall be added to the rate for surplus water furnished to excess land in an amount and under the conditions specified in Article 30 of this contract. Contracts made pursuant to this subdivision may exceed one year in duration.

Except as herein modified, the provisions of Article 21 of this contract are hereby confirmed, and all surplus water not specifically allocated pursuant to this subdivision shall be sold under the provisions of Article 21. Nothing in this subdivision shall limit the right of the Agency to increase its annual entitlements as otherwise provided in this contract.

As used in this subdivision "ground water replenishment use" shall mean the use of project water exclusively by direct application to spreading basins, streambeds, or through other means of direct artificial recharge for the purpose of replenishing overdrawn ground water basins.

6. Within thirty (30) days of the date of execution of this amendment, the Agency shall submit this amendment to a court of competent jurisdiction for determination of its validity by a proceeding in mandamus or other appropriate proceeding or action, which proceeding or action shall be diligently prosecuted to final decree or judgment.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

Chief Counsel
Department of Water
P. O. Box 388
Sacramento, California

Attest:

Secretary
Kern County Water Agency
1100 - 26th Street
Bakersfield, California

Approved as to form:

Counsel

Approved:

Engineer-Manager

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

KERN COUNTY WATER AGENCY

By _____
President

By _____
Director

By _____
Director

By _____
Director

By _____
Director

By _____
Director

By _____
Director

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 2 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 10th day of October, 1966, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency",

WITNESSETH, That:

WHEREAS, the State is authorized to construct and operate facilities for the storage and conveyance of water, certain of which facilities will make water available to the Agency; and

WHEREAS, the State and the Agency have entered into a water supply contract, dated November 15, 1963, as amended September 28, 1964, providing that the State shall supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the annual entitlement for the first year of water deliveries under the Agency's contract is 87,000 acre-feet; and

WHEREAS, the Agency will not furnish water to as large a service area during the first year of water deliveries as was contemplated when the Agency's water supply contract was executed by reason of the fact that the California Aqueduct will not be completed on January 1, 1968, to a point as far south in Kern County as was originally planned; and

WHEREAS, the Agency has requested that its annual entitlement for the first year of water deliveries be reduced to 46,600 acre-feet; and

WHEREAS, the State has determined that allowing such a reduction in entitlement will not impair the financial feasibility of the project facilities;

NOW THEREFORE, it is mutually agreed that the following change is hereby made to the Agency's water supply contract with the State:

Table A entitled "Annual Entitlements Kern County Water Agency" is amended to read as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year	Total Annual Amount in Acre-Feet
1	46,600
2	95,700
3	145,100
4	190,300
5	270,700
6	310,500
7	347,000
8	385,500
9	432,800
10	483,600
11	534,300
12	583,900
13	634,500
14	691,400
15	745,300
16	805,100
17	860,600
18	915,000
19	968,200
20	1,023,500
21	1,074,600
22	1,112,300
23	1,153,400
And each succeeding year thereafter, for the term of this contract as a maximum annual entitlement:	1,153,400

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

Chief Counsel
Department of Water Resources
P. O. Box 388
Sacramento, California

Attest:

Secretary

Kern County Water Agency
1415 18th Street
Bakersfield, California 93301

Approved as to form:

Counsel

Approved:

Engineer-Manager

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By
Director

KERN COUNTY WATER AGENCY

By
President

By
Director

By
Director

By
Director

By
Director

By
Director

By
Director

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 31st day of December, 1968, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency",

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract, dated November 15, 1963, (herein referred to as the "Amended Contract") providing that the State shall supply certain quantities of water to the Agency, and that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a retail agency or another agency, for payment to the State of such surcharge, and for the application, on specified terms and conditions, of the amount of such surcharge as a credit against certain payments by certain water users and by the Agency to the State; and

WHEREAS, the Amended Contract establishes the power credit per acre-foot of water as two dollars until all of the facilities for generation of electrical energy in connection with operation of initial project conservation facilities are installed and in operation, and provides for a redetermination of such credit thereafter to reflect accurately increases or decreases from year to year in the power credit; and

WHEREAS, all of such facilities are not installed and in operation; and

WHEREAS, the power credit of two dollars appears to be grossly excessive, in light of presently estimated power costs and revenues incurred and received and to be incurred and received attributable to initial project conservation facilities, but no accurate redetermination of the power credit can be made at this time;

NOW, THEREFORE, it is mutually agreed as follows:

The provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit shall not be effective as to water deliveries during the years ending December 31, 1967, 1968 and 1969. Prior to March 1, 1970, the State shall determine the power credit to be used for water deliveries during the year ending December 31, 1970, which credit shall be determined in accordance with the formula set forth in Article 30(b) of the Amended Contract.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form
and sufficiency:

By P. G. Turner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By John R. Teerink
Acting Director

Attest:

By Edna M. Cummings
(Title) Secretary
Kern County Water Agency

KERN COUNTY WATER AGENCY

By Robert L. Smith
(Title) President

Approved as to form
and execution:

By Stanley W. Krouch
(Title) Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 4 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 31st day of December, 1969, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency
herein referred to as the "Agency";

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 22(b) of such water supply contract provides that for each year through the year 1969 the Delta Water Charge shall be the product of $3.50 and the Agency's annual entitlement for the respective year and that beginning in the year 1970, the Delta Water Charge shall be the sum of the capital cost component, minimum operation, maintenance, power and replacement component, and

variable operation, maintenance, power and replacement component computed in accordance with Articles 22(c) and (d) of the water supply contract; and

WHEREAS, Articles 22(e) and (g) of such water supply contract provide that the Delta Water Charge as computed in accordance with Articles 22(c) and (d) shall include all projected costs of additional project and supplemental conservation facilities commencing in the years in which the State first incurs capital costs for such facilities after the facilities are authorized; and

WHEREAS, the parties desire that all water supply contracts be amended to postpone inclusion of the projected costs of any authorized additional project and supplemental conservation facilities in the computation of the Delta Water Charge until after the year 1970 and to fix the rate for computing the Delta Water Charge for the year 1970 at $6.65; and

WHEREAS, the payments to be made by the Agency to the State include interest calculated at the "project interest rate" defined in Article 1(r) of such water supply contract to mean the weighted average of the interest rates paid by the State on bonds issued under the Water Resources Development Bond Act (Bond Act) disregarding premiums received on the sale of such bonds; and

WHEREAS, the underlying assumption upon which the "project interest rate" was established was that all of the initial facilities of the State Water Resources Development System (Project) would be financed principally with proceeds of bonds issued under the Bond Act or from other sources on which the interest rate would not exceed that of the bonds issued under the Bond Act; and

WHEREAS, the State already has financed the Oroville-

Thermalito power facilities through Central Valley Project Revenue Bonds and may finance other portions of the project facilities through additional revenue bond issues, bonds issued under other authority granted by the Legislature or the voters, bonds issued by other state agencies, advances from contractors, and other methods under which the financing costs relate to interest rates that may exceed the interest rate of the bonds issued under the Bond Act; and

WHEREAS, either the State or contractors making advances to the State may be subject to interest rates, or other financing costs that relate to interest rates, which will be greater than the "project interest rate" as presently defined in the contracts; and

WHEREAS, the parties desire that (1) the interest costs hereafter incurred by or on behalf of the State in financing the construction of project facilities by means other than the use of moneys provided under the Bond Act will be reflected in appropriate adjustments of the "project interest rate" (excepting the interest costs incurred for the Central Valley Project Revenue Bonds issued prior to the date of this amendment); (2) appropriate credit will be given to any contractor having made an advance of funds to the State corresponding to the bond service obligation payable by such contractor by reason of such advance or if bonds were not used to obtain funds for such advance, then to the net interest cost which would have resulted if the contractor had sold bonds for the purpose of funding the advance; and (3) if any sources of funds other than those provided under the Bond Act are employed to finance the construction of specific project facilities and the interest or other costs of such financing are greater than the cost would have been if bonds issued under the Bond Act had been used, appropriate

adjustments to the charges to contractors will be made with respect to such facilities so that the charges to contractors taking water through reaches which include such facilities will be the same after such adjustments as such charges would have been if such facilities had been financed by the use of proceeds of bonds issued under the Bond Act, except insofar as the "project interest rate" has been adjusted pursuant to (1) in this recital:

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (b) of Article 22 is amended to read as follows:

For each contractor receiving project water in any year through December 31, 1969, the Delta Water Charge shall be the product of $3.50 and the contractor's annual entitlement to project water for the respective year. For each contractor receiving project water in the year 1970, the Delta Water Charge shall be the product of $6.65 and the contractor's annual entitlement to project water for that year. The $6.65 rate for the year 1970 shall consist of a capital cost component of $5.04 and a minimum operation, maintenance, power and replacement component of $1.61. After December 31, 1970, the Delta Water Charge shall consist and be the sum of the following components as these are computed in accordance with subdivisions (c) and (d) of this article: a capital cost component; a minimum operation, maintenance, power and replacement component; and a variable operation, maintenance, power and replacement component.

2. Subdivision (r) of Article 1 is amended to read as follows:

"Project interest rate" shall mean the weighted average interest rate of (1) through (6) below computed by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts:

(1) general obligation bonds issued by the State under the Bond Act,

(2) revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) bonds issued by any agency, district, political subdivision, public corporation, or non-profit corporation of this State,

(5) funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State, and

(6) funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing

by moneys in the Pooled Money Investment Account of such Treasury invested in securities,

to the extent the proceeds of any such bonds, advances or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities (except advances for delivery structures, measuring devices and excess capacity) and without regard to any premiums received on the sale of bonds under item (1) above. The "project interest rate" shall be computed as a decimal fraction to five places.

3. Subdivision (f) of Article 17 is added to the contract to read as follows:

(f) Adjustments Due to Supplemental Financing Costs

(1) If a contractor, with approval of the State, advances funds to the State to assist the State in financing construction of project facilities (not including delivery structures, measuring devices and excess capacity), such advance shall be amortized by means of annual credits to the contractor having made such advance of funds to the State, with such credits being equal to the actual bond service obligations payable by such contractor by reason of such advance or, if no bonded debt was incurred, then such credits shall be sufficient to cover the repayment of principal and interest costs which would have resulted if the contractor had sold bonds for the purpose of funding the advance as determined by the State.

(2) If, after May 1, 1969, any source of funds other than those provided by the Bond Act is employed to finance

construction of specific project facilities, any additional costs incurred because of such financing will not be charged to the contractors, except for adjustments to the "project interest rate".

Approved as to legal form and sufficiency:

P. G. Tonner

Chief Counsel
Department of Water Resources
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

By _____
Director

Attest:

Edna M. Pierines

Secretary
Kern County Water Agency

KERN COUNTY WATER AGENCY

By _____
President

Approved as to form
and execution:

Edward J. Tiedemann

Counsel

AMENDMENT NO. 5

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT TO WATER SUPPLY
CONTRACT BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 22nd day of December, 1970, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Bakersfield, California, herein referred to as the "Agency",

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract, dated November 15, 1963 (herein referred to as the "Amended Contract"), providing that the State shall supply certain quantities of water to the Agency, and that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a retail agency or another agency, for payment to the State of such surcharge, and for the application, on specified terms and conditions, of the amount of such surcharge as a credit against certain payments by certain water users and by the Agency to the State; and

WHEREAS, the Amended Contract establishes the power credit per acre-foot of water as two dollars until all of the facilities for generation of electrical energy in connection with operation of initial project conservation facilities are installed and in operation, and provides for a redetermination of such credit thereafter to reflect accurately increases or decreases from year to year in the power credit; and

WHEREAS, the provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit were suspended as to water deliveries during the years ending not later than December 31, 1969 pending the first redetermination of the power credit; and

WHEREAS, the power credit of two dollars is and will be grossly excessive for the year 1970 and thereafter, the estimated surcharge payments and surcharge credits, based on a redetermination of the power credit, would be relatively small

and the associated administrative costs of the State and its contractors would be large; and

WHEREAS, the State and water contractors are in the process of reevaluating the power credit and such surcharge and surcharge credit provisions;

NOW, THEREFORE, it is mutually agreed as follows:

The provisions of the Amended Contract providing for or related to the surcharge and surcharge credit shall not be effective as to water deliveries during the year ending December 31, 1970.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form
and sufficiency:

By P. G. Tower
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W. R. Gianelli
Director

Attest:

By Edna M. Cummins
Secretary
(Title)

KERN COUNTY WATER AGENCY

By Lewis Kamp
President
(Title)

Approved as to form
and execution:

By Stanley W. Kimball
Counsel
(Title)

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 5 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 31st day of December, 1970, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 22(b) of such water supply contract, as amended, provides that for each year through the year 1969 the Delta Water Charge shall be the product of $3.50 and the Agency's annual entitlement for the respective year, that for the year 1970 the Delta Water Charge shall be the product of $6.65 and the Agency's annual entitlement for that year, and that beginning in the year

1971 the Delta Water Charge shall be the sum of the capital cost component, minimum operation, maintenance, power and replacement component, and variable operation, maintenance, power and replacement component computed in accordance with Articles 22(c) and (d) of the water supply contract; and

WHEREAS, Articles 22(e) and (g) of such water supply contract provide that the Delta Water Charge as computed in accordance with Articles 22(c) and (d) shall include all projected costs of additional project and supplemental conservation facilities commencing in the years in which the State first incurs capital costs for such facilities after the facilities are authorized; and

WHEREAS, the parties desire that all water supply contracts be amended to postpone inclusion of the projected costs of any authorized additional project and supplemental conservation facilities in the computation of the Delta Water Charge until after the year 1971 and to fix the rate for computing the Delta Water Charge for the year 1971 at $7.24;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (b) of Article 22 is amended to read as follows:

For each contractor receiving project water in any year through December 31, 1969, the Delta Water Charge shall be the product of $3.50 and the contractor's annual entitlement to project water for the respective year. For each contractor receiving project water in the year 1970, the Delta Water Charge shall be the

product of $6.65 and the contractor's annual entitlement to project water for that year. The $6.65 rate for the year 1970 shall consist of a capital cost component of $5.04 and a minimum operation, maintenance, power and replacement component of $1.61. For each contractor receiving project water in the year 1971, the Delta Water Charge shall be the product of $7.24 and the contractor's annual entitlement to project water for that year. The $7.24 rate for the year 1971 shall consist of a capital cost component of $5.44 and a minimum operation, maintenance, power and replacement component of $1.80. After December 31, 1971, the Delta Water Charge shall consist and be the sum of the following components as these are computed in accordance with subdivisions (c) and (d) of this article: a capital cost component; a minimum operation, maintenance, power and replacement component; and a variable operation, maintenance, power and replacement component.

Approved as to legal form and sufficiency:

P. G. Towner

Chief Counsel
Department of Water Resources
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

By W P Gianelli
Director

Attest:

Edna M. Ramirez

Secretary
Kern County Water Agency

KERN COUNTY WATER AGENCY

By Lynd Kuykendall
President

Approved as to form and execution:

Stanley W. Smith

Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 7 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 6th day of July, 1971, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Agency takes delivery of project water from the Coastal Branch and from various reaches of the California Aqueduct downstream from its bifurcation with the Coastal Branch; and

WHEREAS, pursuant to Article 17(a) of the water supply contract the Agency initially requested certain deliveries from the Coastal Branch and the various reaches of the California

Aqueduct between Avenal Gap and the Carley V. Porter Tunnel and accordingly the State designed and constructed the project transportation facilities to provide certain capacity in such facilities sufficient to permit delivery of water to the Agency for agricultural use at 18 percent peaking and for municipal and industrial use at 11 percent peaking; and

WHEREAS, the Agency has not been able to market its water in the manner contemplated when such requests of deliveries were made and certain changes in deliveries to the Agency already have been approved by the State and are reflected in Table B-1 of Department of Water Resources Bulletin No. 132-70; and

WHEREAS, the Agency now requests that it be allowed to take delivery of an additional 50,000 acre-feet of its annual entitlement from the Coastal Branch (making a total of 155,100 acre-feet) and to reduce its deliveries in certain reaches of the California Aqueduct by a like amount; and

WHEREAS, the State is willing to approve such request provided that no changes will be made in the allocations of Capital and Minimum Transportation Costs of any of the reaches of the California Aqueduct or the Coastal Branch as a result of such change of deliveries and provided that such change shall not cause any decrease in service or increase in costs to any other water contractor;

NOW, THEREFORE, it is mutually agreed that the following addition is hereby made to the Agency's water supply contract with the State:

Subdivision (e) of Article 45 is added to the contract as follows:

(e) Change of Entitlement Deliveries

(1) The maximum amount of annual entitlement to be delivered to the Agency from the Coastal Branch in any one year shall be 155,100 acre-feet and the maximum instantaneous flow capacity available in the Coastal Branch for the Agency's deliveries shall be 283 cubic feet per second.

(2) Notwithstanding the provisions of Article 24(b) and 28 of this contract the factors for the allocation of capital costs and minimum operation, maintenance, power and replacement costs to the Agency in all reaches of the California Aqueduct and the Coastal Branch shall be as shown in Table B-2 of Department of Water Resources Bulletin No. 132-70.

(3) If (i) the annual entitlement deliveries provided for in this subdivision (e) of this contract, or (ii) peak rates of delivery through any pumping plant exceeding 11 percent for municipal and industrial deliveries or 18 percent for agricultural deliveries (or 11 percent from the Coastal Branch) cause an increase to other contractors in any charges for operating the California Aqueduct or Coastal Branch over the charges which would have been incurred had the Agency taken delivery from the Coastal Branch of the amounts of entitlement water shown on that certain schedule furnished the State on March 9, 1971, entitled "Kern County Water Agency Estimated

Entitlement To Be Delivered From The Coastal Branch Of The California Aqueduct", then the Agency shall pay to the State an extra service charge equal to the State's estimate of such increased charges.

(4) Within 30 days of the execution of this amendment, the Agency shall furnish the State a new schedule of entitlement water deliveries from the Coastal Branch covering each of the remaining years of the project repayment period.

Approved as to legal form and sufficiency:

By _____
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

Attest:

By _____
Secretary
Kern County Water Agency

KERN COUNTY WATER AGENCY

By _____
President

Approved as to form and execution:

By _____
Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 8 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 27th day of December, 1971, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 22(b) of such water supply contract, as amended, provides that for each year through the year 1969 the Delta Water Charge shall be the product of $3.50 and the Agency's annual entitlement for the respective year, that for the year 1970 the Delta Water Charge shall be the product of $6.65 and the

Agency's annual entitlement for that year, that for the year 1971 the Delta Water Charge shall be the product of $7.24 and the Agency's annual entitlement for that year, and that beginning in the year 1972 the Delta Water Charge shall be the sum of the capital cost component, minimum operation, maintenance, power and replacement component, and variable operation, maintenance, power and replacement component computed in accordance with Articles 22(c) and (d) of the water supply contract; and

WHEREAS, Articles 22(e) and (g) of such water supply contract provide that the Delta Water Charge as computed in accordance with Articles 22(c) and (d) shall include all projected costs of additional project and supplemental conservation facilities commencing in the years in which the State first incurs capital costs for such facilities after the facilities are authorized; and

WHEREAS, the parties desire that all water supply contracts be amended to postpone inclusion of the projected costs of any authorized additional project and supplemental conservation facilities in the computation of the Delta Water Charge until the happening of certain events;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (e) of Article 22 is amended to read as follows:

Prior to the time that additional project conservation facilities or supplemental conservation facilities are constructed,

the Delta Water Charge shall be determined on the basis of an allocation to project purposes, by the separable cost-remaining benefits method, of all actual and projected costs of all those initial project conservation facilities located in and above the Delta, and upon an allocation to the purposes of water conservation and water transportation, by the proportionate use of facilities method, of all actual and projected costs of the following project facilities located below the Delta: The aqueduct intake facilities at the Delta, Pumping Plant I (Delta Pumping Plant), the aqueduct from the Delta to San Luis Forebay (O'Neill Forebay), San Luis Forebay (O'Neill Forebay), and San Luis Reservoir: Provided, That all of the actual and projected costs properly chargeable to the generation and transmission of electrical energy in connection with operation of project conservation facilities shall be allocated to the purpose of water conservation in, above, and below the Delta: Provided further, That allocations to purposes the cost of which are to be paid by the United States shall be as determined by the United States.

Commencing in the year in which the State first awards a major construction contract for construction of a major feature of additional project conservation facilities, or first commences payments under a contract with a federal agency in the event a major feature of additional project conservation facilities is constructed by such federal agency under an agreement requiring the State to pay all or part of the costs of such construction, the Delta Water Charge shall be determined on the basis of the

foregoing allocations and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to the foregoing provisos, of all projected costs of such feature of the additional project conservation facilities: Provided, That if the agreement with such federal agency allows repayment of costs of a portion of a facility to be deferred, the associated costs of such portion shall be excluded from the Delta Water Charge computations until repayment of such deferred costs or interest thereon is commenced by the State: Provided further, That all costs of additional project conservation facilities incurred prior to the award of a major construction contract, shall be included in the Delta Water Charge computations in the year in which they are incurred.

2. Subdivision (g) of Article 22 is amended to read as follows:

Upon the construction of the supplemental conservation facilities, the Delta Water Charge shall be paid by all contractors for supplemental water, as well as by contractors for project water, and, together with revenues derived from the sale or other disposal of electrical energy generated in connection with operation of project conservation facilities and supplemental conservation facilities, shall return to the State, in addition to those costs of the project conservation facilities allocated to the purpose of water conservation, in, above, and below the Delta pursuant to subdivision (e) of this article, all costs of such supplemental conservation facilities, including capital, operation, maintenance, power, and replacement costs

which are allocated to the purpose of water conservation, in, above, and below the Delta pursuant hereto. Commencing in the year in which the State first awards a major construction contract for construction of a major feature of any supplemental conservation facilities, or first commences payments under a contract with a federal agency in the event a major feature of supplemental conservation facilities is constructed by such federal agency under an agreement requiring the State to pay all or part of the costs of such construction, the Delta Water Charge shall be determined on the basis of the allocations made pursuant to subdivision (e) of this article, and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to provisos corresponding to those contained in said subdivision (e), of all projected costs of such feature of the supplemental conservation facilities. Commencing in the same year, the computation of the rates to be used in determining the components of the Delta Water Charge shall include the annual entitlements to water under all contracts for supplemental water. If the repayment period of any bonds sold to construct supplemental conservation facilities or the repayment period under any agreement with a federal agency for repayment of the costs of supplemental conservation facilities constructed by such federal agency extends beyond the repayment period of the contract, the Delta Water Charge shall be determined and redetermined on the basis of such extended repayment period as the State determines to be appropriate: Provided, That if the agreement with such federal agency allows repayment of costs

of a portion of a facility to be deferred, the associated costs of such portion shall be excluded from the Delta Water Charge computations until repayment of such deferred costs or interest thereon is commenced by the State.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

By _____
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

Attest:

By _____
(Title) Secretary

KERN COUNTY WATER AGENCY

By _____
(Title) President

Approved as to form and execution:

By _____
(Title) Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 9 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 22nd day of December, 1971, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a retail agency or another agency, for payment to the State of such surcharge, and for the application, on specified terms and conditions, of the amount of such surcharge as a credit against certain payments by certain water users and by the Agency to the State; and

WHEREAS, the provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit have been suspended as to water deliveries during the years ending December 31, 1970; and

WHEREAS, the State and water contractors are still in the process of reevaluating the power credit and such surcharge and surcharge credit provisions;

NOW, THEREFORE, it is mutually agreed as follows:

The provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit shall not be effective as to water deliveries during the year ending December 31, 1971.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form and sufficiency:

By _____
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

Attest:

By _____
(Title) Secretary

KERN COUNTY WATER AGENCY

By _____
(Title) President

Approved as to form and execution:

By _____
(Title) Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 10 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made as of the 15th day of October, 1972, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract, dated November 15, 1963 (herein referred to as the "Amended Contract) providing that the State shall supply certain quantities of water to the Agency, and that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a

retail agency or another agency, for payment to the State of such surcharge, and for the allowance, on specified terms and conditions, of the amount of such surcharge as a credit to the Agency; and

WHEREAS, the Amended Contract establishes the power credit per acre-foot of water as two dollars until all of the facilities for generation of electrical energy in connection with operation of initial project conservation facilities are installed and in operation, and provides for a redetermination of such credit thereafter to reflect accurately increases or decreases from year to year in the power credit; and

WHEREAS, the provisions of the Amended Contract providing for or related to the power credit, surcharge and surcharge credit have been suspended as to water deliveries during the years prior to 1972 pending redetermination of the power credit and a reevaluation of the merits of such contract provisions; and

WHEREAS, estimates indicate that the power credit will be relatively negligible in amount and that administrative costs associated with the power credit, surcharge and surcharge credit provisions will be excessively burdensome to the State, the Agency and its water users; and

WHEREAS, the power credit, surcharge and surcharge credit provisions rest on unclear, confused or mistaken premises and should no longer be retained;

NOW, THEREFORE, it is mutually agreed as follows:

There are hereby deleted from the Amended Contract the following:

1. Article 30 entitled "Surcharge for Excess Use of Project Water".

2. The next-to-the-last sentence of the fifth paragraph of subdivision (c) of Article 45, entitled "Surplus Water", which sentence reads as follows:

> "A surcharge shall be added to the rate for surplus water furnished to excess land in an amount and under the conditions specified in Article 30 of this contract".

3. Subdivision (d) of Article 45 entitled "Surcharge Credit".

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form and sufficiency:

By P. C. Tower
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W. R. Gianelli
Director

Attest:

By Edna M. Simmons
(Title) Secretary

KERN COUNTY WATER AGENCY

By Jack G. Thomas
(Title) President

Approved as to form and execution:

By Stanley W. Kronick
(Title) STANLEY W. KRONICK,
COUNSEL
KERN COUNTY WATER AGENCY

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO.11 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 26th day of December, 1972, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 28 of such water supply contract provides that the State shall redetermine the annual amounts of the Transportation Charge in order that the charges to the Agency may accurately reflect increases or decreases from year to year in projected costs, outstanding reimbursable indebtedness of the State, annual entitlements, estimated deliveries, project interest rate, and all other factors which are determinative of such charges; and

WHEREAS, Article 28 also provides that each such redetermination shall include an adjustment of the components of the Transportation Charge to be paid by the Agency for succeeding years which shall account for differences, if any, between projections used by the State in determining the amounts of such components for all preceding years and actual costs incurred by the State during such years, but does not specify the computational details or the method of payment of such adjustments; and

WHEREAS, the State has been including such adjustments as "one-shot" credits or additional charges to be subtracted from or added to the Transportation Charge to be paid by the Agency in the year following the redetermination; and

WHEREAS, the magnitude of such adjustments together with changes in other determinants of charges may be significantly different in comparison with the amounts projected by the State under previous determinations and could impair the planned fiscal operations of the Agency, depending on the method of payment, and the parties desire to amend the contract to provide a method of amortizing the payment of the amounts of such differences over two or more years, depending on the magnitude of the differences; and

WHEREAS, bookkeeping will be simplified if the amortization of the payments of the amounts of such differences is reflected solely in the capital cost component of the Transportation Charge; and

WHEREAS, the method of payment should apply regardless of whether the adjustments tend to increase or to decrease the Transportation Charge;

NOW THEREFORE, it is mutually agreed that effective January 1, 1973:

1. Article 28 of the Agency's Water Supply Contract with the State is amended to read as follows:

28. Transportation Charge - Redetermination

(a) Determinative Factors Subject to Retroactive Change

The State shall redetermine the values and amounts set forth in Tables B, C, D, E, F, and G of this contract in the year following the year in which the State commences construction of the project transportation facilities and each year thereafter in order that the Transportation Charge to the Agency and the components thereof may accurately reflect the increases or decreases from year to year in projected costs, outstanding reimbursable indebtedness of the State incurred to construct the project transportation facilities described in Table I of this contract, annual entitlements, estimated deliveries, project interest rate, and all other factors which are determinative of such charges. In addition, each such redetermination shall include an adjustment of the components of the Transportation Charge to be paid by the Agency for succeeding years which shall account for the differences, if any, between those factors used by the State in determining the amounts of such components for all preceding years and the factors as then currently known by the State. Such adjustment shall be computed by the State and paid by the Agency or credited to the Agency's account in the manner described in (b) and (c) below or in Article 45(b)(4) if the Agency elects that option.

(b) Adjustment: Transportation Charge-Capital Cost Component

Adjustments for prior underpayments or overpayments of the capital cost component of the Transportation Charge to the Agency, together with accrued interest charges or credits thereon computed at the then current project interest rate on the amount of the underpayment or overpayment and compounded annually for the number of years from the year the underpayment or overpayment occurred to and including the year following the redetermination, shall be paid in the year following the redetermination: Provided, That the Agency may elect to exercise the option whereby when the redetermined Transportation Charge for the following year, with adjustments, including adjustments of the operation, maintenance, power, and replacement components provided for in subdivision (c) of this article, is more or less than the last estimate of the Charge provided pursuant to Article 27 for the corresponding year, without adjustments, an amount equal to the total of such difference shall be deducted from or added to the adjusted capital cost component for that year and paid or credited in accordance with the following schedule:

Percent that Transportation Charge differs from last estimate (+ or -)	Period, in years, for amortizing the difference in indicated charge
for 10% or less	no amortization
more than 10%, but not more than 20%	2
more than 20%, but not more than 30%	3
more than 30%, but not more than 40%	4
more than 40%.	5

Such payments or credits shall be in equal semiannual amounts of principal and interest on or before the 1st day of January and the

1st day of July, with interest computed at the project interest rate and compounded annually, during varying amortization periods as set forth in the preceding schedule: Provided, That for the purpose of determining the above differences in the Transportation Charge, the variable operation, maintenance, power, and replacement component shall be computed on the basis of the same estimated project water deliveries as was assumed in computing pursuant to Article 26(c).

(c) Adjustment: Transportation Charge-Minimum and Variable Components

One-twelfth of the adjustments for prior underpayments or overpayments of the Agency's minimum and variable operation, power, and replacement components for each year shall be added or credited to the corresponding components to be paid in the corresponding month of the year following the redetermination, together with accrued interest charges or credits thereon computed at the then current project interest rate on the amount of the underpayment or overpayment and compounded annually for the number of years from the year the underpayment or overpayment occurred to and including the year following the redetermination.

(d) Exercise of Option

The option provided for in subdivision (b) above and in Article 45(b)(4) shall be exercised in writing on or before the January 1 due date of the first payment of the capital cost component of the Transportation Charge for the year in which the option is to become effective.

Such option, once having been exercised, shall be applicable for all of the remaining years of the project repayment period.

2. Article 45(b)(4) is added to the contract to read as follows:

(4) Notwithstanding any conflicting provisions in Article 28, and as an alternative to the option for further adjustment of the capital cost component as provided for in subdivision (b) thereof, the Agency may elect to exercise an option whereby all adjustments of the capital cost component of the Transportation Charge for the Agency which is attributed by the State to agricultural use of project water thereafter shall be included in the determination of the unit rate per acre-foot which, when paid for the projected portion of the Agency's annual entitlement to be put to agricultural use, will return to the State, during the project repayment period, the portion of the capital cost component of the Transportation Charge allocated to the Agency that has been atributed to agricultural use, including adjustments pursuant to Article 28, and interest thereon, computed at the project interest rate and compounded annually: Provided, That the Agency may elect to exercise the option described in this subdivision with respect to water put to agricultural use whether or not the Agency elects to exercise the option pursuant to Article 28 to amortize charges for water put to municipal and manufacturing use.

IN WITNESS WHEREOF, the parties have executed this contract on the date first above written.

Approved as to legal form
and sufficiency:

By P. G. Torres
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W. R. Gianelli
Director

Attest:

By [illegible]
(Title) Secretary

KERN COUNTY WATER AGENCY

By Jack G. Thomas
(Title) President

Approved as to form
and execution:

By Stanley W. Kronick
(Title) Counsel

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 12 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made as of the 28th day of August, 1974, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State; and

WHEREAS, the State and the Agency included in such contract a subarticle, hereinafter referred to as the agricultural and ground water replenishment provision, which entitles the Agency to obtain from the State a supply of surplus water for agricultural and ground water replenishment use when available; and

WHEREAS, Article 21 of such contract also provides for the sale by the State of a supply of surplus water when available; and

WHEREAS, the State and the Agency desire to amend the provisions of such contract related to the sale and purchase of surplus water;

NOW, THEREFORE, it is mutually agreed as follows:

1. Subdivision (c) of Article 45 of the Agency's water supply contract is deleted.

2. Article 21 of the Agency's water supply contract is amended to read as follows:

21. Sale of Surplus Water.

(a) Definitions. When used in this article:

(1) "Noncontractor" shall mean a person or entity that is not a contractor as that term is defined in Article 1 of this contract.

(2) "Surplus water" shall mean water which can be furnished to contractors and noncontractors, subject to the provisions of Article 14(a) of this contract, without interfering with:

(i) The delivery of annual entitlements of all contractors as specified in Table A and the meeting of the quality criteria of Article 19 of their respective water supply contracts including any modifications of Table A pursuant to Articles 7(a), 12(d), 14(b), 18(b), or 18(c) of the water supply contracts or to any other provisions in such contracts which permit changes in the delivery of annual entitlements;

(ii) The furnishing of water required for use in construction of the System or in exchange for local water used in construction of the System;

(iii) Operational requirements regarding recreation and fish and wildlife uses;

(iv) Generation of power by the System or furnishing of project water required by power contracts;

(v) The exchange of water and the filling, retention, and release of storage in System reservoirs necessary for operational flexibility and to meet the requirements of paragraphs (i) through (iv) of this subdivision.

(vi) Losses of water due to evaporation, leakage, seepage, or other causes to meet the requirements of paragraphs (i) through (v) of this subdivision.

(3) "Ground water replenishment use" shall mean the use of project water exclusively for recharge of ground water basins by direct application to spreading basins, streambeds, or through other means of direct artificial recharge.

(4) "Contractors in the San Joaquin Service Area" shall mean those contractors which are furnished water through delivery structures from the California Aqueduct between Dos Amigos Pumping Plant and the South Portal of the Carley V. Porter Tunnel and from the Coastal Branch, California Aqueduct, from its junction with the California Aqueduct to the site for Devil's Den Pumping Plant.

(5) "Contractors in the Southern California Service Area" shall mean contractors for which water is delivered from the California Aqueduct downstream from the South Portal of the Carley V. Porter Tunnel.

(6) "Contractors in the Central Coastal Service Area" shall mean contractors for which water is delivered from the Coastal Branch, California Aqueduct, downstream from the site for Devil's Den Pumping Plant.

(7) "Deferred entitlement" shall mean those portions of annual entitlements to project water deferred in accordance with Article 7(e) of the contract with Alameda County Flood Control and Water Conservation District, Zone 7, Article 7(e) of the contract with Alameda County Water District, Article 7(e) of the contract with Santa Clara Valley Water District, Article 45(f) of the contract with Empire West Side Irrigation District, Article 45(e) of the contract with Hacienda Water District, Article 45(f) of the contract with County of Kings, Article 45(e) of the contract with Oak Flat Water District, and Article 45(e) of the contract with Tulare Lake Basin Water Storage District.

(b) Priorities. The State shall furnish surplus water in accordance with the following priorities:

(1) First, to contractors for agricultural use or for ground water replenishment use.

(2) Second, to contractors for other uses.

(3) Third, to noncontractors for any beneficial use.

These priority groups shall be referred to as first priority, second priority, and thir priority respectively.

(c) Reductions in Requested Deliveries. If requests for surplus water cannot be met, the following reductions in requested deliveries shall be made:

(1) First, the quantity of surplus water to be delivered to noncontractors shall be limited to the quantity available in excess of the requests under the first priority and the second priority.

(2) Second, if there is not sufficient surplus water in excess of the requests under the first priority to meet the requests of contractors under the second priority, the quantity of water to be delivered under the second priority shall be limited to the quantity available in excess of the requests under the first priority and that quantity shall be apportioned in proportion to the amounts of the contractors' current annual entitlements that are to be used for purposes other than agricultural and ground water replenishment uses as determined by the State. If any contractor decides not to use the surplus water available to it under this provision, such surplus water shall be offered on a similar basis to other contractors for such uses.

(3) If there is not sufficient surplus water to meet the requests of contractors under the first priority, the quantity of water to be delivered under that priority shall be limited to the quantity available, and such quantity shall be apportioned to areas upstream and downstream from Dos Amigos Pumping Plant in proportion to the contractors' current annual entitlements that are to be used in such areas for agricultural and ground water replenishment purposes as determined by the State. The quantity of such water available upstream from Dos Amigos Pumping Plant shall be apportioned to contractors upstream from Dos Amigos Pumping Plant in proportion to the amounts of the contractors' current annual entitlements that are to be used for agricultural and ground water

replenishment purposes as determined by the State. If any such contractor decides not to use the surplus water available to it, such surplus water shall first be offered on a similar basis to other contractors upstream from Dos Amigos Pumping Plant and second offered to contractors downstream from Dos Amigos Pumping Plant. The quantity of surplus water available at Dos Amigos Pumping Plant for delivery to contractors downstream from that plant shall be apportioned 69 percent to the San Joaquin Service Area, 29 percent to the Southern California Service Area, and 2 percent to the Central Coastal Service Area. Within each such service area, surplus water shall be apportioned to contractors in proportion to the amounts of the contractors' current annual entitlements that are to be used for agricultural and ground water replenishment purposes as determined by the State. If any such contractor decides not to use the surplus water available to it, such surplus water, on a similar basis, shall first be offered to other contractors in such service area and second offered to contractors in the other such service areas.

(d) Schedules. On or before October 1 of each year, concurrently with the schedule submitted pursuant to the provisions of Article 12, the contractor shall submit in writing to the State a preliminary water delivery schedule, indicating the desired amounts of surplus water for each month of the subsequent six-year period beginning January 1 of the next succeeding year. The last five years of this preliminary surplus water delivery schedule shall be used by the State for planning and operations studies. If a contractor commits itself in writing at the time it submits its October 1 schedule to guarantee payment of the cost of power required

in the judgment of the State to furnish surplus water to it, the contractor shall have a prior right to have such power utilized for furnishing surplus water otherwise available to it pursuant to this article at a cost no higher than that which the State is obligated to pay at the time it orders such power, but it shall have no greater right or priority to receive surplus water. A contractor's commitment may be for any part of the six-year period of its schedule, and the contractor will become bound by such commitment and become entitled to the prior right provided for in the preceding sentence only when the State, after consultation with the contractor, notifies the contractor in writing that it has ordered power based on the contractor's commitment.

(e) Rates.

(1) Surplus water (except further surplus water as described in subdivision (e)(4) of this article) shall be furnished to a contractor for agricultural use and for ground water replenishment use at rates which will return to the State all power costs as defined in subdivision (f) of this article and all incremental operation, maintenance, and replacement costs, and any other incremental costs, incurred in the conservation and transportation of such surplus water as determined by the State, which rates shall include an administrative charge to be determined by the State for each acre-foot of surplus water scheduled for delivery during the year. The amount of such administrative charge shall be credited to general operating costs of the System prior to the allocation of such costs. Incremental costs shall mean those costs which would not be incurred if surplus water were not scheduled for or delivered to the contractor.

(2) Surplus water furnished to a contractor for purposes other than agricultural use or ground water replenishment use shall be sold at rates determined on the same basis as those charged for surplus water for agricultural use and for ground water replenishment use plus an amount equal to one-half of the current Delta water rate.

(3) Surplus water furnished to a noncontractor shall be at rates, as determined by the State, which will return to the State not less than the charges specified for a contractor for surplus water for agricultural use and for ground water replenishment use plus an amount equal to the current Delta water rate plus an appropriate share of the capital and the minimum operation, maintenance, power and replacement costs of the transportation facilities of the System utilized in conveying such surplus water to the noncontractor.

(4) To the extent that the combined volume of entitlement water and surplus water furnished to a contractor in any year for agricultural use and for ground water replenishment use exceeds 150 percent of such contractor's maximum annual entitlement, such further surplus water shall be sold to the contractor at a rate equal to the rate for surplus water sold for agricultural use and for ground water replenishment use specified in subdivision (e)(1) of this article plus an amount equal to one-quarter of the current Delta water rate.

For years prior to 1990, notwithstanding the provisions of the preceding sentence, an amount up to 3,000 acre-feet of further surplus water may be delivered in any year at the charges provided for in subdivisions (e)(1) and (2) of this

article to any contractor which, under Table A of its contract, is scheduled to receive its maximum annual entitlement prior to 1978 and every year thereafter.

(5) Any revenues in excess of operation, maintenance, power and replacement costs and the administrative charge derived from sales of surplus water shall be credited as follows: The Delta water rate or portion thereof paid in accordance with subdivisions (e)(2), (e)(3), or (e)(4) of this article shall be credited to the cost of project conservation facilities, and the balance of such excess revenues, if any, shall be apportioned and credited, as appropriate, to the capital and to the minimum operation, maintenance, power and replacement costs of reaches of the transportation facilities of the System utilized for conveying such water to the purchasers.

(6) The rates and charges for surplus water shall be subject to redetermination by the State to reflect actual costs incurred and the difference shall be promptly credited or debited to the contractor that purchased such surplus water.

(f) Power Costs. Power costs for pumping surplus water shall consist of the cost of capacity, energy and additional transmission service required for the delivery of surplus water, including but not limited to the following:

(1) To the extent utilized for pumping surplus water:

(i) The cost of power purchased for pumping entitlement water,

(ii) The value of project recovery plant generation scheduled for pumping entitlement water, and

(iii) The value of project recovery plant generation not scheduled for pumping entitlement water; and

(2) Power purchased specifically for pumping surplus water including power ordered pursuant to subdivision (d) of this article.

The cost and value of power in (1)(i) and (ii) of this subdivision shall be credited to the pumping plant power cost attributable to annual entitlement water; the value of power in (1)(iii) that is generated by entitlement water shall be added to the net value of power attributable to such entitlement water; and the value of power in (1)(iii) that is generated by surplus water shall be credited to the costs incurred in pumping such surplus water.

The State shall determine the cost of power for pumping surplus water so that sufficient revenue will be available to the State to cover both the cost of purchased power and the value of recovery plant generation.

(g) Restrictions on Deliveries.

(1) In providing for the delivery of surplus water pursuant to this article, the State shall refuse to deliver such surplus water to any contractor or noncontractor to the extent that the State determines that such delivery would tend to encourage the development of an economy within the area served by such contractor or noncontractor which would be dependent upon the sustained delivery of surplus water.

(2) Surplus water shall not be scheduled to a contractor in a year unless an amount of project water equal to its annual entitlement set forth for that year in Table A of its

contract (disregarding any amendments reducing such Table A executed after July 1, 1974) is first scheduled and unless all of its deferred entitlements are first scheduled: Provided, That at the request of the contractor surplus water may be scheduled in lieu of deferred entitlements and the right to receive such deferred entitlements shall be reduced accordingly. If at the end of any year delivery of scheduled surplus water has prevented any annual entitlement or deferred entitlement from being delivered during that year, then for the purpose of charging for water delivered, deliveries during the year shall be considered first as annual entitlement water to the extent of the annual entitlement, and the balance as deferred entitlement or surplus water in accordance with the option of the contractor previously exercised pursuant to the first sentence of this subdivision.

(3) Before a contractor can receive surplus water under its contract in an amount greater than its annual entitlement for the year as shown in its Table A, it shall first increase its annual entitlement for such year to an amount equivalent to the surplus water scheduled, but it shall not be required to increase its annual entitlement to an amount in excess of 75 percent of its maximum annual entitlement.

(4) The State shall not sell surplus water to a contractor or noncontractor for use directly or indirectly within the boundaries of any other contractor without the written consent of such other contractor, nor shall the State authorize any contractor to supply surplus water for use outside such contractor's boundaries and within the boundaries of any other contractor without the written consent of such other contractor: Provided, That where

a contractor's boundaries include an area within the boundaries of another contractor, only the written consent of the contractor that serves the overlapping area with water under its annual entitlements need be obtained.

(h) Water from Nontributary Source. The provisions of this subdivision shall be applicable only to a contractor to which the delivery of project water for municipal use as of 1990 is estimated by the State to be in excess of 50 percent of such contractor's maximum annual entitlement. For the purpose of fixing such contractor's right to delivery of surplus water, water from a watershed not tributary to the contractor's area which is delivered within the contractor's boundaries for agricultural or ground water replenishment use shall be deemed to be part of the contractor's annual entitlement delivered for such use in computing the quantity of surplus water to which the contractor is entitled under this article: Provided, That the contractor shall not be deemed to have used more than its annual entitlement, as set forth in Table A, for such use. Surplus water shall be deemed to be used by the contractor for agricultural or ground water replenishment use if an equal quantity of water imported from a watershed not tributary to the contractor's area is delivered within the contractor's boundaries for such use.

(i) Determination of Use. For the purpose of computing the portion of the surplus water to which each contractor is entitled, the State shall determine the quantities of annual entitlement used for agricultural use and for ground water replenishment use and for other uses by each contractor in each year: Provided, That each contractor shall furnish certified copies of such records

and data concerning the use of water within its boundaries as the State may request.

(j) Contracts.

(1) To obtain a supply of surplus water, any contractor or noncontractor shall execute a further contract with the State which shall be in conformity with this article and will include at least the following: Further provisions concerning the scheduling of surplus water and provisions as to times and methods of payment.

(2) The State shall not contract to sell surplus water to noncontractors for periods in excess of five years.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form
and sufficiency:

By _____
Acting Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

KERN COUNTY WATER AGENCY

By _____
(Title) Secretary

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 13 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
THE KERN COUNTY WATER AGENCY

THIS CONTRACT, made as of the 16 day of July, 1979, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

RECITALS:

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect:

NOW, THEREFORE, it is mutually agreed as follows:

Subdivision (f) of Article 29 of the Agency's Water Supply Contract with the State is amended to read as follows:

(f) Times of Payment-Capital Components

The Agency shall pay to the State, on or before January 1 of each year, commencing with the year in which payment of the respective charge is to commence pursuant to this article, one-half (1/2) of the charge to the Agency for the year under the capital cost component of the Delta Water Charge and one-half (1/2) of the charge to the Agency for the year under the capital cost component of the Transportation Charge, as such charges are stated pursuant to

subdivision (e) of this article; and shall pay the remaining one-half (1/2) of each of said charges on or before July 1 of that year.

Notwithstanding the preceding sentence, the Agency may defer all or any portion of any payments of the capital components of the Delta Water Charge and the Transportation Charge for a period not to exceed three months beyond said due dates; Provided that the Agency gives the State written notice of its election to defer all or a portion of such a payment at least twenty-one days prior to the date upon which such payment is otherwise due; and Provided Further, that if the requested deferrals from all contracts would impair the State's cash flow needs for fiscal management of the Project, as determined by the State. the State shall proportion the amount available for deferrals among those contractors that can provide information substantiating a need for such assistance.

The Agency shall pay to the State interest on any amounts deferred pursuant to the preceding paragraph from the due date for such payment until the date such deferred payment is made at a rate equivalent to the average rate earned by the State from its surplus money investment fund during that period of time.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form
and sufficiency:

By V. L. Cline
Asst. Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By Ronald B. Robie
Director

KERN COUNTY WATER AGENCY

By Jack G. Thomas

(8) "Extra Surplus Water" shall mean water available in the Delta as determined by the State at various times during the year when scheduled project demands are being delivered and project storage requirements for both project water deliveries and water to meet Delta water quality requirements established by the SWRCB are being met. Excepting Articles 21(b), 21(d), and subdivision (3) [redacted] of Article 21(g), all provisions of this Article 21 related to surplus water shall apply to extra surplus water.

2. Article 21(b) is amended to read as follows:

(b) Priorities. The State shall furnish surplus water, not including extra surplus water, in accordance with the following priorities:

(1) First, to contractors for agricultural use or for ground water replenishment use.

(2) Second, to contractors for other uses.

(3) Third, to noncontractors for any beneficial use.

The State shall furnish extra surplus water in accordance with the following priorities:

(1) First, for ground water replenishment or for agricultural use in lieu of ground water pumping.

(2) Second, for pre-irrigation to increase soil moisture prior to planting.

3. Add the following to Article 21(d):

The schedules required by this Article 21(d) shall not include amounts of extra surplus water. Scheduling of extra surplus water will be done pursuant to provisions of an annual agreement.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 14 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
THE KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 4th day of January, 1980 pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, The State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (8) is added to Article 21(a) of the Agency's water supply contract to read as follows:

4. Add the following to subdivision (3) of Article 21(g):

Extra surplus water shall not be included in this determination.

5. Subdivisions (5) and (6) are added to Article 21(g) as follows:

(5) Delivery of extra surplus water to a contractor shall not adversely affect deliveries or costs of entitlement and surplus water deliveries to any contractor during the respective year.

(6) No extra surplus water shall be delivered when sufficient surplus water is available to satisfy contractor requests.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form
and sufficiency:

By P. A. Towner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By Raymond B. Allen
Director

KERN COUNTY WATER AGENCY

By Jack G. Thomas

THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO.15 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 22 day of February, 1980 pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State;

1. Subdivision t of Article 1 of the Agency's Water Supply Contract with the State is amended to read as follows:

(t) Project Repayment Period

"Project repayment period" shall mean that period of years commencing on January 1, 1961, and extending until December 31, 2035; Provided, that whenever construction of any project facilities is financed by a bond issue with maturity dates later than December 31, 2035, whether the bonds are issued pursuant to the Bond Act or other authority, repayment of the costs of such facilities shall be extended to end on the date of the latest maturities of the bonds with which construction of such facilities is financed.

2. Article 2 of the Agency's Water Supply Contract with the State is amended to read as follows:

(2) Term of Contract

This contract shall become effective on the date first above written and shall remain in effect for the longest of the following:

1. The project repayment period

2. 75 years

3. The period ending with the latest maturity date of any bond issue used to finance the construction costs of project facilities.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form
and sufficiency:

by P. A. Towner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

by Ronald B. Robie
Director

KERN COUNTY WATER AGENCY

by Henry S. Garrett

Title President, Board of Directors

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 16 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 17 day of February, 1982, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following change and addition is hereby made to the Agency's water supply contract with the State:

1. The term "unscheduled water" shall replace the term "Extra Surplus Water" wherever it appears in

Article 21 of the Water Supply Contract between the State of California Department of Water Resources and the Agency.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form and sufficiency:

P.G. Tourner

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Ronald B. Robie

Ronald B. Robie
Director

KERN COUNTY WATER AGENCY

By Stuart T. Pyle Feb 16 1982

Title Engineer - Manager

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 17 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND THE
KERN COUNTY WATER AGENCY

THIS CONTRACT, made this 1st day of December, 1972, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Article 1(e) is amended to read:

(e) Project Facilities

"Project facilities" shall mean those facilities of the system which will, in whole or in part, serve the purposes of this contract by conserving water and making it available for use in and above the Delta and for export from the Delta and from such additional facilities as are defined in Article 1(h)(2) herein, and by conveying water to the Agency. Said project facilities shall consist specifically of "project conservation facilities" and "project transportation facilities", as hereinafter defined.

2. Article 1(h) is amended to read:

(h) Additional Project Conservation Facilities

"Additional project conservation facilities" shall mean the following facilities and programs which will serve the purpose of preventing any reduction in the minimum project yield as hereinafter defined:

(1) Those project facilities specified in Section 12938 of the Water Code;

(2) Those facilities and programs described in (A), (B), (C), (D), and (E) below which, in the State's determination, are engineeringly feasible and capable of producing project water which is economically competitive with alternative new water supply sources, provided that, in the State's determination, the construction and operation of such facilities and programs will not interfere with the requested deliveries of annual entitlement to any contractor other than the sponsoring contractor, and will not result in any greater annual charges to any contractor other than the sponsoring contractor than would have occurred with the construction at the same time of alternative new water supply

sources which are either reservoirs located north of the Delta or off-Aqueduct storage reservoirs located south or west of the Delta designed to supply water to the California Aqueduct. The following facilities and programs shall hereinafter be referred to as "Local Projects":

(A) On-stream and off-stream surface storage reservoirs not provided for in Section 12938 of the Water Code, that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(B) Ground water storage facilities that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(C) Waste water reclamation facilities that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(D) Water and facilities for delivering water purchased by the State for the System for a period of time agreed to by the sponsoring contractor; provided that the economic test specified herein shall be applied to the cost of these facilities together with the cost of the purchased water; and

(E) Future water conservation programs and facilities that will reduce demands by the sponsoring contractor for project water from the System for a period of time agreed to by the sponsoring contractor and will thereby have the effect of increasing project water available in the Delta for distribution.

(3) Whether a Local Project described in (2) above shall be considered economically competitive shall be determined by the State by comparing, in an engineering and economic analysis, such Local Project with alternative new water supply

sources which are either reservoirs located north of the Delta or off-Aqueduct storage reservoirs located south or west of the Delta designed to supply water to the California Aqueduct. The analysis for such alternative new water supply sources shall use the average cost per acre-foot of yield in the latest studies made for such sources by the State and shall compare those facilities with the proposed Local Project using commonly accepted engineering economics. In the case of a Local Project to be funded in part by the State as part of the System and in part from other sources, the economic analysis specified herein shall be applied only to the portion to be funded by the State as part of the System.

(4) The Local Projects in (2) above shall not be constructed or implemented unless or until:

(A) The sponsoring contractor signs a written agreement with the State which:

(i) Contains the sponsoring contractor's approval of such facility or program.

(ii) Specifies the yield and the period of time during which the water from the Local Project shall constitute project water; and

(iii) Specifies the disposition of such Local Project or of the yield from such Local Project upon the expiration of such period of time; and

(B) All contractors within whose boundaries any portion of such Local Project is located, and who are not sponsoring contractors for such Local Project give their written approval of such Local Project.

(5) "Sponsoring contractor" as used in this Article 1(h) shall mean the contractor or contractors who either will receive the yield from facilities described in 2(A), (B), (C), or (D) above, or agree to reduce demands for project water from the System pursuant to 2(E) above.

(6) In the event of a shortage in water supply within the meaning of Article 18(a), the determination of whether to count, in whole or in part, the yield from facilities described in 2(A), (B), (C), or (D) above, or the reduced demand from future conservation programs described in 2(E) above in the allocation of deficiencies among contractors will be based on a project-by-project evaluation taking into consideration such factors as any limitation on the use of the water from such facilities and whether the sponsoring contractor has access to project water from the Delta as an alternate to such facilities.

3. Article 1(i)(2) is amended to read:

(2) Facilities for the generation and transmission of electrical energy of the following types:

(A) Hydroelectric generating and transmission facilities, whose operation is dependent on the transportation of project water, or on releases to channels downstream of project facilities defined under (1) above. Such facilities shall be called "project aqueduct power recovery plants."

(B) All other generating and associated transmission facilities, except those dependent on water from project conservation facilities, for the generation of power. These facilities shall be called "off-aqueduct power facilities" and shall consist of the State's interest in the Reid-Gardner and

any other generating and associated transmission facilities, constructed or financed in whole or in part by the State, which are economically competitive with alternative power supply sources as determined by the State.

4. Article 1(r) is amended to read:

(r) Project Interest Rate

"Project interest rate" shall mean the weighted average interest rate of (1) through (6) below computed by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts:

(1) general obligation bonds issued by the State under the Bond Act,

(2) revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) bonds issued by any agency, district, political subdivision, public corporation, or nonprofit corporation of this State,

(5) funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State, and

(6) funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest

rate earned over the period of such borrowing by moneys in the Pooled Money Investment Account of such Treasury invested in securities,

to the extent the proceeds of any such bonds, advances or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities, (except off-aqueduct power facilities and advances for delivery structures, measuring devices and excess capacity) and without regard to any premiums received on the sale of bonds under item (1) above. The "project interest rate" shall be computed as a decimal fraction to five places.

5. Subdivision (h) is added to Article 22 to read:

(h) The determination of the rate for water under the Delta Water Charge shall be made by including the appropriate costs and quantities of water, calculated in accordance with subdivisions (c), (d) and (e) above, for all additional project conservation facilities as defined in Article 1(h) hereinabove. In the event a Local Project as defined in Article 1(h)(2) will, pursuant to written agreement between the State and the sponsoring contractor, be considered and treated as an additional project conservation facility for less than the estimated life of the facility, the rate under the Delta Water Charge will be determined on the basis of that portion of the appropriate cost and water supply associated with such facility as the period of time during which such facility shall be considered as an additional project conservation facility bears to the estimated life of such facility. No costs for the construction or implementation of any Local

Project are to be included in the Delta Water Charge unless and until the written agreement required by Article 1(h) has been entered into.

6. Subdivision (i) is added to Article 22 to read:

(i) In calculating the rate for project water to be paid by each contractor for the Delta Water Charge under subdivisions (c), (d) and (e) above, the component for operation, maintenance, power and replacement costs shall include, but not be limited to, all costs to the State incurred in purchasing water, which is competitive with alternative sources as determined by the State, for delivery as project water.

7. Subdivision (f) is added to Article 24 to read:

(f) The capital costs of project aqueduct power recovery plants shall be charged and allocated in accordance with this Article 24. The capital costs of off-aqueduct power facilities shall be charged and allocated in accordance with Article 25(d).

8. Subdivision (d) is added to Article 25 to read:

(d) Notwithstanding the provisions of subdivisions (a) and (b) of this article, or of Article 1(s), the costs of off-aqueduct power facilities shall be determined and allocated as follows:

(1) The off-aqueduct power costs shall include all annual costs the State incurs for any off-aqueduct power facility, which shall include, but not be limited to, power purchases, any annual principal and interest payments on funds borrowed by or advanced to the State, annual principal and interest on bonds issued by the State or other agency, or under revenue bond financing contracts, any requirements for coverage, deposits to reserves, and associated operation and maintenance costs of such

facility, less any credits, interest earnings, or other monies received by the State in connection with such facility. In the event the State finances all or any part of an off-aqueduct power facility directly from funds other than bonds or borrowed funds, in lieu of such annual principal and interest payments, the repayment of capital costs as to that part financed by such other funds shall be determined on the basis of the schedule that would have been required under Article 24.

(2) The annual costs of off-aqueduct power facilities as computed in (1) above shall initially be allocated among contractors in amounts which bear the same proportions to the total amount of such power costs that the total estimated electrical energy (kilowatt hours) required to pump through project transportation facilities the desired delivery amounts of annual entitlements for that year, as submitted pursuant to Article 12(a)(1) and as may be modified by the State pursuant to Article 12(a)(2), bears to the total estimated electrical energy (kilowatt hours) required to pump all such amounts for all contractors through project transportation facilities for that year, all as determined by the State.

(3) An interim adjustment in the allocation of the power costs calculated in accordance with (2) above, may be made in May of each year based on April revisions in approved schedules of deliveries of annual entitlement for such year. A further adjustment shall be made in the following year based on actual deliveries of annual entitlement; provided, however, in the event no deliveries are made through a pumping plant, the adjustments shall not be made for that year at that plant.

(4) To the extent the monies received or to be received by the State from all contractors for off-aqueduct power costs in any year are determined by the State to be less than the amount required to pay the off-aqueduct power costs in such year, the State may allocate and charge that amount of off-aqueduct power costs to the Agency and other contractors in the same manner as costs under the capital cost component of the Transportation Charge are allocated and charged. After that amount has been so allocated, charged and collected, the State shall provide a reallocation of the amounts allocated pursuant to this paragraph (4), such reallocation to be based on the allocations made pursuant to (2) and (3) above for that year, or in the event no such allocation was made for that year, on the last previous allocation made pursuant to (2) and (3) above. Any such reallocation shall include appropriate interest at the project interest rate.

9. Subdivision (e) is added to Article 25 to read:

(e) The total minimum operation, maintenance, power and replacement component due that year from each contractor shall be the sum of the allocations made under the proportionate use of facilities method provided in subdivision (b) of this article and the allocations made pursuant to subdivision (d) of this article for each contractor.

10. Subdivision (b) of Article 32 is amended to read:

(b) Interest on Overdue Payments

Upon every amount of money required to be paid by the Agency to the State pursuant to this contract which remains unpaid after it becomes due and payable, interest shall accrue at

an annual rate equal to that earned by the Pooled Money Investment Fund, as provided in Government Code Sections 16480, et seq. calculated monthly on the amount of such delinquent payment from and after the due date until it is paid, and the Agency hereby agrees to pay such interest: provided, that no interest shall be charged to or be paid by the Agency unless such delinquency continues for more than thirty (30) days.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form
and sufficiency:

By _____
Acting Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

KERN COUNTY WATER AGENCY

By _____
(Title) President

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 18 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT, is made this 29 day of February, 1984, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

WHEREAS, the Agency has requested that 15,000 acre-feet of its annual entitlement for the seventeenth (1984) and each succeeding year thereafter, for the term of this contract be reclassified from agricultural use to municipal and industrial use; and

WHEREAS, the State has determined that allowing such a permanent conversion in entitlement use will not impair the financial feasibility of the project;

NOW THEREFORE, the parties agree to the following:

1. Table A-1 entitled "PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE, KERN COUNTY WATER AGENCY" in the Agency's water supply contract with the State is amended to read as follows:

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(in acre-feet)

Year	Agricultural Use	Agricultural Use	Municipal Use	Total Annual Amount
	(Coastal Aqueduct)	(San Joaquin Valley-Southern California Aqueduct)		
1	13,313	33,287	0	46,600
2	30,303	65,397	0	95,700
3	61,000	55,400	28,700	145,100
4	35,500	119,100	35,700	190,300
5	31,800	199,700	39,200	270,700
6	37,500	229,500	43,500	310,500
7	52,600	246,400	48,000	347,000
8	57,000	301,120	52,700	410,820
9	61,800	324,250	56,100	442,150
10	66,000	357,000	60,600	483,600
11	70,800	399,400	64,100	534,300
12	75,300	441,000	67,600	583,900
13	79,400	484,000	71,100	634,500
14	83,800	532,800	74,800	691,400
15	87,700	578,000	79,600	745,300
16	90,800	630,800	83,500	805,100
17	94,500	662,500	103,600	860,600
18	97,100	709,000	108,900	915,000
19	100,100	754,700	113,400	968,200
20	102,200	802,200	119,100	1,023,500
21	103,800	846,900	123,900	1,074,600
22	104,700	879,400	128,200	1,112,300
23	105,100	913,700	134,600	1,153,400

and each succeeding year thereafter, for the term of this contract.

2. The 15,000 acre-feet entitlement reclassified by this amendment from agricultural use to municipal and industrial use will retain its agricultural priority when deficiencies are determined pursuant to Article 18.

3. The proportionate use factors in Table B will remain at their present value.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form
and sufficiency:

By _____
Acting Chief Counsel

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

KERN COUNTY WATER AGENCY

By _____
President

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 19 TO WATER SUPPLY CONTRACT
BETWEEN THE DEPARTMENT OF WATER RESOURCES
OF THE STATE OF CALIFORNIA AND
KERN COUNTY WATER AGENCY

THIS CONTRACT is made this 14th day of May, 1987, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the Department of Water Resources of the State of California, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment;

WHEREAS, the Agency takes delivery of project water from the Coastal Branch and from various reaches of the California Aqueduct downstream from its bifurcation with the Coastal Branch;

WHEREAS, pursuant to Amendment No. 7 of the water supply contract the Agency requested and the State approved under certain conditions the delivery of an additional 50,000 acre-feet from the Coastal Branch; and

WHEREAS, the State and the Agency are involved in litigation with other State Water Project water contractors relating to Article 45(e)(2) added by Amendment No. 7.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the Agency's water supply contract with the State:

1. Subdivisions e(1) and e(2) of Article 45 are deleted.

2. Subdivision (e)(3) of Article 45 is amended and renumbered to read:

(1) If peak rates of delivery through any pumping plant exceeding 11 percent for municipal and industrial deliveries or 18 percent for agricultural deliveries (or 16-1/4 percent from the Coastal Branch) cause an increase to other contractors in any charges for operating the California Aqueduct or Coastal Branch over the charges which would have been incurred had the Agency taken delivery from the Coastal Branch of the amounts of entitlement water shown on that certain schedule furnished the State on March 9, 1971, entitled "Kern County Water Agency Estimated Entitlement To Be Delivered From The Coastal Branch Of The California Aqueduct", then the Agency shall pay to the State an extra service charge equal to the State's estimate of such increased charges.

3. Subdivision e(4) of Article 45 is renumbered subdivision e(2).

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the day first above written.

APPROVED AS TO LEGAL FORM
AND SUFFICIENCY:

By _____
Chief Counsel

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

KERN COUNTY WATER AGENCY

By Henry S. Garrett
Title President

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 20 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS CONTRACT is made this 4th day of March, 1987, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment;

WHEREAS, the State and the Agency wish to provide financing for project facilities with water system revenue bonds and provide for repayment of water system revenue bonds;

WHEREAS, the State and the Agency wish to clarify the definition of the project interest rate without changing the interpretation of Article 1(r), except for the addition of item (7), and to specify that financing costs of water system facilities and East Branch Enlargement facilities shall not be included in calculating the project interest rate; and

WHEREAS, the State is willing to amortize over the remaining repayment period of the contract, the "one-shot" adjustment applied to previous payments resulting from revisions in the project interest rate under conditions defined in this amendment.

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Article 1(r) is amended to read:

(r) "Project interest rate" shall mean the weighted average interest rate on bonds, advances, or loans listed in this section to the extent the proceeds of any such bonds, advances, or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities (except off-aqueduct power facilities; water system facilities; advances for delivery structures, measuring devices and excess capacity; and East Branch Enlargement Facilities). The project interest rate shall be calculated as a decimal fraction to five places by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts. The bonds, advances, or loans used in calculating the project interest rate shall be:

(1) General obligation bonds issued by the State under the Bond Act, except that any premium received on the sale of these bonds shall not be included in the calculation of the project interest rate,

(2) Revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) Bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) Bonds issued by any agency, district, political subdivision, public corporation, or nonprofit corporation of this State,

(5) Funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State,

(6) Funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing by moneys in the Surplus Money Investment Fund of such Treasury invested in securities, and

(7) Any other financing capability available in the Treasury of the State of California at whatever interest rate and other financing costs are provided in the law authorizing such borrowing. However, the use of other financing from the State Treasury is intended to involve only short term borrowing at interest rates and other financing costs no greater than those charged to other State agencies during the same period until such time as the Department can sell bonds and reimburse the source of the short term borrowing from the proceeds of the bond sale.

2. Article 1(cc) is added to read:

(cc) "Water system revenue bonds" shall mean revenue bonds or revenue bond anticipation notes issued by the State under the Central Valley Project Act after January 1, 1987 for water system facilities identified in Article 1(hh).

3. Article 1(gg) is added to read:

(gg) "East Branch Enlargement Facilities" shall mean all of the following:

(1) The facilities remaining to be constructed as part of the East Branch Enlargement construction;

(2) The work done pursuant to the letter agreement between the State and The Metropolitan Water District of Southern California dated November 29, 1966, which consisted of constructing the California Aqueduct between Cottonwood (now known as Alamo) Powerplant and Cedar Springs (now known as Silverwood) Reservoir so that, by future additions to the canal lining, siphons, and additional pumping units at Pearblossom Pumping Plant, the capacity could be increased by a then-estimated approximately 700 cubic feet per second;

(3) That portion of the enlargement of the Pearblossom Pumping Plant Forebay and Cofferdam construction which would not have been constructed but for the proposed East Branch Enlargement and which was done pursuant to the letter agreement between the State and The Metropolitan Water District of Southern California, dated January 19, 1984;

(4) That portion of the canal lining work between Alamo Powerplant and Pearblossom Pumping Plant done pursuant to the letter agreements

between the State and The Metropolitan Water District of Southern California, dated July 2, 1984, and May 15, 1985, which increased the East Branch Aqueduct capacity beyond that set forth in Table B-2 as shown in State Bulletin 132-70;

(5) That portion of Reach 24 (Silverwood Lake) to be determined by reallocation of Reach 24 to reflect the additional use to be made of that reach as a result of the East Branch Enlargement operation; and

(6) That portion of Reach 25 (San Bernardino Tunnel) to be determined by an allocation of total delivery capacity of Reach 25 between the basic East Branch facilities and the East Branch Enlargement as a result of East Branch Enlargement operation.

4. Article 1 (hh) is added to read:

(hh) "Water System Facilities" shall mean the following facilities to the extent that they are financed with water system revenue bonds or to the extent that other financing of such facilities is reimbursed with proceeds from water system revenue bonds:

(1) The North Bay Aqueduct,

(2) The Coastal Branch Aqueduct,

(3) Delta Facilities, including Suisun Marsh facilities, to serve the purposes of water conservation in the Delta, water supply in the Delta, transfer of water across the Delta, and mitigation of the environmental effects of project facilities, and to the extent presently authorized as project purposes, recreation and fish and wildlife enhancement,

(4) Local projects as defined in Article 1(h)(2) designed to develop no more than 25,000 acre-feet of project yield from each project,

(5) Land acquisition for the Kern Fan Element of the Kern Water Bank,

(6) Additional pumps at the Banks Delta Pumping Plant,

(7) The transmission line from Midway to Wheeler Ridge Pumping Plant, and

(8) Repairs, additions, and betterments to conservation or transportation facilities existing as of January 1, 1987, and to all other facilities described in this subarticle (hh) except for item (5).

5. Article 22(j) of the Agency's water supply contract with the State is added as follows:

(j) Notwithstanding provisions of Article 22(a) through (i), the capital cost component and the minimum OMP&R component of the Delta Water Charge shall include an annual charge to recover the Agency's share of the conservation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with provisions in Article 50 of this contract.

6. Article 24(g) of the Agency's water supply contract with the State is added as follows:

(g) Notwithstanding provisions of Article 24(a) through (d), the capital cost component of the Transportation charge shall include an annual charge to recover the Agency's share of the transportation portion of the water system revenue bond financing costs. Charges to the Agency for these costs

shall be calculated in accordance with provisions in Article 50 of this contract.

6.5. Article 28(e) of the Agency's water supply contract with the State is added to read:

28(e) Notwithstanding the provisions of Article 28(b), adjustments for prior overpayments and underpayments shall be repaid beginning in the year following the redetermination by application of a unit rate per acre-foot which, when paid for the projected portion of the Agency's annual entitlement will return to the State, during the project repayment period, together with interest thereon computed at the project interest rate and compounded annually, the full amount of the adjustments resulting from financing after January 1, 1987, from all bonds, advances, or loans listed in Article 1(r) except for Article 1(r)(3) and except for bonds issued by the State under the Central Valley Project Act after January 1, 1987 for facilities not listed among the water system facilities in Article 1(hh). Notwithstanding the immediately preceding exception, such amortization shall also apply to any adjustments in this component charge resulting from a change in the project interest rate due to any refunding after January 1, 1986 of bonds issued under the Central Valley Project Act. However, amortization of adjustments resulting from items 1(r)(4) through (7) shall be limited to a period which would allow the Department to repay the debt service on a current basis until such time as bonds are issued to reimburse the source of such funding. In no event shall this amortization period be greater than the project repayment period.

7. Article 28(f) of the Agency's water supply contract with the State is added as follows:

f. Adjustment: Water System Revenue Bond Financing Costs. The use of water system revenue bonds for financing facilities listed in Article 1(hh) would result in adjustments for prior underpayments or overpayments of the capital cost component of the Transportation Charge to the Agency under the provisions of this article; however, in place of making such adjustments, charges to the Agency will be governed by Article 50.

8. Article 50 of the Agency's water supply contract with the State is added as follows:

50. Water System Revenue Bond Financing Costs.

(a) Charges to the Agency for water system revenue bond financing costs shall be governed by provisions of this article. Charges to all contractors for water system revenue bond financing costs shall return to the State an amount equal to the annual financing costs the State incurs in that year for water system revenue bonds (including water system revenue bond anticipation notes). Annual financing costs shall include, but not be limited to, any annual principal and interest on water system revenue bonds plus any additional requirements for bond debt service coverage, deposits to reserves, and annual premiums for insurance or other security obtained pursuant to subdivision (f) of this article. The State shall provide credits to the contractors for excess reserve funds, excess debt service coverage, interest, and other earnings of the State in connection with repayment of such revenue bond financing costs, when and as permitted by the bond resolution. When such

credits are determined by the State to be available, such credits shall be promptly provided to the contractors and shall be in proportion to the payments under this article from each contractor. Reserves, bond debt service coverage, interest, and other earnings may be used in the last year to retire the bonds.

(b) Annual charges to recover water system revenue bond financing costs shall consist of two elements.

(1) The first element shall be an annual charge to the Agency for repayment of capital costs of water system facilities as determined under Articles 22 and 24 of this contract with interest at the project interest rate. For conservation facilities, the charge shall be a part of the capital cost component of the Delta Water Charge in accordance with Article 22. For transportation facilities, the charge shall be a part of the capital cost component of the Transportation Charge in accordance with Article 24.

(2) The second element shall be the Agency's share of a Water System Revenue Bond Surcharge to be paid in lieu of a project interest rate adjustment. The total annual amount to be paid by all contractors under this element shall be the difference between the total annual charges under the first element and the annual financing costs of the water system revenue bonds. The amount to be paid by each contractor shall be calculated annually as if the project interest rate were increased to the extent necessary to produce revenues from all contractors sufficient to pay such difference for that year. In making that calculation, adjustments in the Agency's Transportation capital cost component charges for prior overpayments and underpayments shall be determined as if amortized over the remaining years of the project repayment period.

(c) The Water System Revenue Bond Surcharge will be identified by component and charge in the Agency's invoice.

(d) Timing of Payments. Payments shall be made in accordance with Article 29(f) of this contract.

(e) Reduction in Charges. The Water System Revenue Bond Surcharge under Article 50(b)(2) shall cease for each series of water system revenue bonds when that series is fully repaid. However, the annual charge determined pursuant to Article 50(b)(1) shall continue to be collected for the time periods otherwise required under Articles 22 and 24.

After the Department has repaid the California Water Fund in full and after each series of Water System Revenue Bonds is repaid, the Department will reduce the charges to all contractors in an equitable manner in a total amount that equals the amount of the charges under Article 50(b)(1) that the Department determines is not needed for future financing of facilities of the System which, in whole or in part, will serve the purposes of the water supply contract with the Agency.

(f) To the extent economically feasible and justifiable, as determined by the State after consultation with contractors, the State shall maintain insurance or other forms of security protecting bondholders and non-defaulting contractors against costs resulting from the failure of any contractor to make the payments required by this article.

(g) Before issuing each series of water system revenue bonds, the State shall consult with the contractors, prepare a plan for the State's future financing of water system facilities, and give the Agency an opportunity to comment on the plan. The plan shall include but not be limited to the size

of any water system revenue bond issuances and the form of any necessary resolutions or supplements.

(h) Defaults. (1) If a contractor defaults partially or entirely on its payment obligations calculated under this article and sufficient insurance or other security protecting the non-defaulting contractors is not provided under Article 50(f), the State shall allocate a portion of the default to each non-defaulting contractor. The Agency's share of the default shall be equal to an amount determined by multiplying the total default amount to be charged to all non-defaulting contractors by the ratio that the Agency's maximum Table A entitlement bears to the maximum Table A entitlements of all non-defaulting contractors. However, such amount shall not exceed in any year 25 percent of the Water System Revenue Bond financing costs that are otherwise payable by the Agency in that year. The amount of default to be charged to non-defaulting contractors shall be reduced by any receipts from insurance protecting non-defaulting contractors and bond debt service coverage from a prior year and available for such purpose.

(2) If a contractor defaults partially or entirely on its payment obligations under this article, the State shall also pursuant to Article 20, upon six months' notice to the defaulting contractor, suspend water deliveries under Article 20 to the defaulting contractor so long as the default continues. The suspension of water deliveries shall be proportional to the ratio of the default to the total water system revenue bond payments due from the defaulting contractor. However, the State may reduce, eliminate, or not commence suspension of deliveries pursuant to this subparagraph if it determines suspension in the amounts otherwise required is likely to impair the

defaulting contractor's ability to avoid further defaults or that there would be insufficient water for human consumption, sanitation, and fire protection. The State may distribute the suspended water to the non-defaulting contractors on terms it determines to be equitable.

(3) During the period of default, credits otherwise due the defaulting contractor shall be applied to payments due from the defaulting contractor.

(4) Except as otherwise provided in Article 50(h)(3), the defaulting contractor shall repay the entire amount of the default to the State with interest compounded annually at the Surplus Money Investment Fund rate before water deliveries that had been suspended shall be fully resumed to that contractor. If the defaulting contractor makes a partial repayment of its default, the Department may provide a proportional restoration of suspended deliveries. The amount of the default to be repaid shall include any amounts previously received by the State from insurance proceeds, bond debt service coverage, or other reserves, and payments from other contractors pursuant to this subparagraph (h). The defaulting contractor shall not be entitled to any make-up water deliveries as compensation for any water deliveries suspended during the period when the contractor was in default.

(5) At such time as the default amount is repaid by the defaulting contractor, the non-defaulting contractors shall receive credits in proportion to their contributions towards the amount of the default with interest collected by the State on the defaulted amount.

(6) In the event there is an increase in the amount a non-defaulting contractor contributes to reserves and/or bond debt service

coverage, such increase shall be handled in the same manner as provided in Article 50(a).

(7) Action taken pursuant to this subarticle shall not deprive the State of or limit any remedy provided by this contract or by law for the recovery of money due or which may become due under this contract.

(i) Power of Termination.

(1) The Department and the Agency agree to negotiate in good faith the development of a means to provide adequate protection for the Department's cash flow into priorities one and two for revenues under Water Code Section 12937(b) with the goal of obtaining agreement by April 1, 1987. The Department and the Agency agree to continue negotiations beyond April 1, 1987 if necessary to meet their common goal of arriving at agreement.

(2) If such an agreement has not been reached by April 1, 1987, and if the Director of Water Resources determines that adequate progress has not been made toward such an agreement, the Director may give notice to the Agency and other contractors that he intends to exercise the power to terminate provided in this subarticle 50(i). The Director's authority to give such a notice shall terminate on July 1, 1988.

(3) After six months from the date of issuing the notice of intent to terminate, but in no event later than January 1, 1989, the Director may terminate the authority of the Department to issue additional series of water system revenue bonds using the repayment provisions of Article 50. The Department shall promptly notify the Agency and other contractors that the Director has exercised the power of termination.

(4) No additional series of water system revenue bonds shall be issued under the provisions of this Article 50 after the Director has exercised the power to terminate, but Article 50 shall remain in effect as to any series of water system revenue bonds issued prior to the time the Director exercises the power to terminate.

(5) An exercise of the power to terminate provided in this subarticle 50(i) shall also rescind any changes made by this amendment in the schedule of payment of overpayment or underpayment of capital costs resulting from a change in the project interest rate and shall also rescind the addition of item (7) to Article 1(r). However, if the Department has borrowed any funds under Article 1(r)(7), Article 1(r)(7) shall remain in effect as to that and only that borrowing. Upon the exercising of the power to terminate, subarticles 28(e) and (f) shall be rescinded and Article 1(r) shall read as it previously read as shown on Attachment Number 1 to this amendment.

(6) At any time before January 1, 1989, so long as the Director has not already exercised the power of termination, the Director may irrevocably waive his right to exercise the power of termination or may rescind any previously issued notice of intention to terminate.

(7) If the Director does not exercise the power of termination before January 1, 1989, this Subarticle 50(i) shall expire, and the remainder of this Article 50 shall remain in effect. Changes made by this amendment to other articles shall also remain in effect.

IN WITNESS WHEREOF, the parties have executed this contract on the date first above written.

Approved as to legal form
and sufficiency:

By _____
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

Attest:

By _____
(Title) Secretary to the Board

AGENCY

By _____
(Title) President

Attachment 1

4. Article 1(r) is amended to read:

(r) Project Interest Rate

"Project interest rate" shall mean the weighted average interest rate of (1) through (6) below computed by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts:

(1) general obligation bonds issued by the State under the Bond Act,

(2) revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) bonds issued by any agency, district, political subdivision, public corporation, or nonprofit corporation of this State,

(5) funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State, and

(6) funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing by moneys in the Pooled Money Investment Account of such Treasury invested in securities,

to the extent the proceeds of any such bonds, advances or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities, (except off-aqueduct power facilities and

advances for delivery structures, measuring devices and excess capacity) and without regard to any premiums received on the sale of bonds under item (1) above. The "project interest rate" shall be computed as a decimal fraction to five places.

22 51431

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 21 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 8th day of December, 1995, pursuant to the provisions of the California Water Resources Development Bond Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as "State," and Kern County Water Agency, herein referred to as the "Agency."

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State;

WHEREAS, a more efficient use of entitlement water may be achieved by deferral of its use from October, November and December of one calendar year into the first three months of the next year.

WHEREAS, the State and the Agency desire to amend the provisions of such contract related to the delivery and scheduling of entitlement water to allow, under certain conditions, the carry-over of a portion of the Agency's entitlement deliveries from a respective year into the first three months of the next calendar year.

WHEREAS, the carry-over of entitlement by the Agency is not intended to adversely impact current or future project operations.

WHEREAS, the State Water Project contractors and the Department are aware that the carry-over of entitlement water from one year into the next may increase or decrease the costs to other SWP contractors in either year. The tracking of those costs may be too complex and expensive and does not warrant special accounting procedures to be established; however, any significant identifiable cost shall be charged to those contractors causing such cost, as determined by the Department;

WHEREAS, the carry-over of entitlement water is not to affect the payment provisions of the contract.

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's Water Supply Contract with the State:

1. Article 1(ii) is added to read:

"Carry-over Entitlement Water" shall mean water from a contractor's annual entitlement for a respective year which is made available for delivery by the State in the next year pursuant to Article 12(e).

2. Article 12(e) is added to read:

(e) Delivery of Carry-over Entitlement Water

Upon request of the Agency, the State shall make Carry-over Entitlement Water available for delivery to the Agency during the first three months of the next year, to the extent that such deliveries do not adversely affect current or future project operations, as determined by the State. The State's determination shall include, but not be limited to the operational constraints of project facilities, filling of project conservation storage, flood control releases and water quality restrictions.

Carry-over of entitlement water shall be limited to entitlement water that was included in the Agency's approved delivery schedule for October, November and December, but was not delivered due to:

(1) scheduled or unscheduled outages of facilities within the Agency's service area; or

(2) a delay in the planned application of a contractor's annual entitlement water for pre-irrigation; or

(3) a delay in the planned spreading of the Agency's annual entitlement water for ground water storage.

After determining that the carry-over of entitlement water would not adversely affect project operations, the State shall notify the Agency of the amount of entitlement water to be carried over to the following January through March period. The notification shall include the proposed terms and conditions consistent with this Article 12(e) that would govern the delivery of the Carry-over Entitlement Water.

The Agency agrees to pay all significant identifiable costs associated with its Carry-over Entitlement Water, as determined by the State.

All scheduling and delivery of Carry-over Entitlement Water shall be carried out pursuant to the provisions of this contract.

The Agency agrees to forego the delivery of any Carry-over Entitlement Water that is lost because of project operations or is not delivered by March 31 of the next year.

Any Carry-over Entitlement Water foregone by the Agency will become a part of the current year's total project supply.

WITNESS WHEREOF, the parties have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

Attest:

Name

Executive Secretary
Title

October 26, 1995
Date

KERN COUNTY WATER AGENCY

Name

President
Title

October 26, 1995
Date

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

632-5149-1

AMENDMENT NO. 22 TO WATER SUPPLY
CONTRACT BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 11th day of APRIL, 1991, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

RECITALS:

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State;

WHEREAS, the State and the Agency included in such contract an article which entitles the Agency to obtain from the State deliveries of surplus water when available;

WHEREAS, the State and the Agency desire to amend the provisions of such contract related to the deliveries of surplus water; and

WHEREAS, beginning January 1, 1991 the Agency desires to be charged for the power used for pumping surplus water at the Melded Power Rate as provided herein for the remainder of the project repayment period.

WHEREAS, the parties to this Amendment, and those approving the Amendment, intend no impact upon their positions with respect to the interpretation of any existing contractual provisions.

AGREEMENT:

It is agreed that the following changes are hereby made to the Agency's water supply contract as follows:

1. Purpose and Scope. This Amendment is only intended to define the procedure for determining the charges for power used to pump surplus and unscheduled water. The scope of the Amendment is strictly confined to that purpose.

2. Article 21(d) of the Agency's water supply contract with the State is amended to read:

(d) Schedules. On or before October 1 of each year, concurrently with the schedule submitted pursuant to the provisions of Article 12, the Agency shall submit in writing to the State a preliminary water delivery schedule, indicating the desired amounts of surplus water for each month of the subsequent six-year period beginning January 1, of the next succeeding year. The last five years of this preliminary surplus water delivery schedule shall be used by the State for planning and operations studies.

3. Article 21(f) of the Agency's water supply contract with the State is amended to read:

(f) Power Costs.

(1) Beginning January 1, 1991, the Agency shall pay power charges for pumping surplus water as follows:

(A) If during a calendar month it is either not necessary to purchase power for pumping surplus water, or it is necessary to purchase power for pumping surplus water and the purchased power rate is less than or equal to the Melded Power Rate (defined as the average unit charge for pumping entitlement water during the calendar year for all power resources, including on-aqueduct power resources, off-aqueduct power resources, and any other power resources), then the monthly charges to the Agency for the Net Power (gross power used to pump the surplus water less power generated by the surplus water) used to pump surplus water to the Agency shall be determined using the Melded Power Rate.

(B) If during a calendar month it is necessary to purchase power for pumping surplus water and the purchased power rate is greater than the Melded Power Rate, the monthly charges to the Agency for the Net Power used to pump surplus water for delivery to the Agency shall be determined using a composite rate equal to the sum of:

(i) The monthly average purchased power rate per unit of power so purchased times the power purchased for pumping surplus water and that result divided by the Net Power; plus,

(ii) The Melded Power Rate per unit of power times a quantity which equals the Net Power used for pumping surplus water minus the power purchased for pumping surplus water and that result divided by the Net Power.

(C) In all cases, the power charges shall include the cost of any additional transmission service required for the delivery of surplus water to the Agency.

(2) By receiving surplus or unscheduled water under this Article 21(f), the Agency accepts the responsibility to indemnify, defend, and hold harmless the State, its officers, employees and agents from all liability, expenses, defense costs, attorney fees, claims, actions, liens, and lawsuits of whatever kind, arising out of or related to this article.

(3) Effective January 1, 1991, power charges for delivery of unscheduled water to the Agency shall be calculated in the same manner as provided in this Article 21(f).

4. This Amendment shall take effect on January 1, 1991, only if, by January 31, 1991 an Amendment substantially the same as this one is executed by contractors that together have maximum annual entitlements totaling at least 3,796,007 acre-feet. By February 15, 1991, the State will inform the Agency of whether sufficient contractors had executed the Amendment to cause the Amendment to take effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Acting Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

SIGNATURE

Thomas N. Clark
NAME

General Manager
TITLE

ATTEST:

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 23 (THE MONTEREY AMENDMENT)
TO WATER SUPPLY CONTRACT BETWEEN THE
STATE OF CALIFORNIA DEPARTMENT OF
WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 13th day of December, 1995, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

RECITALS:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, on December 1, 1994, representatives of the contractors and the State executed a document entitled "Monterey Agreement - Statement of Principles - By the State Water Contractors and the State of California Department of Water Resources For Potential Amendments To The State Water Supply Contracts" (the "Monterey Agreement"); and

WHEREAS, the contractors and the State have negotiated an amendment to the water supply contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment"); and

WHEREAS, the State and the Agency desire to implement such provisions by incorporating this Monterey Amendment into the water supply contract;

NOW, THEREFORE, IT IS MUTUALLY AGREED that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Article 1(d) is amended to read:

(d) **Contractor**

"Contractor" shall mean any entity that has executed, or is an assignee of, a contract of the type published in Department of Water Resources Bulletin No. 141 dated November 1965, with the State for a dependable supply of water made available by the System, except such water as is made available by the facilities specified in Section 12934(d)(6) of the Water Code.

2. Article 1(k) is amended to read:

(k) **Minimum Project Yield**

"Minimum project yield" shall mean the dependable annual supply of project water to be made available, estimated to be 4,185,000 acre-feet per year, said amount to be determined by the State on the basis of coordinated operation studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon:

(1) The estimated relative proportion of deliveries for agricultural use to deliveries for municipal use for the year 1990, and the characteristic distributions of demands for these two uses throughout the year.

(2) Agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the diversion or utilization of waters of the Delta or streams tributary thereto.

3. Article 1(hh) is amended to read:

(hh) **Water System Facilities**

(hh) "Water System Facilities" shall mean the following facilities to the extent that they are financed with water system revenue bonds or to the extent that other financing of such facilities is reimbursed with proceeds from water system revenue bonds:

(1) The North Bay Aqueduct,

(2) The Coastal Branch Aqueduct,

(3) Delta Facilities, including Suisun Marsh facilities, to serve the purposes of water conservation in the Delta, water supply in the Delta, transfer of water across the Delta, and mitigation of the environmental effects of project facilities, and to the extent presently authorized as project purposes, recreation and fish and wildlife enhancement,

(4) Local projects as defined in Article 1(h)(2) designed to develop no more than 25,000 acre-feet of project yield from each project,

(5) Land acquisition prior to December 31, 1995, for the Kern Fan Element of the Kern Water Bank,

(6) Additional pumps at the Banks Delta Pumping Plant,

(7) The transmission line from Midway to Wheeler Ridge Pumping Plant,

(8) Repairs, additions, and betterments to conservation or transportation facilities existing as of January 1, 1987, and to all other facilities described in this subarticle (hh) except for item (5),

(9) A project facilities corporation yard, and

(10) A project facilities operation center.

4. Article 1(jj) is added to read:

(jj) **Interruptible water**

"Interruptible water" shall mean project water available as determined by the State that is not needed for fulfilling contractors' annual entitlement deliveries as set forth in their water delivery schedules furnished pursuant to Article 12 or for meeting project operational requirements, including storage goals for the current or following years.

5. Article 1(kk) is added to read:

(kk) **Nonproject water**

"Nonproject water" shall mean water made available for delivery to contractors that is not project water as defined in Article 1(j).

6. Article 1(ll) is added to read:

(ll) "Monterey Amendments" shall mean this amendment and substantially similar amendments to other contractors' water supply contracts that include, among other provisions, the addition of Articles 51 through 56.

7. Article 4 is amended to read:

4. OPTION FOR CONTINUED SERVICE

By written notice to the State at least six (6) months prior to the expiration of the term of this contract, the Agency may elect to receive continued service after expiration of said term under the following conditions unless otherwise agreed to:

(1) Service of water in annual amounts up to and including the Agency's maximum annual entitlement hereunder.

(2) Service of water at no greater cost to the Agency than would have been the case had this contract continued in effect.

(3) Service of water under the same physical conditions of service, including time, place, amount and rate of delivery, as are provided for hereunder.

(4) Retention of the same chemical quality objective provision as is set forth herein.

(5) Retention of the same options to utilize the project transportation facilities as are provided for in Articles 18 (c) and 55, to the extent such options are then applicable.

Other terms and conditions of the continued service shall be reasonable and equitable and shall be mutually agreed upon. In the event that said terms and conditions provide for continued service for a limited number of years only, the Agency shall have the same option to receive continued service here provided for upon the expiration of that and each succeeding period of continued service.

8. Article 7(a) is amended to read:

(a) **Changes in Annual Entitlements**

The Agency may, at any time or times during the term of this contract, by timely written notice furnished to the State, request that project water be made available to it thereafter in annual amounts greater or less than the annual entitlements designated in Table A of this contract. Subject to approval by the State of any such request, the State's construction schedule shall be adjusted to the extent necessary to satisfy the request, and the requested increases or decreases in said annual entitlements shall be incorporated in said Table A by amendment thereof. Requests for changes in annual entitlements for more than one year shall be approved by the State: *Provided*, That no change shall be approved if in the judgment of the State it would impair the financial feasibility of project facilities.

9. The title of Article 12 is amended to read "Priorities, Amounts, Times and Rates of Deliveries".

10. Article 12(a)(2) is amended to read:

(2) Upon receipt of a preliminary schedule the State shall review it and, after consultation with the Agency, shall make such modifications in it as are necessary to insure the delivery of the annual quantity allocated to the Agency in accordance with Article 18 and to insure that the amounts, times, and rates of delivery to the Agency will be consistent with the State's overall delivery ability, considering the then current delivery schedules of all contractors. On or before December 1 of each year, the State shall determine and furnish to the Agency the water delivery schedule for the next succeeding year which shall show the amounts of water to be delivered to the Agency during each month of that year.

11. Article 12(d) is deleted.

12. Article 12(f) is added to read:

(f) **Priorities**

Each year water deliveries to the contractors shall be in accordance with the following priorities to the extent there are conflicts:

First, project water to meet scheduled deliveries of contractors' annual entitlements for that year.

Second, interruptible water to the extent contractors' annual entitlements for that year are not met by the first priority.

Third, project water to fulfill delivery requirements pursuant to Article 14(b).

Fourth, project water previously stored pursuant to Articles 12(e) and 56.

Fifth, nonproject water to fulfill contractors' annual entitlements for that year not met by the first two priorities.

Sixth, additional interruptible water delivered to contractors in excess of their annual entitlements for that year.

Seventh, additional nonproject water delivered to contractors in excess of their annual entitlements for that year.

13. Article 14 is amended to read:

Curtailment of Delivery

(a) **State May Curtail Deliveries**

The State may temporarily discontinue or reduce the delivery of project water to the Agency hereunder for the purposes of necessary investigation, inspection, maintenance, repair, or replacement of any of the project facilities necessary for the delivery of project water to the Agency, as well as due to outages in, or reductions in capability of, such facilities beyond the State's control or unuseability of project water due to an emergency affecting project facilities. The State shall notify the Agency as far in advance as possible of any such discontinuance or reduction, except in cases of emergency, in which case notice need not be given.

(b) **Agency May Receive Later Delivery of Water Not Delivered**

In the event of any discontinuance or reduction of delivery of project water pursuant to subdivision (a) of this article, the Agency may elect to receive the amount of annual entitlement which otherwise would have been delivered to it during such period under

the water delivery schedule for that year at other times during the year or the succeeding year to the extent that such water is then available and such election is consistent with the State's overall delivery ability, considering the then current delivery schedules of annual entitlement to all contractors.

14. Article 16(a) is amended to read:

(a) **Limit on Total of all Maximum Annual Entitlements**

The Agency's maximum annual entitlement hereunder, together with the maximum annual entitlements of all other contractors, shall aggregate no more than the minimum project yield as defined herein and in no event more than 4,185,000 acre-feet of project water.

15. Article 18 is amended to read:

18. SHORTAGE IN WATER SUPPLY

(a) **Shortages; Delivery Priorities**

In any year in which there may occur a shortage due to drought or any other cause <u>whatsoever</u>, in the supply of project water available for delivery to the contractors, with the result that such supply is less than the total of the annual entitlements of all contractors for that year, the State shall allocate the available supply in proportion to each contractor's annual entitlement as set forth in its Table A for that year and shall reduce the allocation of project water to each contractor using such water for agricultural purposes and to each contractor using such water for other purposes by the same percentage of their respective annual entitlements for that year: *Provided,* that the State may allocate on some other basis if such is required to meet minimum demands of

contractors for domestic supply, fire protection, or sanitation during the year. If a contractor is allocated more water than it requested, the excess water shall be reallocated among the other contractors in proportion to their annual entitlements as provided for above. The foregoing provisions of this subdivision shall be inoperative to the extent necessary to comply with subdivision (c) of this article and to the extent that a contractor's annual entitlement for the respective year reflects established rights under the area of origin statutes precluding a reduction in deliveries to such contractor.

(b) - Deleted

(c) **Permanent Shortage; Contracts for Areas-of-Origin**

In the event that the State, because of the establishment by a party of a prior right to water under the provisions of Sections 11460 through 11463 of the Water Code, enters into a contract with such party for a dependable supply of project water, which contract will cause a permanent shortage in the supply of project water to be made available to the Agency hereunder:

(1) The State shall: (i) equitably redistribute the costs of all transportation facilities included in the System among all contractors for project water, taking into account the diminution of the supply to the Agency and other prior contractors in accordance with the terms of their contracts, and (ii) revise the Agency's annual entitlements and maximum annual entitlement, by amendment of Table A of this contract to correspond to the reduced supply of project water to be made available to the Agency: *Provided*, That such redistribution of costs of transportation facilities shall not be made until there has been reasonable

opportunity for the Agency to exercise the option provided for in (2) below, and for other prior contractors to exercise similar options.

(2) The Agency, at its option, shall have the right to use any of the project transportation facilities which by reason of such permanent shortage in the supply of project water to be made available to the Agency are not required for delivery of project water to the Agency, to transport water procured by it from any other source: *Provided*, That such use shall be within the limits of the capacities provided in the project transportation facilities for service to the Agency under this contract: *Provided further*, That, except to the extent such limitation in Section 12931 of the Water Code be changed, the Agency shall not use the project transportation facilities under this option to transport water the right to which was secured by the Agency through eminent domain unless such use be approved by the Legislature by concurrent resolution with a majority of the members elected to each house voting in favor thereof. This option shall terminate upon a redistribution of costs of transportation facilities by the State pursuant to (1) above. In the event that this option is exercised, the State shall take such fact into account in making such redistribution of costs, and shall offset such use as is made of the project transportation facilities pursuant thereto against any reduction in the Agency's payment obligation hereunder resulting from such redistribution of costs.

(d) **Reinstatement of Entitlements**

If after any revision of annual entitlements and maximum annual entitlements pursuant to subdivision (c) of this article, circumstances arise which, in the judgment of the State, justify a revision upward of the same, the State shall, with the consent of the affected contractor, reinstate proportionately the previously reduced entitlements of such contractor to the extent deemed justified, and shall equitably redistribute the costs of the project transportation facilities if inequities would otherwise occur as a result of such reinstatement of entitlements.

(e) **Advance Notice of Delivery Reductions**

The State shall give the Agency written notice as far in advance as possible of any reduction in deliveries to it which is to be made under subdivision (a) of this article and, to the extent possible, shall give the Agency written notice five (5) years in advance of any reduction in its annual entitlements and maximum annual entitlement under subdivision (c) of this article. Reports submitted to the Agency pursuant to Article 16(c) may constitute such notices.

(f) **No Liability for Shortages**

Neither the State nor any of its officers, agents, or employees shall be liable for any damage, direct or indirect, arising from shortages in the amount of water to be made available for delivery to the Agency under this contract caused by drought, operation of area of origin statutes, or any other cause beyond its control.

16. Old Article 21 "Sale of Surplus Water" is deleted and replaced by new Article 21 "Interruptible Water Service" to read:

21. Interruptible Water Service

(a) **Allocation of Interruptible Water**

Each year from water sources available to the project, the State shall make available and allocate interruptible water to contractors in accordance with the procedure in Article 18(a). Allocations of interruptible water in any one year may not be carried over for delivery in a subsequent year, nor shall the delivery of interruptible water in any year impact a contractor's approved deliveries of annual entitlement or the contractor's allocation of water for the next year. Deliveries of interruptible water in excess of a contractor's annual entitlement may be made if the deliveries do not adversely affect the State's delivery of annual entitlement to other contractors or adversely affect project operations. Any amounts of water owed to the Agency as of the date of this amendment pursuant to former Article 12(d), any contract provisions or letter agreements relating to wet weather water, and any Article 14(b) balances accumulated prior to 1995, are canceled. The State shall hereafter use its best efforts, in a manner that causes no adverse impacts upon other contractors or the project, to avoid adverse economic impacts due to a contractor's inability to take water during wet weather.

(b) **Rates**

For any interruptible water delivered pursuant to this article, contractors shall pay the State the same (including adjustments) for power resources (including on-aqueduct,

off-aqueduct, and any other power) incurred in the transportation of such water as if such interruptible water were entitlement water, as well as all incremental operation, maintenance, and replacement costs, and any other incremental costs, as determined by the State. The State shall not include any administrative or contract preparation charge. Incremental costs shall mean those nonpower costs which would not be incurred if interruptible water were not scheduled for or delivered to the contractor. Only those contractors not participating in the repayment of the capital costs of a reach shall be required to pay any use of facilities charge for the delivery of interruptible water through that reach.

(c) **Contracts**

To obtain a supply of interruptible water, a contractor shall execute a further contract with the State which shall be in conformity with this article and shall include at least provisions concerning the scheduling of deliveries of interruptible water and times and methods of payment.

17. Article 22(j) is amended to read:

(j) Notwithstanding provisions of Article 22(a) through (i), the capital cost component and the minimum OMP&R component of the Delta Water Charge shall include an annual charge to recover the Agency's share of the conservation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with provisions in Article 50 of this contract. Charges for the conservation portion of the water system revenue bond financing costs shall not be affected by any reductions in payments pursuant to Article 51.

18. The first paragraph of Article 24(b) is amended to read:

(b) In the first step, the total amount of capital costs of each aqueduct reach to be returned to the State shall be allocated among all contractors entitled to delivery of project water from or through the reach by the proportionate use of facilities method of cost allocation and in accordance with (1) and (2) below. The measure of the proportionate use of each contractor of each reach shall be the average of the following two ratios: (i) the ratio of the contractor's maximum annual entitlement to be delivered from or through the reach to the total of the maximum annual entitlements of all contractors to be delivered from or through the reach from the year in which charges are to be paid through the end of the project repayment period and (ii) the ratio of the capacity provided in the reach for the transport and delivery of project water to the contractor to the total capacity provided in the reach for the transport and delivery of project water to all contractors served from or through the reach from the year in which charges are to be paid through the end of the project repayment period. Allocations of capital costs to the Agency pursuant hereto shall be on the basis of relevant values which will be set forth in Table B of this contract by the State as soon as designs and cost estimates are prepared by it subsequent to receipt of requests from the Agency as to the maximum monthly delivery capability to be provided in each aqueduct reach of the project transportation facilities for the transport and delivery of project water to the Agency, pursuant to Article 17(a): *Provided*, That these values shall be subject to redetermination by the State in accordance with Article 28: *Provided further*, That the principles and procedures set forth in this

subdivision shall be controlling as to allocations of capital costs to the Agency. Proportionate use of facilities factors for prior years shall not be adjusted by the State in response to changes or transfers of entitlement among contractors unless otherwise agreed by the State and the parties to the transfer and unless there is no impact on past charges or credits of other contractors.

19. Article 24(g) is amended to read:

(g) Notwithstanding provisions of Article 24(a) through (d), the capital cost component of the Transportation Charge shall include an annual charge to recover the Agency's share of the transportation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with the provisions of Article 50 of this contract. Charges for the transportation portion of the water system revenue bond financing costs shall not be affected by any reductions in payments pursuant to Article 51.

20. Article 25(d)(3) is amended to read:

(3) An interim adjustment in the allocation of the power costs calculated in accordance with (2) above, may be made in May of each year based on April revisions in approved schedules of deliveries of project and nonproject water for contractors for such year. A further adjustment shall be made in the following year based on actual deliveries of project and nonproject water for contractors provided, however, in the event no deliveries are made through a pumping plant, the adjustments shall not be made for that year at that plant.

21. Article 50(j) is added to read:

(j) Amounts payable under this article shall not be affected by any reductions in payments pursuant to Article 51.

22. Article 51 is added to read:

51. FINANCIAL ADJUSTMENTS

(a) **General Operating Account**

(1) The State shall maintain a General Operating Account to provide the moneys needed to pay obligations incurred by the State of the types described in Water Code sections 12937(b)(1) and (2) in the event of emergency or cash flow shortages.

(2) An initial deposit of $15 million shall be made available from revenue bond reserves that are no longer required by revenue bond covenants and that would otherwise be credited to the contractors including the Agency. In 1998 or when the funds become available an additional $7.7 million will be deposited in the General Operating Account from revenue bond reserves that are no longer required by revenue bond covenants and that would otherwise be credited to the contractors including the Agency, bringing the deposits to that account under this article to $22.7 million.

(3) The balance in the General Operating Account will increase pursuant to subdivision (e)(3)(v) of this article to an amount determined by the State but not in excess of $32 million. However, after the year 2001, the maximum amount of the fund may increase or decrease annually by not more than the same percentage as the increase or decrease in the charges, other than power charges for pumping water, to all the contractors for the previous year from

the charges for the year before that for obligations under subdivisions (c)(2)(ii) and (iii) of this article.

(b) **State Water Facilities Capital Account**

(1) The State shall establish a State Water Facilities Capital Account to be funded from revenues available under Water Code section 12937(b)(4). Through procedures described in this article and as limited by this article, the State may consider as a revenue need under subdivision (c)(2)(v) of this article and may deposit in the State Water Facilities Capital Account the amounts necessary to pay capital costs of the State Water Facilities for which neither general obligation bond nor revenue bond proceeds are available, including but not limited to planning, reconnaissance and feasibility studies, the San Joaquin Valley Drainage Program and, through the year 2000, the CALFED Bay-Delta Program.

(2) The Director of the Department of Water Resources shall fully consult with the contractors and consider any advice given prior to depositing funds into this account for any purposes. Deposits into this account shall not exceed the amounts specified in subdivision (c)(2)(v) of this article plus any amounts determined pursuant to subdivision (e)(1)(iii) of this article.

(3) The State shall use revenue bonds or other sources of moneys rather than this account to finance the costs of construction of any major capital projects.

(c) **Calculation of Financial Needs**

(1) Each year the State shall calculate in accordance with the timing provisions of Articles 29 and 31 the amounts that would have been charged (but for this article) to each contractor as provided in other provisions of this contract.

(2) Each year the State shall also establish its revenue needs for the following year for the following purposes, subject to the following limitations:

(i) The amount required to be collected under the provisions of this contract, other than this article, with respect to all revenue bonds issued by the State for Project Facilities.

(ii) The amount required for payment of the reasonable costs of the annual maintenance and operation of the State Water Resources Development System and the replacement of any parts thereof as described in Water Code section 12937(b)(1). These costs shall not include operation and maintenance costs of any Federal Central Valley Project facilities constructed by the United States and acquired by the State of California after 1994, other than the State's share of the joint use facilities which include San Luis Reservoir, the San Luis Canal and related facilities.

(iii) The amount required for payment of the principal of and interest on the bonds issued pursuant to the Burns-Porter Act as described in Water Code section 12937(b)(2).

(iv) Any amount required for transfer to the California Water Fund in reimbursement as described in Water Code section 12937(b)(3) for funds utilized from said fund for construction of the State Water Resources Development System.

(v) For the years 1998 and thereafter, the amount needed for deposits into the State Water Facilities Capital Account as provided in subdivision (b) of this article, but (A) not more than $6 million per year for the years 1998, 1999 and 2000, and (B) not more than $4.5 million per year for the years 2001 and thereafter.

(3) Subject to the provisions of subdivision (e) of this article, the State shall reduce the annual charges in the aggregate for all contractors by the amounts by which the hypothetical charges calculated pursuant to subdivision (c)(1) above exceed the revenue needs determined pursuant to subdivision (c)(2) above. The reductions under this article shall be apportioned among the contractors as provided in subdivisions (d), (e), (f) and (g) of this article. Reductions to contractors shall be used to reduce the payments due from the contractors on each January 1 and July 1; *Provided*, however, that to the extent required pursuant to subdivision (h) of this article, each Agricultural Contractor shall pay to the Agricultural Rate Management Trust Fund an amount equal to the reduction allocated to such Agricultural Contractor. Any default in payment to the trust fund shall be subject to the same remedies as any default in payment to the State under this contract.

(4) The State may submit a supplemental billing to the Agency for the year in an amount not to exceed the amount of the prior reductions for such year under this article if necessary to meet unanticipated costs for purposes identified in Water Code section 12937(b)(1) and (2) for which the State can issue billings under other provisions of this contract. Any supplemental billing made to the Agency for these purposes shall be in the same proportion to the total supplemental billings to all contractors for these purposes as the prior reduction in charges to the Agency in that year bears to the total reductions in charges to all contractors in that year and shall be treated as reducing the amount of the reduction made available for that year to the Agency by the amount of the supplemental bill to the Agency.

(5) The State may also submit a supplemental billing to the Agency for the year if necessary to meet unanticipated costs for revenue bond debt service and coverage for which the State can issue a statement of charges under provisions of this contract other than this article. The relative amounts of any supplemental billing made to the Agency and to other contractors for revenue bond purposes shall be governed by such other applicable provisions of this contract.

(6) Payment of any supplemental billing shall be due thirty days after the date of the invoice. Delinquency and interest on delinquent amounts due shall be governed by Article 32.

(d) **Apportionment of Reductions between Agricultural and Urban Contractors**

(1) Reductions available under this article are projected to begin to occur in 1997. The numbers and percentages in this subdivision reflect certain estimates of dollars and sharing of reductions. The actual reductions may vary slightly from the amounts described below. The State shall determine the availability of reductions for each year in accordance with this article.

(2) Reductions shall be phased in as follows:

(i) In 1997 reductions in the amount of $14 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(ii) In 1998 reductions in the amount of $17 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the

Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(iii) In 1999 reductions in the amount of $32 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(iv) In 2000 reductions in the amount of $33 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(3)(i) In the event that the aggregate amount of reductions in any of the years 1997 through 2000 is less than the respective amount projected for such year in subdivision (d)(2) above, the shortfall shall be taken first from reductions that would have been provided to Urban Contractors. Only after all reductions to Urban Contractors have been eliminated in a given year shall the remaining shortfall be taken from reductions scheduled for Agricultural Contractors. Any projected reductions not made available due to such shortfalls in the years 1997 through 2000 shall be deferred with interest at the project interest rate to the earliest subsequent years when reductions in excess of those projected for those years are available. Such deferred reductions with interest at the project interest rate shall be applied to the charges of the contractors whose reductions have been deferred.

(ii) In the event that the aggregate amount of reductions available in any of the years 1997 through 2000 is

greater than the sum of (A) the respective amount projected for such year in subdivision (d)(2) above, plus (B) the amount of any shortfall with accrued interest at the project interest rate, remaining from any prior year to be applied, the excess shall be applied for the purposes and in the amounts per year described in subdivisions (e)(3)(iii), (iv), (v) and (vi) of this article, in that order.

(4) In 2001 and in each succeeding year reductions equal to or in excess of $40.5 million are projected to be available and shall be applied as follows:

(i) If reductions are available in an amount that equals or exceeds $40.5 million, $10 million of reductions shall be apportioned among the Agricultural Contractors, and $30.5 million of reductions shall be apportioned among the Urban Contractors. If reductions are available in an amount greater than $40.5 million, the excess shall be applied as provided in subdivision (e)(3) of this article, subject however to subdivision (e)(1).

(ii) If reductions are available in an amount less than $40.5 million in any of these years, the reductions shall be divided on a 24.7% - 75.3% basis between the Agricultural Contractors and the Urban Contractors respectively. Any such reductions not made due to shortages shall be applied without interest in the next year in which reductions in an amount in excess of $40.5 million are available pursuant to subdivision (e)(3) of this article with any remainder that is not available carried over without interest to be applied in the earliest subsequent years when reductions in excess of $40.5 million are available.

(5) Annual charges to a contractor shall only be reduced prospectively from and after the date it executes the Monterey Amendment to this contract. Apportionments of reductions shall be calculated on the assumption that all contractors have executed such amendment.

(e) **Review of Financial Requirements**

(1) In 2001 and every fifth year thereafter the Director of the Department of Water Resources, in full consultation with the contractors, will review the financial requirements of the State Water Resources Development System and determine the following:

(i) The amount of revenues that are needed for State Water Resources Development System purposes in addition to those needed for the purposes specified in subdivisions (c)(2)(i), (ii), (iii), and (iv) of this article;

(ii) If the aggregate amount that would have been charged to all contractors in any year but for this article exceeds the sum of (A) the amount of revenues needed for the purposes specified in subdivisions (c)(2)(i), (ii), (iii) and (iv), plus (B) $40.5 million, plus (C) the amount determined pursuant to subdivision (c)(2)(v) of this article, the amount of such excess.

(iii) The amount of the excess determined in subdivision (e)(1)(ii) above that should be collected by the State for additional State Water Resources Development System purposes and the amount of such excess that should be used for further annual charge reductions.

(2) After making the determinations required above, the State may collect the revenues for additional State Water Resources

Development System purposes in the amount determined pursuant to subdivision (e)(1)(iii) above.

(3) If and to the extent that as a result of such determinations, the aggregate amount to be charged to contractors is to be reduced by more than $40.5 million per year, the following priorities and limitations shall apply with respect to the application of such additional reductions:

(i) First, reductions shall be allocated to make up shortfalls in reductions from those projected for the years 1997 through 2000 with interest at the project interest rate pursuant to subdivision (d)(3)(i).

(ii) Second, reductions shall be allocated to make up shortfalls in reductions from those projected for the years beginning with 2001 without interest pursuant to subdivision (d)(4)(ii).

(iii) Third, additional reductions in the amount of $2 million per year shall be apportioned among the Urban Contractors until a total of $19.3 million in such additional reductions have been so applied.

(iv) Fourth, reductions up to an additional $2 million per year shall be allocated to make up any shortfalls in the annual reductions provided for in subdivision (e)(3)(iii).

(v) Fifth, $2 million per year shall be charged and collected by the State and deposited in the General Operating Account to bring the account ultimately up to an amount determined by the State but not in excess of $32 million with adjustments as provided in subdivision (a) of this article. Any amount in the

account in excess of this requirement shall be returned to general project revenues.

(vi) Sixth, remaining amounts if any shall be used for reductions divided on a 24.7% - 75.3% basis between the Agricultural Contractors and the Urban Contractors respectively.

(f) **Apportionment of Reductions among Urban Contractors.** Reductions in annual charges apportioned to Urban Contractors under subdivisions (d) and (e) of this article shall be further allocated among Urban Contractors pursuant to this subdivision. The amount of reduction of annual charges for each Urban Contractor shall be based on each Urban Contractor's proportionate share of total allocated capital costs as calculated below, for both project conservation and project transportation facilities, repaid by all Urban Contractors over the project repayment period.

(1) The conservation capital cost component of the reduction allocation shall be apportioned on the basis of maximum annual entitlement. Each Urban Contractor's proportionate share shall be the same as the percentage of that contractor's maximum annual entitlement to the total of all Urban Contractors' maximum annual entitlements.

(2) The transportation capital cost component of the reduction allocation shall be apportioned on the basis of transportation capital cost component repayment obligations, including interest over the project repayment period. Each Urban Contractor's proportionate share shall be the same as the percentage that the contractor's total transportation capital cost component repayment obligation is of the total of all Urban Contractors' transportation capital cost component repayment obligations.

(i) Recalculations shall be made annually through the year 1999. Beginning in the year 2000 recalculations shall be made every five years unless an Urban Contractor requests a recalculation for an interim year and does so by a request in writing delivered to the Department by January 1 of the year in which the recalculation is to take place.

(ii) The transportation capital cost component repayment obligations, for purposes of this Article 51(f), shall be based in the year of recalculation on the then most recent Department of Water Resources Bulletin 132, Table B-15, "Capital Cost Component of Transportation Charge for Each Contractor," or its equivalent, excluding any costs or entitlement associated with transfers of entitlement from Agricultural Contractors pursuant to Article 53.

(3) To reflect the relative proportion of the conservation capital cost component and the transportation capital cost component to the total of all capital cost repayment obligations, the two cost components shall be weighted as follows:

(i) The conservation capital cost component shall be weighted with a thirty percent (30%) factor. The weighting shall be accomplished by multiplying each Urban Contractor's percentage of maximum annual entitlements as calculated in subdivision (f)(1) of this article by thirty percent (30%).

(ii) The transportation capital cost component shall be weighted with a seventy percent (70%) factor. The weighting shall be accomplished by multiplying each Urban Contractor's percentage of transportation capital cost component repayment obligations as

calculated in subdivision (f)(2) of this article by seventy percent (70%).

(iii) A total, weighted capital cost percentage shall be calculated for each Urban Contractor by adding the weighted conservation capital cost component percentage to their weighted transportation capital cost component percentage.

(4) The total amount of the annual charges to be reduced to Urban Contractors in each year shall be allocated among them by multiplying the total amount of annual charges to be reduced to the Urban Contractors by the total, weighted capital cost percentages for each such contractor. If the amount of the reduction to an Urban Contractor is in excess of that contractor's payment obligation to the Department for that year, such excess shall be reallocated among the other Urban Contractors.

(5) In the case of a permanent transfer of urban entitlement, the proportionate share of annual charge reductions associated with that entitlement shall be transferred with the entitlement to the buying contractor. In the case of an entitlement transfer by either Santa Barbara County Flood Control and Water Conservation District or San Luis Obispo County Flood Control and Water Conservation District, the reductions in annual charges to that agency shall be allocated (a) on the basis of that entitlement being retained by that agency which bears Coastal Branch Phase II transportation costs, (b) on the basis of that entitlement being retained by that agency which does not bear Coastal Branch Phase II transportation costs, and (c) on the basis of the balance of that agency's entitlement which also does not bear Coastal Branch Phase II transportation costs.

(g) **Apportionment of Reductions Among Agricultural Contractors**

(1) Reductions in annual charges apportioned to Agricultural Contractors under subdivisions (d) and (e) of this article shall be allocated among the Agricultural Contractors pursuant to this subdivision. The amount of reduction of annual charges for each Agricultural Contractor for the years 1997 through 2001 shall be based on each Agricultural Contractor's estimated proportionate share of the total project costs, excluding the variable operation, maintenance, power and replacement components of the Delta Water Charge and the Transportation Charge and also excluding off-aqueduct power charges, to be paid by all Agricultural Contractors for the years 1997 through 2035, calculated without taking into account this article. For purposes of these calculations, Kern County Water Agency's and Dudley Ridge Water District's estimated project costs shall not include any costs associated with the 45,000 acre-feet of annual entitlement being relinquished by those contractors pursuant to subdivision (i) of Article 53. Also, for purposes of these calculations, an Agricultural Contractor's estimated project costs shall not be reduced by the transfer of any of the 130,000 acre-feet of annual entitlements provided for in subdivisions (a) through (i) of Article 53. The proportionate shares for 1997 through 2001 shall be calculated as follows:

(i) Each Agricultural Contractor's statement of charges received on July 1, 1994, shall be the initial basis for calculating the proportionate shares for the five years 1997 through 2001.

(ii) Each Agricultural Contractor's estimated capital and minimum components of the Delta Water Charge and the

Transportation Charge (excluding off-aqueduct power charges) and Water Revenue Bond Surcharge shall be totaled for the years 1997 through 2035.

(iii) Kern County Water Agency and Dudley Ridge Water District totaled costs shall be reduced for the 45,000 acre-feet of annual entitlement being relinquished by them.

(iv) Any reductions in an Agricultural Contractor's totaled costs resulting from the transfer of any of the 130,000 acre-feet of annual entitlement shall be re-added to that contractor's costs.

(v) Each Agricultural Contractor's proportionate share shall be computed by dividing that contractor's total costs by the total costs for all Agricultural Contractors determined pursuant to subparagraphs (ii), (iii) and (iv) above.

(2) The reductions in annual charges, for 1997 through 2001, shall be calculated using the method described in subdivision (g)(1) of this article.

(3) The allocation shall be recalculated using the same method described in subdivision (g)(1) of this article every five years beginning in 2002, if any Agricultural Contractor requests such a recalculation. Any recalculation shall be based on project cost data beginning with the year that the recalculation is to become effective through 2035.

(h) **Agricultural Rate Management Trust Fund**

(1) **Establishment.** Through a trust agreement executed contemporaneously with this amendment, the State and the Agricultural Contractors that sign the Monterey Amendments shall

establish the Agricultural Rate Management Trust Fund with a mutually agreed independent trustee.

(2) **Separate Accounts.** The trustee shall maintain within the trust fund a separate account for each Agricultural Contractor that signs the trust agreement to hold deposits made pursuant to this article.

(3) **Deposits.** Each Agricultural Contractor that signs the trust agreement shall deposit into such contractor's account within the trust fund, at the same time as payments would otherwise be required by this contract to be made to the State, an amount equal to the amount by which such contractor's charges under this contract have been reduced by reason of this article, until the balance in such contractor's account within the trust fund is the same percentage of $150,000,000 as such contractor's percentage share of reductions made available to all Agricultural Contractors as specified in subdivision (g) of this article. In 2002 and every fifth year thereafter, the Agricultural Contractors will review the maximum accumulation in the trust fund (the "Cap") and determine whether the cap should be adjusted. However, the Cap shall not be reduced below an aggregate of $150,000,000 for all Agricultural Contractor accounts.

(4) **Trust Fund Disbursements.**

(i) In any year in which the State's allocation of water to an Agricultural Contractor by April 15th of that year is less than one-hundred percent (100%) of the contractor's requested annual entitlement for that year, the trustee shall, to the extent there are funds in that contractor's account, distribute to the State from such account for the benefit of that contractor an amount equal to

the percentage of the total of that contractor's statement of charges for that year, as redetermined by the State on or about May 15th of that year, for (a) the Delta Water Charge; (b) the capital cost and minimum operation, maintenance, power and replacement components of the Transportation Charge (including off-aqueduct power charges); and (c) the water system revenue bond surcharge, that is equal to the percentage of that contractor's annual entitlement for that year that was not allocated to it by the State by April 15th of that year.

(ii) In addition to the provisions of subdivision (h)(4)(i) of this article, if on April 15 of any year any of the irrigable land within the Tulare Lake Basin Water Storage District (Tulare) is flooded, and Tulare in writing requests the trustee to do so, the trustee shall, to the extent there are funds in Tulare's account, distribute to the State from such account for the benefit of Tulare an amount equal to the percentage of the total of Tulare's statement of charges for that year, as redetermined by the State on or about May 15th of that year, for (a) the Delta Water Charge; (b) the capital cost and minimum components of the Transportation Charge (including off-aqueduct power charges); and (c) the water system revenue bond surcharge, that is equal to the percentage of the irrigable land within Tulare that is flooded on April 15.

(iii) Each Agricultural Contractor shall remain obligated to make payments to the State as required by other articles in this contract. Any amount to be disbursed pursuant to subdivisions (h)(4)(i) and (h)(4)(ii) shall be paid by the trustee to the State on July 1 of the year involved and shall be credited by the State toward any amounts owed by such respective Agricultural

Contractor to the State as of that date. However, an Agricultural Contractor may direct the trustee to make the disbursement to that Agricultural Contractor which shall in turn make the payment to the State as required by other provisions of this contract. If the amount to be disbursed exceeds the amount owed to the State by such contractor as of July 1, the excess shall be disbursed by the Trustee to the State at the time of and in payment of future obligations owed to the State by such contractor. Alternatively, upon the request of such contractor, all or part of the excess shall be paid by the trustee to that contractor in reimbursement of prior payments by the contractor to the State for that year.

(5) **Payment of Supplemental Bills.** In any year in which a supplemental bill has been submitted to an Agricultural Contractor pursuant to subdivision (c)(4) of this article, such supplemental bill shall be treated as reducing by an equal amount the obligation of such contractor for that year to make payments into the Agricultural Rate Management Trust Fund. To the extent that such contractor has already made payments to the trust fund in an amount in excess of such contractor's reduced trust fund payment obligation, such contractor may request the trustee to use the excess from the trust fund to pay the supplemental bill.

(6) **Discharge of Payment Obligation.** Each payment to the State by the trust fund shall discharge and satisfy the Agricultural Contractor's obligation to pay the amount of such payment to the State. No reimbursement of the trust fund by the Agricultural Contractor for such payments shall be required. However, each Agricultural Contractor shall continue to make deposits to the trust fund matching the amount of each year's reductions as provided in

subdivision (d) of this article so long as the amount in that contractor's account is less than its share of the Cap.

(7) **Distribution of Funds in Excess of the Cap.** Whenever accumulated funds (including interest) in an Agricultural Contractor's account in the trust fund exceed that contractor's share of the Cap, or the estimated remaining payments the contractor is required to make to the State prior to the end of the project repayment period, that contractor may direct the trustee to pay such excess to the contractor.

(8) **Termination of Trust Fund.** At the end of the project repayment period, the Agricultural Rate Management Trust Fund shall be terminated and any balances remaining in the accounts for each of the Agricultural Contractors shall be disbursed to the respective Agricultural Contractors.

(i) **Definitions.** For the purposes of this article, the following definitions will apply:

(1) "Agricultural Contractor" shall mean the following agencies as they now exist or in any reorganized form:

(i) County of Kings,

(ii) Dudley Ridge Water District,

(iii) Empire West Side Irrigation District,

(iv) Kern County Water Agency for 993,300 acre-feet of its entitlement,

(v) Oak Flat Water District,

(vi) Tulare Lake Basin Water Storage District.

(2) "Urban Contractor" shall mean every other agency having a long term water supply contract with the State as they exist as of the date of this amendment or in any reorganized form as well as

Kern County Water Agency for 119,600 acre-feet of its entitlement.

(j) Except as provided in subdivisions (c)(4) and (c)(5), this article shall not be interpreted to result in any greater State authority to charge the contractors than exists under provisions of this contract other than this article.

23. Article 52 is added to read:

52. KERN WATER BANK

(a) The State shall convey to the Kern County Water Agency (KCWA) in accordance with the terms set forth in the agreement between the State of California Department of Water Resources and Kern County Water Agency entitled "Agreement for the Exchange of the Kern Fan Element of the Kern Water Bank" (the Kern Water Bank Contract), the real and personal property described therein.

(b) Subject to the approval of KCWA, other contractors may be provided access to and use of the property conveyed to KCWA by the Kern Water Bank Contract for water storage and recovery. Fifty percent (50%) of any project water remaining in storage on December 31, 1995, from the 1990 Berrenda Mesa Demonstration Program and the La Hacienda Water Purchase Program shall be transferred to KCWA pursuant to the Kern Water Bank Contract. The remaining fifty percent (50%) of any such water (approximately 42,828.5 acre-feet) shall remain as project water and the State's recovery of such project water shall be pursuant to the provisions of a separate recovery contract. Any other Kern Water Bank demonstration program water shall remain as project water and the State's recovery of such water shall be pursuant to the provisions of the respective contracts for implementation of such demonstration programs.

24. Article 53 is added to read:

53. PERMANENT TRANSFERS AND REDUCTIONS OF ENTITLEMENT

(a) Article 41 provides that no assignment or transfer of a contract or any part thereof, rights thereunder or interest therein by a contractor shall be valid unless and until it is approved by the State and made subject to such reasonable terms and conditions as the State may impose. In accordance with State policy to assist water transfers, the State and the County of Kings, Dudley Ridge Water District (DRWD), Empire West Side Irrigation District, Kern County Water Agency (KCWA), Oak Flat Water District and Tulare Lake Basin Water Storage District (for the purposes of this article the "Agricultural Contractors") shall, subject to the conditions set forth in this article, expeditiously execute any necessary documents and approve all contracts between willing buyers and willing sellers until permanent transfers totaling 130,000 acre-feet of annual entitlements of the Agricultural Contractors and, to the extent provided in such contracts, rights in project transportation facilities related to such annual entitlement have been made to other contractors (the "Urban Contractors") or noncontractors in accordance with the provisions of this article. Such approval requirement shall apply to all contracts executed prior to January 1, 2011. KCWA shall be responsible for approval of such transfers for any portion of the 130,000 acre-feet not previously made available under this article by the other Agricultural Contractors. A contract between a willing buyer and a willing seller shall mean a contract between (1) a buyer which is an Urban Contractor or, to the extent provided in subdivision (e) of this article, a noncontractor and (2) a seller which is an Agricultural Contractor

or a public entity which obtains project water from an Agricultural Contractor.

(b) The State shall not be obligated to approve any transfer of annual entitlements if in its judgment the transfer would impair the security of the State's bondholders and the State may impose conditions on any transfer as necessary to make the delivery of the water operationally feasible and to assure that the transportation costs associated with the transferred entitlement are fully repaid. Transfers not approved by the State shall not be considered as part of the 130,000 acre-feet of annual entitlements provided for in this article.

(c) KCWA member units shall have 90 days to exercise a right of first refusal to purchase any annual entitlements being offered for sale to Urban Contractors by another KCWA member unit pursuant to this article, other than those annual entitlements made available to Urban Contractors by subdivision (d) of this article, by agreeing to pay the same price offered by the buyer. Any such sales to KCWA member units exercising such right of first refusal shall not be considered a part of the 130,000 acre-feet of annual entitlements provided for in this article.

(d) Any permanent transfers of annual entitlements by Agricultural Contractors to noncontractors, including transfers to KCWA urban member units or to KCWA's Improvement District Number 4, other than transfers pursuant to subdivision (c) of this article, will be considered a part of the 130,000 acre-feet of annual entitlements provided for in this article if the Urban Contractors have been given a right of first refusal to purchase such annual

entitlements as well as transportation rights in accordance with the following terms and procedure:

(1) The Agricultural Contractor shall provide the State a copy of a bona fide contract or Proposed Contract (the "Proposed Contract") and the State shall, within five working days of receipt, provide copies of such Proposed Contract to all Urban Contractors together with a Notice of Proposed Contract stating the date on or before which a Notice of Intent to Exercise a Right of First Refusal (NOI) must be delivered to both the State and the seller, which date shall be 90 days from the date the State mails the Notice of Proposed Contract.

(2) The Proposed Contract shall provide for the transfer of rights in project transportation facilities sufficient to deliver to the seller's service area in any one month eleven percent (11%) of the annual entitlement being transferred or such greater amount as the seller determines to sell; *Provided*, however, that sellers shall not be obligated to sell any transportation rights in the Coastal Aqueduct.

(3) To exercise the right of first refusal, an Urban Contractor shall deliver to the State and the seller its NOI within the time period stated in the Notice of Proposed Contract and shall proceed in good faith to try to complete the transfer to the Urban Contractor. If two or more Urban Contractors deliver NOI's to the State, the amount of annual entitlement and transportation rights being sold shall be allocated among those Urban Contractors that are prepared to perform the purchase by the Performance Date provided for herein in proportion to their maximum annual entitlements, or in another manner acceptable to the Urban Contractors delivering the

NOIs. An offer by an Urban Contractor in its NOI to purchase less than the entire annual entitlement and transportation right being transferred shall not be deemed to be an effective exercise of the right of first refusal unless other Urban Contractors submit NOIs to purchase the remainder of the annual entitlement and transportation right or the noncontractor buyer agrees to purchase the remainder at the same unit price and on the same terms and conditions provided for in the Proposed Contract. The Performance Date shall be the date upon which the Urban Contractor is prepared to perform the purchase, which date shall be the later of: (1) 180 days after the delivery of the NOI or (2) the date set forth in the Proposed Contract for the noncontractor buyer to perform the purchase.

The Performance Date shall be extended at the request of the Urban Contractor if a temporary restraining order or preliminary injunction is in effect as a result of a lawsuit challenging the execution of the contract on the basis of noncompliance with the California Environmental Quality Act. Such extensions shall continue until five days after the temporary restraining order or injunction expires or until the Urban Contractor requests it be discontinued, whichever occurs first. The Urban Contractor shall be liable for any damages suffered by the seller as a result of such extensions of the Performance Date.

(4) If the seller and the noncontractor buyer under the Proposed Contract make any substantive changes in the Proposed Contract, such changes shall constitute a new Proposed Contract that cannot be performed without compliance with all of the procedures set forth in this article.

(5) If an Urban Contractor issuing a NOI fails to complete its exercise of the Right of First Refusal by the Performance Date, the seller shall be free to sell its entitlement in substantial conformance with the terms and conditions set forth in the Proposed Contract . An Urban Contractor issuing a NOI may assign its rights to exercise a right of first refusal to another Urban Contractor and the assignee shall have the same rights as the assignor to complete the purchase by the Performance Date.

(6) In exercising the Right of First Refusal, an Urban Contractor, at its option, may either agree to perform the Proposed Contract in its entirety, including all of its terms and conditions, or agree to pay the price offered under the Proposed Contract for the annual entitlement and transportation rights without condition and without being entitled to enforce or being subject to any other provisions of the Proposed Contract.

(e) As used in this article, "price" shall mean the dollar amount of consideration provided for in the Proposed Contract.

(f) Upon the effective date of any such transfer, the seller shall be relieved of and the buyer shall become liable to the State for all prospective Delta Water Charges, the related Transportation Charges and any other charges for the annual entitlements and associated transportation rights transferred unless the seller and buyer provide otherwise in the contract for the transfer and the State approves such other provisions. However, the contractor making the sale shall remain obligated to the State to make the payments if the buyer defaults on its payments to the State related to the water transferred and is not a party to a long term water supply contract of the type contained in Department of Water

Resources Bulletin Number 141. If the contractor making the sale is required to make any payments to the State as a result of the buyer's default, the entitlement transferred to the defaulting buyer shall, if provided for in the Proposed Contract, revert back to the contractor making the sale. The buyer may also be liable for any charges imposed pursuant to subdivision (g) of this article.

(g) A contractor which is a buyer of annual entitlement pursuant to this article may receive deliveries using any portion of the capacity previously provided by the State in each reach of the project transportation facilities for such contractor that is necessary for transporting the entitlement purchased by it on the same basis as any other entitlement provided for in its Table A in effect prior to the date of the Monterey Amendment. Such contractor may also use any transportation rights transferred to it by a seller in the same manner as the seller was entitled to use them and any unused capacity in any of the reaches specified in this paragraph so long as project operations and/or priority of service of water to other contractors participating in repayment of capital costs in such reaches is not adversely affected. The State shall not be responsible for any resulting adverse impacts upon its ability to provide such contractor peaking capacity. The capital cost and minimum, operation, maintenance, power and replacement components of the Transportation Charge allocated to a buying contractor needing transportation capacity in excess of the capacity factors on which its charges are based in any reach shall be determined prospectively based upon the increase in the buying contractor's annual entitlement resulting from the purchase, and service of water to fulfill annual entitlement to other contractors shall not be

impaired. The capital cost and minimum operation, maintenance, power and replacement components of the Transportation Charges shall then be reallocated among the other entities participating in repayment of costs of that reach. For the purposes of this determination, all payments received by the State from the seller relating to the annual entitlement sold shall be deemed to have been received from the buying contractor. Any increased Transportation minimum operation, maintenance, power and replacement component charges allocated to the buying contractor pursuant to this subdivision (g) shall begin January 1 of the year following the effective date of the transfer.

(h) Individual contractors may transfer entitlements among themselves in amounts in addition to those otherwise provided for in this article. The State shall expeditiously execute any necessary documents and approve all contracts involving permanent sales of entitlements among contractors, including permanent sales among Urban Contractors. Such sales shall be subject to the provisions of subdivisions (b), (f) and (g) of this article; *Provided*, however, that for a buying contractor needing transportation capacity in excess of the capacity factors on which its charges are based in any reach, reallocation of the Transportation capital cost component charges for transfers other than (i) the 130,000 acre-feet provided for in this article and (ii) the approximate 33,000 acre-feet of transfers proposed from contractors located in Santa Barbara or San Luis Obispo counties, shall be determined both prospectively and retroactively.

(i) On January 1 following the year in which such Monterey Amendments take effect and continuing every year thereafter until

the end of the project repayment period: (i) Kern County Water Agency's (KCWA) annual entitlement for agricultural use as currently designated in Table A-1 of its contract shall be decreased by 40,670 acre-feet; (ii) Dudley Ridge Water District's (DRWD) annual entitlement as currently designated in Table A of its contract shall be decreased by 4,330 acre-feet; and (iii) the State's prospective charges (including any adjustments for past costs) for the 45,000 acre-feet of annual entitlements to be relinquished by KCWA and DRWD thereafter shall be deemed to be costs of project conservation facilities and included in the Delta Water Charge for all contractors in accordance with the provisions of Article 22. If by November 20, 1995 and each October 1 thereafter until the Monterey Amendments of both KCWA and DRWD take effect, KCWA and DRWD at their option notify the State in writing that they will relinquish up to their shares of 45,000 acre-feet of annual entitlements for the following calendar year beginning before the Monterey Amendments take effect, the State, when and if the Monterey Amendments take effect, shall adjust the charges retroactively for the acre-feet relinquished by KCWA and DRWD to January 1 of each year for which water was relinquished. The delivery points for the 45,000 acre-feet of annual entitlement to be relinquished shall be identified for the State by KCWA and DRWD to enable the State to calculate the transportation costs for the 45,000 acre-feet to be included in the Delta Water Charge.

25. Article 54 is added to read:

54. Usage of Lakes Castaic and Perris

(a) The State shall permit the contractors participating in repayment of the capital costs of Castaic Lake (Reach 30) and Lake Perris (Reach 28J) to withdraw water from their respective service connections in amounts in excess of deliveries approved pursuant to other provisions of the state water contracts. Each such contractor shall be permitted to withdraw up to a Maximum Allocation from the reach in which it is participating. The contractors participating in repayment of Castaic Lake may withdraw a collective Maximum Allocation up to 160,000 acre-feet pursuant to this article, which shall be apportioned among them pursuant to the respective proportionate use factors from the Department of Water Resources' Bulletin 132-94, Table B-1 upon which capital cost repayment obligations are based, as follows:

Castaic Lake

Participating Contractor	Proportionate Use Factor	Maximum Allocation (Acre Feet)
The Metropolitan Water District of Southern California	0.96212388	153,940
Ventura County Flood Control and Water Conservation District	0.00860328	1,376
Castaic Lake Water Agency	0.02927284	4,684
Total	**1.00000000**	**160,000**

The Metropolitan Water District of Southern California, as the only contractor participating in repayment of Lake Perris, shall be allocated a Maximum Allocation at Lake Perris of 65,000 acre-feet based upon a proportionate use factor of 1.00000000.

The Maximum Allocation totals of 160,000 acre-feet and 65,000 acre-feet shall not be subject to adjustment. The individual contractor's Maximum Allocations shall be adjusted only as agreed to among the contractors desiring to adjust their Maximum Allocations. Adjustments between the contractors shall be subject to approval of the State which approval shall be given unless there are adverse impacts upon another contractor participating in the reach which are unacceptable to such contractor. The participating contractors will, in consultation with the State, cooperate with each other in an effort to promote efficient utilization of Castaic Lake, and to minimize any adverse impacts to each other, through coordination of deliveries pursuant to other provisions of the State Water Contract as well as withdrawals of allocations pursuant to this article.

(b) The State shall operate Castaic and Perris Reservoirs as transportation facilities in a manner consistent with this article. A contractor desiring to withdraw a portion or all of its Maximum Allocation shall furnish the State with a proposed delivery schedule. The proposed schedule may be submitted as part of the preliminary water delivery schedule submitted pursuant to Article 12(a)(1). Upon receipt of a schedule the State shall promptly review it to ensure that the amounts, times and rates of delivery will be consistent with the State's ability to operate the reach. The contractor may modify its proposed

delivery schedule at any time, and the modified schedule shall be subject to review in the same manner. If necessary, the State may modify the schedule after consultation with the contractor and other contractors participating in repayment of that reach but may not change the total quantity of water to be withdrawn. As part of the consultation, the State shall advise a contractor if it determines a withdrawal will adversely impact the rate of delivery provided for the contractor in this contract. The State shall not be responsible for any such impacts.

(c) A contractor may withdraw all or a portion of its Maximum Allocation. It shall restore any withdrawn portion of such allocation by furnishing an equivalent amount of replacement water to the reservoir from which the water was withdrawn within five years from the year in which the withdrawal takes place. The unused portion of the allocation, in addition to any replacement water furnished to the reservoir, shall remain available for subsequent withdrawal. The State shall keep an accounting of the contractor's storage withdrawals and replacements. In any year, the State shall permit a contractor to withdraw an amount equivalent to the contractor's Maximum Allocation minus remaining replacement water requirements due to previous withdrawals. If the contractor fails to schedule and replace the withdrawn water within the five-year return period, the State shall provide the replacement water from water scheduled for delivery to the contractor in the sixth year or as soon as possible thereafter. The total amount of scheduled annual entitlement which a contractor can use in any one year for restoring its Maximum Allocation and storing water in surface storage facilities

outside of its service area pursuant to Article 56 shall be the sum of the maximum amount the contractor can add to storage that year pursuant to Article 56 and the amount of acre-feet shown in column 2 of the following table, depending on the State's final water supply allocation percentage as shown in column 1.

1. Final Water Supply Allocation Percentage	2. Maximum Acre-Feet of Scheduled Entitlement for Restoring Maximum Allocation*
50% or less	100,000
51%	98,000
52%	96,000
53%	94,000
54%	92,000
55%	90,000
56%	88,000
57%	86,000
58%	84,000
59%	82,000
60%	80,000
61%	78,000
62%	76,000
63%	74,000
64%	72,000
65%	70,000
66%	68,000
67%	66,000
68%	64,000
69%	62,000
70%	60,000
71%	58,000
72%	56,000
73%	54,000
74%	52,000
75 to 99%	50,000
100%	no limit

* Excludes the maximum amount that can be added to storage in a year pursuant to Article 56, which may be used in addition to the amounts in this table to restore Maximum Allocation.

A contractor may use any of this total amount for replacement water but cannot use any more than that provided for in Article 56 to add to storage in project surface conservation facilities and in nonproject surface storage facilities. There shall be no limit under this article on the amount of scheduled annual entitlement a contractor can use to restore its Maximum Allocation in a year when its percentage of annual water supply allocation is one-hundred percent (100%), nor shall there be any limit under this article on the amount of interruptible water, nonproject water or water obtained through an exchange which a contractor can use to restore its Maximum Allocation.

(d) For any replacement water furnished to reservoir storage pursuant to this article, the responsible contractor shall pay the State charges for the conservation, if any, and transportation of such replacement water as are associated with the type of replacement water that is furnished, as if such water were delivered to the turnout at the reservoir to which the replacement water is furnished. Adjustments from estimated to actual costs shall be subject to provisions applicable to the type of replacement water. The State shall not charge contractors for water withdrawn pursuant to this article.

(e) The State shall operate capacity in Castaic and Perris Reservoirs, not required for purposes of Maximum Allocation deliveries, in compliance with the requirement of Article 17(b) of The Metropolitan Water District of Southern California's water supply contract with the State to maintain an amount of water reasonably sufficient to meet emergency requirements of the contractors participating in repayment of that reach. A

contractor receiving water pursuant to this article accepts that the State shall not be liable for any damage, direct or indirect, arising from shortages in the amount of water to be made available from that reservoir to meet the contractor's actual emergency requirements as a result of prior storage withdrawals by that contractor pursuant to this article. Nothing in this article shall permit or require the State to adjust allocations or deliveries under Article 18.

(f) To the extent a contractor, during a calendar year, uses all or a portion of its Maximum Allocation, the State may, to the extent necessary to service project purposes, reduce that contractor's requested peaking service. Such reduction in peaking service shall only occur to the extent such usage of Maximum Allocation causes the State to be unable to provide all peaking service requested. This paragraph shall not apply to the extent the contractor requested usage of Maximum Allocation as part of the preliminary water delivery schedule submitted pursuant to Article 12(a)(1).

(g) The State may reduce water stored in Castaic Lake and Lake Perris to the extent necessary for maintenance and to respond to emergencies resulting from failure of project transportation facilities or of other supply importation facilities serving the State project service area. The State shall promptly replace water within the Maximum Allocation as soon as the need for the reduction terminates.

26. Article 55 is added to read:

55. Transportation of Nonproject Water

(a) Subject to the delivery priorities in Article 12(f), contractors shall have the right to receive services from any of the project transportation facilities to transport water procured by them from nonproject sources for delivery to their service areas and to interim storage outside their service areas for later transport and delivery to their service areas: *Provided*, that except to the extent such limitation in Section 12931 of the Water Code be changed, a contractor shall not use the project transportation facilities under this option to transport water the right to which was secured by the contractor through eminent domain unless such use be approved by the Legislature by concurrent resolution with the majority of the members elected to each house voting in favor thereof.

(b) For any nonproject water delivered pursuant to this article, contractors shall pay the State the same (including adjustments) for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the conservation and transportation of such water as if such nonproject water were entitlement water, as well as all incremental operation, maintenance, and replacement costs, and any other incremental costs, which may include an administrative or contract preparation charge, all as determined by the State. Incremental costs shall mean those nonpower costs which would not be incurred if nonproject water were not scheduled for or delivered to contractors. Only those contractors not participating in the repayment of a reach shall be required to pay a use of facilities

charge for the delivery of nonproject water from or through that reach. Costs for transporting water placed into interim storage shall be paid in the same manner provided for in subdivision (c)(6) of Article 56.

(c) The amounts, times and rates of delivery of nonproject water shall be provided for pursuant to a water delivery schedule to be issued in the same manner as provided for in Article 12. The costs specified in this article shall be paid for at the same time the corresponding project water costs are paid.

27. Article 56 is added to read:

56. Use, Storage and Sale of Project Water Outside of Service Area and Storage of Water in Project Surface Conservation Facilities

(a) **State Consent to Use of Project Water Outside of Service Area**

Notwithstanding the provisions of Article 15(a), the State hereby consents to the Agency storing project water outside its service area for later use within its service area in accordance with the provisions of subdivision (c) of this article and to the Agency selling project water for use outside its service area in accordance with the provisions of subdivision (d) of this article.

(b) **Groundwater Storage Programs**

The Agency shall cooperate with other contractors in the development and establishment of groundwater storage programs.

(c) **Storage of Project Water Outside of Service Area**

(1) A contractor may elect to store project water outside its service area for later use within its service area, up to the

limits and in accordance with the provisions provided for in this subdivision (c) and any applicable water right laws, by setting forth on the preliminary water delivery schedule submitted to the State on or before October 1 of each year pursuant to Article 12(a) the quantity of project water it wishes to store in the next succeeding year. There shall be no limit on the amount of project water a contractor can store outside its service area during any year in a then existing and operational groundwater storage program. The amount of project water a contractor can add to storage in project surface conservation facilities and in nonproject surface storage facilities located outside the contractor's service area each year shall be limited to the lesser of the percent of the contractor's Table A annual entitlement shown in column 2 or the acre-feet shown in column 3 of the following table, depending on the State's final water supply allocation percentage as shown in column 1. However, there shall be no limit to storage in nonproject facilities in a year in which the State's final water supply allocation percentage is one hundred percent. These limits shall not apply to water stored pursuant to Article 12(e).

1. Final Water Supply Allocation Percentage	2. Maximum Percent of Agency's Annual Entitlement That Can be Stored	3. Maximum Acre-Feet That Can be Stored
50% or less	25%	100,000
51%	26%	104,000
52%	27%	108,000
53%	28%	112,000
54%	29%	116,000
55%	30%	120,000
56%	31%	124,000
57%	32%	128,000
58%	33%	132,000
59%	34%	136,000
60%	35%	140,000
61%	36%	144,000
62%	37%	148,000
63%	38%	152,000
64%	39%	156,000
65%	40%	160,000
66%	41%	164,000
67%	42%	168,000
68%	43%	172,000
69%	44%	176,000
70%	45%	180,000
71%	46%	184,000
72%	47%	188,000
73%	48%	192,000
74%	49%	196,000
75% or more	50%	200,000

(2) Storage capacity in project surface conservation facilities at any time in excess of that needed for project operations shall be made available to requesting contractors for storage of project and nonproject water. If such storage requests exceed the available storage capacity, the available capacity shall be allocated among contractors requesting storage in proportion to their annual entitlements designated in their Table A's for that year. A contractor may store water in excess of its allocated share of capacity as long as capacity is available for such storage.

(3) If the State determines that a reallocation of excess storage capacity is needed as a result of project operations or because of the exercise of a contractor's storage right, the available capacity shall be reallocated among contractors requesting storage in proportion to their annual entitlements designated in their Table A's for that year. If such reallocation results in the need to displace water from the storage balance for any contractor or noncontractor, the water to be displaced shall be displaced in the following order of priority:

First, water, if any, stored for noncontractors.

Second, water stored for a contractor that previously was in excess of that contractor's allocation of storage capacity.

Third, water stored for a contractor that previously was within that contractor's allocated storage capacity.

The State shall give as much notice as feasible of a potential displacement.

(4) Any contractor electing to store project water outside its service area pursuant to this subdivision may not sell project water under the provisions of subdivision (d) of this article during the year in which it elected to store project water. This limitation shall not apply to replacement water furnished to Castaic and Perris Reservoirs pursuant to Article 54, nor to the storage of water introduced into a groundwater basin outside a contractor's service area if recovery is intended to occur within that contractor's service area.

(5) The restrictions on storage of project water outside a contractor's service area provided for in this subdivision (c), shall not apply to storage in any project offstream storage facilities constructed south of the Delta after the date of this amendment.

(6) For any project water stored outside its service area pursuant to this subdivision (c), a contractor shall pay the State the same (including adjustments) for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the transportation of such water as the contractor pays for the transportation of annual entitlement to the reach of the project transportation facility from which the water is delivered to storage. If annual entitlement is stored, the Delta Water Charge shall be charged only in the year of delivery to interim storage. For any stored water returned to a project transportation facility for final delivery to its service area, the contractor shall pay the State the same for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the transportation of such water calculated from the

point of return to the aqueduct to the turn-out in the contractor's service area. In addition, the contractor shall pay all incremental operation, maintenance, and replacement costs, and any other incremental costs, as determined by the State, which shall not include any administrative or contract preparation charge. Incremental costs shall mean those nonpower costs which would not be incurred if such water were scheduled for or delivered to the contractor's service area instead of to interim storage outside the service area. Only those contractors not participating in the repayment of a reach shall be required to pay a use of facilities charge for use of a reach for the delivery of water to, or return of water from, interim storage.

(7) A contractor electing to store project water in a nonproject facility within the service area of another contractor shall execute a contract with that other contractor prior to storing such water which shall be in conformity with this article and will include at least provisions concerning the point of delivery and the time and method for transporting such water.

(d) **Sale of Project Water For Use Outside Service Area**

(1) If in any year a contractor has been allocated annual entitlement that it will not use within its service area, the contractor has not elected to store project water in accordance with the provisions of subdivision (c) of this article during that year, and the contractor has not elected to carry over entitlement water from the prior year pursuant to the provisions of Article 12(e), the contractor may sell such annual entitlement for use outside its service area in accordance with the following provisions.

(2) Each year the State shall establish an annual entitlement water pool (the Pool) for contractors wishing to sell or buy project water pursuant to the provisions of this subdivision. The Pool shall constitute the exclusive means of selling portions of annual entitlements not desired by contractors that year. Contractors willing to sell to or buy water from the Pool shall notify the State in writing of their desire to do so indicating the quantity to be sold or purchased. Contractors shall have the first priority to purchase all water placed in the Pool. The State may purchase any water remaining in the Pool not purchased by contractors at the same price available to contractors and use such water for the purpose of providing additional carryover storage for contractors: *Provided*, that the State shall consult with the contractors prior to making any such purchases.

(3) Each year, the price per acre-foot to be paid by the State to contractors selling water placed in the Pool on or before February 15 that is purchased by a contractor requesting such purchase by March 1 or by the State on March 1 shall be equal to fifty percent (50%) of the Delta water rate as of that date. The price per acre-foot to be paid to the State for the purchase of water from the Pool by a contractor placing a request for such purchase on or before March 1 shall be equal to fifty percent (50%) of the Delta water rate as of that date. Any water placed in the Pool on or before February 15 that is not purchased by contractors or the State by March 1 may be withdrawn from the Pool by the selling contractor.

(4) Each year the price per acre-foot to be paid by the State to contractors selling water remaining in the Pool or placed in the Pool after February 15, but on or before March 15 that is purchased by a contractor requesting such purchase by April 1 or by the State on April 1 shall be equal to twenty-five percent (25%) of the Delta water rate as of that date. The price per acre-foot to be paid to the State for the purchase of water from the Pool by a contractor placing a request for such purchase between March 2 and April 1 shall be equal to twenty-five percent (25%) of the Delta water rate as of the later date. Any water placed in the Pool on or before March 15 that is not purchased by a contractor or the State by April 1 may be withdrawn from the Pool by the selling contractor.

(5) If there are more requests from contractors to purchase water from the Pool than the amount in the Pool, the water in the Pool shall be allocated among those contractors requesting such water in proportion to their annual entitlements for that year up to the amount of their requests. If requests to purchase water from the Pool total less than the amount of water in the Pool, the sale of Pool water shall be allocated among the contractors selling such water in proportion to their respective amounts of water in the Pool.

(6) Any water remaining in the Pool after April 1 that is not withdrawn by the selling contractor shall be offered by the State to contractors and noncontractors and sold to the highest bidder: *Provided*, that if the highest bidder is a noncontractor, all contractors shall be allowed fifteen days to exercise a right of first refusal to purchase such water at the price offered by

the noncontractor. The price to be paid to the selling contractor shall be the amount paid by the buyer exclusive of the amount to be paid by the buyer to the State pursuant to subdivision (d)(7) of this article.

(7) For any water delivered from the Pool to contractors, the buyer shall pay the State the same for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the transportation of such water as if such water were entitlement water, as well as all incremental operation, maintenance, and replacement costs, and any other incremental costs, as determined by the State, which shall not include any administrative or contract preparation charge. Incremental costs shall mean those nonpower costs which would not be incurred if such water were not scheduled for or delivered to the buyer. Only those buyers not participating in the repayment of a reach shall be required to pay any use of facilities charge for the delivery of such water from or through the reach. Adjustments from estimated to actual costs shall be computed by the State pursuant to these provisions and shall be paid by the buyer or credited to the buyer at the times and interest rates described in Article 28(c).

(e) **Continuance of Article 12(e) Carry-over Provisions**

The provisions of this article are in addition to the provisions of Article 12(e), and nothing in this article shall be construed to modify or amend the provisions of Article 12(e). Any contractor electing to sell project water during any year in accordance with the provisions of subdivision (d) of this article, shall not be precluded from using the provisions of

Article 12(e) for carrying over water from the last three months of that year into the first three months of the succeeding year.

(f) **Bona Fide Exchanges Permitted**

Nothing in this article shall be deemed to prevent the Agency from entering into bona fide exchanges of project water for use outside the Agency's service area with other parties for project water or nonproject water if the State consents to the use of the project water outside the Agency's service area. Also, nothing in this article shall be deemed to prevent the Agency from continuing those exchange or sale arrangements entered into prior to September 1, 1995, which had previously received any required State approvals. A "bona fide exchange" shall mean an exchange of water involving a contractor and another party where the primary consideration for one party furnishing water to another is the return of a substantially similar amount of water, after giving due consideration to the timing or other nonfinancial conditions of the return. Reasonable payment for costs incurred in effectuating the exchange and reasonable deductions from water delivered, based on expected storage or transportation losses may be made. A "bona fide exchange" shall not include a transfer of water from one contractor to another party involving a significant payment unrelated to costs incurred in effectuating the exchange. The State, in consultation with the contractors, shall have authority to determine whether transfers of water constitute "bona fide exchanges" within the meaning of this paragraph and not disguised sales.

(g) **Other Transfers**

Nothing in this article shall be deemed to modify or amend the provisions of Article 15(a), or Article 41, except as expressly provided for in subdivisions (c) and (d) of this article.

28. All balances of wet weather and Article 12(d) water otherwise available to any contractor executing the Monterey Amendment shall be eliminated as of the effective date of such amendment and no new balances for such water shall be established.

29. **Effective Dates and Phase-in.**

(a) No Monterey Amendment to any contractor's water supply contract shall take effect unless and until both of the following have occurred (1) the Monterey Amendments to both the Kern County Water Agency's and The Metropolitan Water District of Southern California's contracts have been executed and no legal challenge has been filed within sixty days of such execution or, if filed, a final judgment of a court of competent jurisdiction has been entered sustaining or validating said amendments; and (2) the State has conveyed the property which constitutes the Kern Fan Element of the Kern Water Bank to Kern County Water Agency pursuant to the Kern Water Bank Contact provided for in Article 52 either on or before October 1, 1996 or, if the conveyance on such date has been prevented by an interim court order, within ninety days after such court order has become ineffective so long as said ninety days expires not later than January 1, 2000. The

October 1, 1996 date and the January 1, 2000 date may be extended by unanimous agreement of the State, Kern County Water Agency and The Metropolitan Water District of Southern California.

(b) The State shall administer the water supply contracts of any contractors that do not execute the Monterey Amendment so that such contractors are not affected adversely or to the extent feasible beneficially by the Monterey Amendments of other contractors' water supply contracts.

(c) If a court of competent jurisdiction issues a final judgment or order determining that any part of a contractor's Monterey Amendment is invalid or unenforceable, all provisions of that amendment shall be of no force or effect as to such contractor, except as provided in subdivisions (e) and (f) of this paragraph.

(d) If any part of the Monterey Amendment of the Kern County Water Agency's or The Metropolitan Water District of Southern California's contracts or if the conveyance of the Kern Fan Element of the Kern Water Bank to the Kern County Water Agency provided for in Article 52 is determined by a court of competent jurisdiction in a final judgment or order to be invalid or unenforceable, the Monterey Amendments of all contractors and the Kern Water Bank Contract shall be of no force and effect except as provided in subdivisions (e) and (f) of this paragraph.

(e) Notwithstanding subdivisions (c), (d) and (f) of this paragraph, if any part of the Monterey Amendment of the Kern County Water Agency's or The Metropolitan Water District of Southern California's contract is determined by a court of competent jurisdiction in a final judgment or order to be invalid

or unenforceable, and if Articles 52 and 53 (i) have been implemented (i.e., the property which constitutes the Kern Fan Element of the Kern Water Bank has been conveyed by the State and the 45,000 acre-feet of annual entitlements have been relinquished to the State), the implementation of the relinquishment shall not be reversed unless the implementation of the conveyance is also reversed, and conversely, implementation of the conveyance shall not be reversed unless implementation of the relinquishment is also reversed. Nothing in this subdivision shall affect any party's right to seek additional damages, compensation or any other remedy available at law or in equity.

(f) The total invalidity or unenforceability of one contractor's Monterey Amendment as provided for in subdivision (c) of this paragraph or of all contractor's Monterey Amendments as provided for in subdivision (d) of this paragraph or of the Kern Water Bank Contract as provided for in subdivision (d) of this paragraph may be avoided only if such invalidity or unenforceability is explicitly waived in writing signed by the State, Kern County Water Agency and The Metropolitan Water

District of Southern California. In cases arising under subdivision (c) or (d), the affected contractor whose Monterey Amendment has been determined to be partially invalid or unenforceable must first request the waiver.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form and sufficiency

Chief Counsel
Department of Water Resources

ATTEST:

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 24 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 13 day of DECEMBER, 1995, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Kern County Water Agency, herein referred to as the "Agency".

RECITALS:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the contractors and the State have negotiated an amendment to the water supply contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment"); and

WHEREAS, the State and the Agency intend to implement such provisions by incorporating this Monterey Amendment into the Agency's water supply contract with the State; and

WHEREAS, subdivision (i) of Article 53 of the Monterey Amendment requires that the Agency, on January 1 following the year in which such Monterey Amendments take effect and continuing every year thereafter until the end of the project repayment period, decrease its annual entitlement for agricultural use as currently designated in Table A-1 of its contract by 40,670 acre-feet. This reduction will begin in 1997; and;

WHEREAS, subdivision (i) of Article 53 of the Monterey Amendment also provides that if by November 20, 1995, the Agency notifies the State that it will relinquish all or part of the 40,670 acre-feet of its annual entitlement for 1996, the State, shall, if the Monterey Amendment takes effect in 1996, adjust the charges retroactively to January 1, 1996 for the acre-feet relinquished; and

WHEREAS, on or before November 20, 1995, the Agency notified the State in writing that it will relinquish 36,340 acre-feet of its annual entitlement in 1996;

NOW THEREFORE, IT IS MUTUALLY AGREED that the following change is hereby made to the Agency's water supply contract with the State:

1. Table A entitled "ANNUAL ENTITLEMENTS, KERN COUNTY WATER AGENCY" in the Agency's water supply contract with the State, dated November 15, 1963, is amended to read as follows:

TABLE A
ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year		Total Annual Amount in Acre-Feet
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	401,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	968,200
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
and each succeeding year thereafter, for the term of this contract as a maximum annual entitlement:		1,112,730

2. Table A-1 entitled "PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE, KERN COUNTY WATER AGENCY" in the Agency's water supply contract with the State is amended to read as follows:

TABLE A-1
PROJECTED PORTIONS OF ANNUAL ENTITLEMENT
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(in acre-feet)

Year		Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1	(1968)	13,313	33,287	0	46,600
2	(1969)	30,303	65,397	0	95,700
3	(1970)	61,000	55,400	28,700	145,100
4	(1971)	35,500	119,100	35,700	190,300
5	(1972)	31,800	199,700	43,500	270,700
6	(1973)	37,500	229,500	43,500	310,500
7	(1974)	53,600	246,400	48,000	347,000
8	(1975)	57,000	301,120	52,700	401,820
9	(1976)	61,800	324,250	56,100	442,150
10	(1977)	66,000	357,000	60,600	483,600
11	(1978)	70,800	399,400	64,100	534,300
12	(1979)	75,300	441,000	67,600	583,900
13	(1980)	79,400	484,000	71,100	634,500
14	(1981)	83,800	532,800	74,800	691,400
15	(1982)	87,700	578,000	79,600	745,300
16	(1983)	90,800	630,800	83,500	805,100
17	(1984)	94,500	662,500	103,600	860,600
18	(1985)	97,100	709,000	108,900	915,000
19	(1986)	100,100	754,700	113,400	968,200
20	(1987)	102,200	802,200	119,100	1,023,500
21	(1988)	103,800	846,900	123,900	1,074,600
22	(1989)	104,700	879,400	128,200	1,112,300
23	(1990)	105,100	913,700	134,600	1,153,400
24	(1991)	105,100	913,700	134,600	1,153,400
25	(1992)	105,100	913,700	134,600	1,153,400
26	(1993)	105,100	913,700	134,600	1,153,400
27	(1994)	105,100	913,700	134,600	1,153,400
28	(1995)	105,100	913,700	134,600	1,153,400
29	(1996)	105,100	877,360	134,600	1,117,060
30	(1997)	105,100	873,030	134,600	1,112,730
And each succeeding year thereafter, for the term of this contract as a maximum annual entitlement:					1,112,730

3. Reductions in the Agency's Delta and Transportation charges and water system revenue bond surcharge resulting from the decrease in the Agency's annual entitlements for agricultural use for 1996 and each year thereafter shall be identified by the State and shown separately on its annual statement of charges to the Agency.

4. This Amendment Number 24 shall become effective only if the Monterey Amendment (Amendment Number 23 to the Agency's water supply contract with the State) becomes effective in 1996.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency

Susan M. Wolk
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

ATTEST:

Signature

Executive Secretary
Title

Adrienne Jo Mathews
Signature

President
Title

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 25 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND THE KERN COUNTY WATER AGENCY

THIS CONTRACT is made this 23 day of September, 1996, pursuant to the provisions of the California Water Resources Development Bond Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

WHEREAS, the State and the Agency have entered into, and subsequently amended, a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment;

WHEREAS, the annual entitlements of the Agency were increased for the eighth (1975) and ninth (1976) years pursuant to Article 21(g)(3) related to deliveries of surplus water;

WHEREAS, the Agency desires to decrease its annual entitlement for 1986 by 34,554 acre-feet, which is equivalent to the sum of the prior increases in annual entitlements made in the eighth and ninth years; and

WHEREAS, in negotiating the Surplus Water Amendment, the contractors and the Department intended that further contract amendments would result in the increases in annual entitlements related to the delivery of surplus water being matched in later years by equivalent offsetting reductions in Table A annual entitlements which will return to the Agency the increased Delta Water Charges with interest.

NOW THEREFORE, it is mutually agreed as follows:

1. Table A entitled "Annual Entitlements, Kern County Water Agency," as modified by Contract Amendments No. 18, and as may be modified by Amendment No. 24, is further amended for the year 1986 from 968,200 acre-feet to 933,646 acre-feet.

2. The Department will provide a credit for the reduction in annual entitlement made by this Amendment at a future time when the Department determines that the credit could be made without a substantial adverse effect on the Department's cash flow and fund balances.

3. The Agency agrees to indemnify, defend, and hold harmless the State from any liability, expenses, defense costs, attorney fees, claims, actions, liens and lawsuits of any kind arising out of or related to the actions implementing this Amendment.

IN WITNESS WHEREOF, the parties have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Susan M. Weber

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Robert Rotte

Director

Attest:

By Pam Bosworth
Pam Bosworth

Title Executive Secretary

KERN COUNTY WATER AGENCY

By Thomas N. Clark
Thomas N. Clark

Title General Manager

622.5H4B1
KCWA

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 26 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31st day of January, 1997, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

WHEREAS, the State and the Agency have entered into and subsequently amended a Water Supply Contract (the "Water Supply Contract") providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment"); and

WHEREAS, among other things, Article 53 of the Water Supply Contract provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies; and

WHEREAS, the Mojave Water Agency and the Berrenda Mesa Water District have entered into an Agreement to Purchase Berrenda Mesa Water District State Water Project Entitlement to Water (the "Purchase Agreement") executed as of April 12, 1996 to provide for the sale by the Agency on behalf of BMWD to MWA of 25,000 acre-feet per year of the Agency's annual entitlement that has been allocated to BMWD by the Agency under the contract between BMWD and the Agency (the "BMWD/KCWA Contract") dated March 9, 1967, and all amendments thereto; and

WHEREAS, the State and Agency wish to set forth their agreement as to such matters as (i) the 25,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, (iii) the revision of proportionate use of facilities factors set forth in the Water Supply Contract; and

WHEREAS, the State and MWA are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 18 to MWA's Water Supply Contract between MWA and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, (iii) the

delivery priority for the purchased entitlement, and (iv) the revision of proportionate use of facilities factors; and

WHEREAS, this Amendment is permitted by the terms of the Water Supply Contract.

NOW, THEREFORE, IT IS MUTUALLY AGREED that the following changes are hereby made to the Agency's Water Supply Contract with the State:

1. Table A-1 entitled "ANNUAL ENTITLEMENTS, KERN COUNTY WATER AGENCY" in the Agency's Water Supply Contract with the State, dated November 15, 1963, is amended to read as follows:

TABLE A
ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

Year		Total Annual Amount in Acre-Feet
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	401,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
and each succeeding year thereafter, for the term of this contract as an annual entitlement:		1,087,730

2. Table A-1 entitled "PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE, KERN COUNTY WATER AGENCY" in the Agency's Water Supply Contract with the State is amended to read as follows:

TABLE A-1
PROJECTED PORTIONS OF ANNUAL ENTITLEMENT
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(in acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	43,500	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	53,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	401,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
And each succeeding year thereafter, for the term of this contract as an annual entitlement:				1,087,730

3. Reductions in the Agency's Delta Water and Transportation Charges and Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlements for agricultural use for 1998 and each year thereafter shall commence January 1, 1998, and be identified by the State and shown on its annual statement of charges to the Agency.

4. Article 12(c) is amended to read;

(c) Limit on Rate of Delivery to the Agency

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding three thousand eighty-six (3,086) cubic feet per second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

5. Article 45(f) is added to read:

(f) Recognizing that MWA will not be using Reach 31A of the Coastal Branch of the California Aqueduct for delivery of any of the 25,000 acre-feet of annual entitlement purchased from the Agency, effective January 1, 1998, the Agency is relieved of and MWA is liable to the State for all prospective Delta Water Charges, Transportation Charges, and the Water System Revenue Bond Surcharge for Reach 31A

related to the applicable portion of the 25,000 acre-feet of annual entitlement purchased from the Agency. However, the Agency shall retain the right to use the transportation capacity in Reach 31A. For movement of water by KCWA in Reach 31A, KCWA shall remain responsible for any applicable portion of the variable operation, maintenance, power, and replacement component of the Transportation Charge and any applicable portion of the Off-Aqueduct Power Facilities charge of the minimum operation, maintenance, power and replacement component of the Transportation Charge.

6. Article 45(g) is added to read:

(g) All future adjustments in charges and credits of past costs associated with the 25,000 acre-feet of annual entitlement (or applicable portion thereof) and the related transportation capacity in Reaches 1 through 10A of the California Aqueduct and Reach 31A of the Coastal Branch shall be attributable to MWA as if the MWA's annual entitlement and the related transportation capacity had been increased by the 25,000 acre-feet of annual entitlement purchased from KCWA in years prior to January 1, 1998.

7. Attached as Exhibit A hereto are tables showing rounded-off values of data which will be used by the State in implementing the terms of this Amendment.

8. Except as amended herein, the provisions of the Water Supply Contract remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

ATTEST:

Signature

Title

KERN COUNTY WATER AGENCY

Signature

Board President
Title

EXHIBIT A

KERN's ALLOCATED CAPACITY FOR EACH REACH

The capacity rights after the transfer are estimated to be as follows:

California Aqueduct[2]	Existing Annual Entitlement (AF) (1)	Existing Capacity (cfs) (2)	Entitlement Transferred to Mojave WA (AF) (3)	Capacity Transferred to Mojave WA[1] (cfs) (4)	Total Annual Entitlement (AF) (5)	Total Capacity (cfs) (6)
Reach 1	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 2A	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 2B	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 3	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 4	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 5	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 6	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 7	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 8C	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 8D	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 9	1,014,030	2,887	8,059[4]	24[4]	1,005,971	2,863
Reach 10A	967,390	2,747	8,059[4]	24[4]	959,331	2,723
Reach 11B	710,620	1,981			710,620	1,981
Reach 12D	599,655	1,650			599,655	1,650
Reach 12E	595,955	1,639			595,955	1,639
Reach 13B	387,755	1,108			387,755	1,108
Reach 14A	241,755	803			241,755	803
Reach 14B	204,255	691			204,255	691
Reach 14C	177,555	510			177,555	510
Reach 15A	145,055	413			145,055	413
Reach 16A	86,770	239			86,770	239
Reach 17E	5,000	9			5,000	9
Reach 31A[3]	105,100[3]	283[3]	0[3]	0[3]	105,100[3]	283[3]

1. From the Delta to Berrenda Mesa Water District's service area.
2. These numbers apply to the reaches as set forth in Figure B-5, "Repayment Reaches and Descriptions: Project Transportation Facilities."
3. For repayment purposes, the Department will allocate cost of 46 cfs capacity and 16,941 AF in Reach 31A to Mojave Water Agency. Kern County Water Agency will retain the right to use its original 283 cfs capacity and 105,100 AF in Reach 31A.
4. The Department will allocate cost of 24 cfs capacity and 8,059 acre-feet in Reaches 9 and 10A to Mojave Water Agency for repayment purposes and the right to use the 24 cfs of transportation capacity.

STATE OF CALIFORNIA—THE RESOURCES AGENCY

PETE WILSON, *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

SEP 0 2 1997

RECEIVED
SEP 5 1997
Kern County Water Agency

TNC ☐ JFS ☐ LWF ☐ GLB ☐ SHR ☐ ___ ☐
SMR ☐ RBI ☐ JMB ☐ JWP ☐ ALL ☐ ___ ☐

638 5143
KCWA

Mr. Thomas N. Clark
General Manager
Kern County Water Agency
Post Office Box 58
Bakersfield, California 93302-0058

Dear Mr. ~~Clark~~ Tom:

As discussed among our staff, enclosed for your records is a revised copy of EXHIBIT A to the "Amendment No. 26 to Water Supply Contract Between the State of California, Department of Water Resources and Kern County Water Agency," dated November 15, 1963. EXHIBIT A is referenced in section 7 of the Amendment. The "Existing Annual Entitlement" column (column 1) values for Reaches 14A and 14B have been changed from 241,755 and 204,255 to 275,755 and 238,255 respectively. This change is being made to correct a mathematical error. In addition, language was added to Footnotes 3 and 4 to reference Article 53 of Kern's long-term Water Supply Contract and Footnote 5 was added to clarify that Kern retains its right to use the transportation capacity associated with the 40,670 acre-feet Kern relinquished. If you concur with these changes, please replace the existing EXHIBIT A with the revised version enclosed and sign and date the enclosed copy of this letter and return it to me at State Water Project Analysis Office, Department of Water Resources, State of California, Post Office Box 942836, Sacramento, California 94236-0001.

If you have any questions, please call Dan Flory, at (916) 653-5942.

Sincerely,

Donald R. Long, Chief
State Water Project Analysis Office

CONCUR:

KERN COUNTY WATER AGENCY

Name

General Manager
Title

September 8, 1997
Date

Enclosures

KERN's ALLOCATED CAPACITY FOR EACH REACH

The capacity rights after the transfer are estimated to be as follows:

California Aqueduct[2]	Existing Annual Entitlement[5] (AF) (1)	Existing Capacity[5] (cfs) (2)	Entitlement Transferred to Mojave WA (AF) (3)	Capacity Transferred to Mojave WA[1] (cfs) (4)	Total Annual Entitlement (AF) (5)	Total Capacity (cfs) (6)
Reach 1	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 2A	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 2B	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 3	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 4	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 5	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 6	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 7	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 8C	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 8D	1,112,730	3,156	25,000	70	1,087,730	3,086
Reach 9	1,014,030	2,887	8,059[4]	24[4]	1,005,971	2,863
Reach 10A	967,390	2,747	8,059[4]	24[4]	959,331	2,723
Reach 11B	710,620	1,981			710,620	1,981
Reach 12D	599,655	1,650			599,655	1,650
Reach 12E	595,955	1,639			595,955	1,639
Reach 13B	387,755	1,108			387,755	1,108
Reach 14A	275,755	803			275,755	803
Reach 14B	238,255	691			238,255	691
Reach 14C	177,555	510			177,555	510
Reach 15A	145,055	413			145,055	413
Reach 16A	86,770	239			86,770	239
Reach 17E	5,000	9			5,000	9
Reach 31A[3]	105,100[3]	283[3]	0[3]	0[3]	105,100[3]	283[3]

1. From the Delta to Berrenda Mesa Water District's service area.
2. These numbers apply to the reaches as set forth in Figure B-5, "Repayment Reaches and Descriptions: Project Transportation Facilities."
3. For repayment purposes, the Department will allocate cost of 46 cfs capacity and 16,941 AF in Reach 31A to Mojave Water Agency. Kern County Water Agency will retain the right to use its original 283 cfs capacity and 105,100 AF in Reach 31A as described in Article 53 of Kern's long-term Water Supply Contract.
4. The Department will allocate cost of 24 cfs capacity and 8,059 acre-feet in Reaches 9 and 10A to Mojave Water Agency for repayment purposes and the right to use the 24 cfs of transportation capacity as described in Article 53 of Kern's long-term Water Supply Contract.
5. The amounts under columns (1) and (2) above have been reduced by the 40,670 AF and 121 cfs relinquished by Kern under Article 53(i) of the Monterey Amendment. However, Kern retains its right to use the 121 cfs of transportation capacity as described in Article 53 of Kern's long-term Water Supply Contract.

630 51431
15. CWR
34. 1A

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 27 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31st day of March, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract (the "Water Supply Contract") providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. This Amendment corrects typographical numerical errors in the current Table A and restores one value in Table A (Year 8, 1975) and three values in Table A-1 (Year 5, 1972, for Municipal Use; Year 7, 1974, for Agricultural Use (Coastal Aqueduct); and Year 8, 1975, for Total Annual Amount) to their correct values.

C. This Amendment is permitted by the terms of the Water Supply Contract, and except as amended herein, the provisions of the Water Supply Contract will remain in full force and effect.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the Agency's Water Supply Contract:

1. Article 6(b), Table A, Restoration

   (a) Year 8 (1975) of Table A indicated in Amendment No. 24, December 13, 1995, as 401,820, restored to correct value and amended to read 410,820.

   (b) Year 8 (1975) of Table A indicated in Amendment No. 26, January 31, 1997, as 401,820, restored to correct value and amended to read 410,820.

2. Article 45(b), Table A-1, Restoration

   (a) Year 5 (1972) of Table A-1 indicated in Amendment No. 24, December 13, 1995, as Municipal Use, 43,500, restored to correct value and amended to read 39,200.

   (b) Year 7 (1974) of Table A-1 indicated in Amendment No. 24, December 13, 1995, as Agricultural Use (Coastal Aqueduct), 53,600, restored to correct value and amended to read 52,600.

(c) Year 8 (1975) of Table A-1 indicated in Amendment No. 24, December 13, 1995, as Total Annual Amount, 401,820, restored to correct value and amended to read 410,820.

(d) Year 5 (1972) of Table A-1 indicated in Amendment No. 26, January 31, 1997, as Municipal Use, 43,500, restored to correct value and amended to read 39,200.

(e) Year 7 (1974) of Table A-1 indicated in Amendment No. 26, January 31, 1997, as Agricultural Use (Coastal Aqueduct), 53,600, restored to correct value and amended to read 52,600.

(f) Year 8 (1975) of Table A-1 indicated in Amendment No. 26, January 31, 1997, as Total Annual Amount, 401,820, restored to correct value and amended to read 410,820.

3. Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY
(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
~~8~~	~~(1975)~~	~~401,820~~
8	(1975)	**410,820**
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730

And each succeeding year thereafter,
for the term of this contract as an
annual entitlement: 1,087,730

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
~~5 (1972)~~	~~31,800~~	~~199,700~~	~~43,500~~	~~270,700~~
5 (1972)	31,800	199,700	**39,200**	270,700
6 (1973)	37,500	229,500	43,500	310,500
~~7 (1974)~~	~~53,600~~	~~246,400~~	~~48,000~~	~~347,000~~
7 (1974)	**52,600**	246,400	48,000	347,000
~~8 (1975)~~	~~57,000~~	~~301,120~~	~~52,700~~	~~401,820~~
8 (1975)	57,000	301,120	52,700	**410,820**
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
And each succeeding year thereafter, for the term of this contract as an annual entitlement:				1,087,730

4. Except as amended herein, the provisions of the Water Supply Contract remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

for Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

for Stephen J. Kashiwada
Director

ATTEST:

Signature

Board Secretary
Title

KERN COUNTY WATER AGENCY

Signature

President
Title

628.57431
KCWA

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 28 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31st day of March, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract (the "Water Supply Contract") providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment").

C. Among other things, Article 53 of the Water Supply Contract provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The State and Agency wish to set forth their agreement as to such matters as (i) the 41,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Water Supply Contract.

E. The State and Castaic Lake Water Agency ("Castaic Lake") are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 18 to Castaic Lake's Water Supply Contract between Castaic Lake and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

F. This Amendment is permitted by the terms of the Water Supply Contract, and except as amended herein, the provisions of the Water Supply Contract will remain in full force and effect.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the Agency's Water Supply Contract:

1. Article 12(c), which defines the limits on the instantaneous rate of flow to the Agency based on peaking factors, is modified to delete "three thousand eighty-six (3,086)" and replace it with "two thousand nine hundred sixty-four (2,964)."
2. Article 45(h) is added to read:

   (h) In accordance with Article 53(a) the Agency is decreasing its Table A and Table A-1 annual entitlements by 41,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract through a sale to Castaic Lake Water Agency of 41,000 acre-feet of the 130,000 acre-feet made available to Urban Contractors. As a result of this sale, Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY
(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
~~33~~	~~(2000)~~	~~1,087,730~~
33	(2000)	**1,046,730**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:		~~1,087,730~~ **1,046,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
~~33 (2000)~~	~~105,100~~	~~848,030~~	~~134,600~~	~~1,087,730~~
33 (2000)	105,100	**807,030**	134,600	**1,046,730**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,087,730~~ **1,046,730**

The following apply to this sale:

(1) Reductions in the Agency's Delta Water and Transportation Charges and Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlements for agricultural use for 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in the annual Statement of Charges to the Agency.

(2) All future adjustments in charges and credits of past costs associated with the 41,000 acre-feet of annual entitlement (or applicable portion thereof) and the related transportation capacity in Reaches 1 through 16A of the California Aqueduct shall be attributable to Castaic Lake as if Castaic Lake's annual entitlement and the related transportation capacity had been increased by the 41,000 acre-feet of annual entitlement purchased from the Agency in years prior to January 1, 2000.

(3) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates. These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing

the terms of this Amendment and in redetermination of Table B of this Water Supply Contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 18, between the State and the Castaic Lake Water Agency. If either amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative, for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

for Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Stephen J. Kashiwada
for Director

ATTEST:

Signature

Board Secretary
Title

KERN COUNTY WATER AGENCY

Signature

President
Title

AMENDMENT NO. 28
EXHIBIT A

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

California Aqueduct [1]	Before Transfer		Entitlement Transferred to Castaic Lake [3] (AF) (3)	Capacity Transferred to Castaic Lake [3] (cfs) (4)	After Transfer	
	Annual Entitlement [2] (AF) (1)	Capacity [2] (cfs) (2)			Total Annual Entitlement (AF) (5)	Total Capacity (cfs) (6)
Reach 1	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 2A	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 2B	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 3	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 4	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 5	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 6	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 7	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 8C	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 8D	1,087,730	3,086	41,000	122	1,046,730	2,964
Reach 9	1,005,971	2,863	41,000	122	964,971	2,741
Reach 10A	959,331	2,723	41,000	122	918,331	2,601
Reach 11B	710,620	1,981	41,000	122	669,620	1,859
Reach 12D	599,655	1,650	41,000	122	558,655	1,528
Reach 12E	595,955	1,639	41,000	122	554,955	1,517
Reach 13B	387,755	1,108	41,000	122	346,755	986
Reach 14A	275,755	803	41,000	120	234,755	683
Reach 14B	238,255	691	24,683	77	213,572	614
Reach 14C	177,555	510	12,164	46	165,391	464
Reach 15A	145,055	413	9,547	39	135,508	374
Reach 16A	86,770	239	5,976	25	80,794	214
Reach 17E	5,000	9	0	0	5,000	9
Coastal Aqueduct						
Reach 31A [4]	105,100 [4]	283 [4]	0 [4]	0 [4]	105,100 [4]	283 [4]

[1] These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."

[2] The amounts under columns (1) and (2) above have been reduced by the 40,670 AF and 121 cfs relinquished under Article 53(i) of the Monterey Amendment. However, the Agency retains the ability to receive deliveries through the 121 cfs as described in Article 53 of the Water Supply Contract. These amounts are from columns (1) and (2) of Revised Exhibit A to Amendment No. 26.

[3] From the Delta to Wheeler Ridge-Maricopa Water Storage District's service area.

[4] For repayment purposes, the Department allocated the cost of 46 cfs capacity and 16,941 AF in Reach 31A to Mojave Water Agency. The Agency will retain the ability to receive deliveries through the 283 cfs and 105,100 AF in Reach 31A as described in Article 53 of the Water Supply Contract.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 29 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 29th day of December, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall

make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement.

C. Among other things, Article 53 of the Water Supply Contracts provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The State and the Agency wish to set forth their agreement as to such matters as (i) the 4,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the contract.

E. The State and Palmdale Water District, herein referred to as "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 16 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand nine hundred fifty-seven (2,957) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(i) is added to read:

   (i)(1) In accordance with Article 53(a) and an agreement between Belridge Water Storage District, a member unit of the Agency, and District, the Agency is decreasing its Table A and Table A-1 annual entitlements by 4,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY
(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
~~33~~	~~(2000)~~	~~1,046,730~~
33	(2000)	**1,042,730**

And each succeeding year thereafter, for the term of this contract as an annual entitlement:	~~1,046,730~~ **1,042,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
~~33 (2000)~~	~~105,100~~	~~807,030~~	~~134,600~~	~~1,046,730~~
33 (2000)	105,100	**803,030**	134,600	**1,042,730**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,046,730~~ **1,042,730**

(i)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in a revised Statement of Charges for the year 2000 and in future annual Statement of Charges to the Agency.

(b) Any over and under adjustments to payments made by the Agency for 1999 and prior years attributable to the 4,000 acre-feet of entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by District for 2000 and future years attributable to the 4,000 acre-feet of entitlement shall be paid by or credited to District.

(c) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in

implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 16 between the State and the District. If either amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.
4. This Amendment shall not be used as precedent.
5. This Amendment is permitted by the terms of the contract, and except as amended herein, the provisions of the contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

ATTEST:

Signature

Title

Date

KERN COUNTY WATER AGENCY

Signature

Board Vice-President
Title

Dec. 20, 1999
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer		Entitlement Transferred to Palmdale (c	Capacity Transferred to Palmdale (c	After Transfer	
	Annual Entitlement (AF)	Capacity (cfs)	(AF)	(cfs)	Total Annual Entitlement (AF)	Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 2A	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 2B	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 3	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 4	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 5	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 6	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 7	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 8C	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 8D	1,046,730	2,964	4,000	7	1,042,730	2,957
Reach 9	964,971	2,741	4,000	7	960,971	2,734
Reach 10A	918,331	2,601	4,000	7	914,331	2,594
Reach 11B	669,620	1,859	4,000	7	665,620	1,852
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	88,159	237			88,159	237

a) Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."
c) From the Delta to Belridge Water Storage District's service area

State Water Project Analysis Office
December 16, 1999

630.51431
KCWA

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 30 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 21st day of December, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "contract," providing that the State will

supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement.

C. Among other things, Article 53 of the Water Supply Contract provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The State and Agency wish to set forth their agreement as to such matters as (i) the 7,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the contract.

E. The State and Alameda County Flood Control and Water Conservation District, Zone 7, herein referred to as "Zone 7," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 19 to Zone 7's Water Supply Contract between Zone 7 and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand nine hundred thirty-seven (2,937) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(j) is added to read:

   (j)(1) In accordance with Article 53(a) and an agreement between Berrenda Mesa Water District, a member unit of the Agency, and Zone 7, the Agency is decreasing its Table A and Table A-1 annual entitlements by 7,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract. This reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
~~33~~	~~(2000)~~	~~1,042,730~~
33	(2000)	**1,035,730**

And each succeeding year thereafter, for the term of this contract as an annual entitlement:	~~1,042,730~~ **1,035,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
~~33 (2000)~~	~~105,100~~	~~803,030~~	~~134,600~~	~~1,042,730~~
33 (2000)	105,100	**796,030**	134,600	**1,035,730**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,042,730~~ **1,035,730**

(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water and Transportation Charges and Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlements for agricultural use for 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in the annual Statement of Charges to the Agency.

(b) Recognizing Reach 31A of the Coastal Branch of the California Aqueduct will not be used for delivery of any of the 7,000 acre-feet of annual entitlement purchased from the Agency, effective January 1, 2000, the Agency is relieved of and Zone 7 is liable to the State for all prospective Delta Water Charges, Transportation Charges, and the Water System Revenue Bond Surcharge for Reach 31A related to the applicable portion of the 7,000 acre-feet of annual entitlement purchased from the Agency. However, the Agency shall retain the right to use the transportation capacity in Reach 31A associated with the 7,000 acre-feet being transferred. For delivery of water to the Agency in Reach 31A, the Agency shall remain responsible for any applicable portion of the variable operation, maintenance, power, and replacement component of the Transportation Charge and any applicable portion of the

Off-Aqueduct Power Facilities Charge of the minimum operation, maintenance, power and replacement component of the Transportation Charge.

(c) All future adjustments in charges and credits of past costs associated with the 7,000 acre-feet of annual entitlement (or applicable portion thereof) and the related transportation capacity in Reaches 1 through 10A of the California Aqueduct and Reach 31A of the Coastal Branch shall be attributable to Zone 7 as if the Zone 7's annual entitlement and the related transportation capacity had been increased by the 7,000 acre-feet of annual entitlement purchased from the Agency in years prior to January 1, 2000.

(d) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 19, between the State and Zone 7. If either

amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative, for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. This Amendment is permitted by the terms of the contract, and except as amended herein, the provisions of the contract, including but not limited to Articles12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

ATTEST:

Signature

Title

Date

KERN COUNTY WATER AGENCY

Signature

Board Vice-President
Title

Dec. 20, 1999
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer		Entitlement Transferred to Zone 7 (c	Capacity Transferred to Zone 7 (c	After Transfer	
	Annual Entitlement (AF)	Capacity (cfs)	(AF)	(cfs)	Total Annual Entitlement (AF)	Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 2A	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 2B	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 3	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 4	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 5	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 6	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 7	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 8C	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 8D	1,042,730	2,957	7,000	20	1,035,730	2,937
Reach 9	960,971	2,734	2,257	7	958,714	2,727
Reach 10A	914,331	2,594	2,257	7	912,074	2,587
Reach 11B	665,620	1,852			665,620	1,852
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	88,159	237	4,743	13	83,416	224

a) Does not include capacity for outages and losses.

b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."

c) From the Delta to Berrenda Mesa Water District's service area.

State Water Project Analysis Office
December 16, 1999

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 31 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 7th day of December, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall

make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement.

C. Among other things, Article 53 of the Water Supply Contracts provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The State and the Agency wish to set forth their agreement as to such matters as (i) the 15,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the contract.

E. The State and Alameda County Flood Control and Water Conservation District, Zone 7, herein referred to as "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 20 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand nine hundred ten (2,910) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(k) is added to read:

   (k)(1) In accordance with Article 53(a) and an agreement between Lost Hills Water District, a member unit of the Agency, and Alameda County Flood Control and Water Conservation District, Zone 7, the Agency is decreasing its Table A and Table A-1 annual entitlements by 15,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY
(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
~~33~~	~~(2000)~~	~~1,035,730~~
33	(2000)	**1,020,730**

And each succeeding year thereafter, for the term of this contract as an annual entitlement:	~~1,035,730~~
	1,020,730

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
~~33 (2000)~~	~~105,100~~	~~796,030~~	~~134,600~~	~~1,035,730~~
33 (2000)	105,100	**781,030**	134,600	**1,020,730**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,035,730~~ **1,020,730**

(k)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in a revised Statement of Charges for the year 2000 and in future annual Statement of Charges to the Agency.

(b) Any over and under adjustments to payments made by the Agency for 1999 and prior years attributable to the 15,000 acre-feet of entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by Alameda County Flood Control and Water Conservation District, Zone 7 for 2000 and future years attributable to the 15,000 acre-feet of entitlement shall be paid by or credited to Alameda County Flood Control and Water Conservation District, Zone 7 .

(c) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A

are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 20, between the State and the District. If either amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative, for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. This Amendment is permitted by the terms of the contract, and except as amended herein, the provisions of the contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

DEC 28 1999

Date

KERN COUNTY WATER AGENCY

Signature

Vice President

Title

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer		Entitlement Transferred to Zone 7 (c	Capacity Transferred to Zone 7 (c	After Transfer	
	Annual Entitlement (AF)	Capacity (cfs)	(AF)	(cfs)	Total Annual Entitlement (AF)	Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 2A	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 2B	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 3	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 4	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 5	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 6	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 7	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 8C	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 8D	1,035,730	2,937	15,000	27	1,020,730	2,910
Reach 9	958,714	2,727	15,000	27	943,714	2,700
Reach 10A	912,074	2,587	15,000	27	897,074	2,560
Reach 11B	665,620	1,852			665,620	1,852
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	83,416	224			83,416	224

a) Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."
c) From the Delta to Lost Hills Water District's service area.

State Water Project Analysis Office
December 16, 1999

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 32 TO THE WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

632.15431
KCWA

THIS AMENDMENT to the Water Supply Contract is made this 8TH day of DECEMBER, 2000, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "Contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contract was amended to add the Monterey Amendment; the Monterey Amendment and the Environmental Impact Report for the Monterey Agreement were challenged in a lawsuit and addressed by the Court of Appeal in *Planning and Conservation League, et al.* v. *Department of Water Resources and Central Coast*

Water Agency, (2000) 83 Cal. App. 4th 892; and petitions for review of the Court of Appeal's decision are now pending before the Supreme Court.

C. The State and the Agency wish to set forth their agreement as to such matters as (i) the 10,000 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Contract.

D. The State and Alameda County Flood Control and Water Conservation District, Zone 7, herein referred to as "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 21 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

E. An environmental impact report was prepared by Belridge Water Storage District, a member unit of the Agency, in compliance with the California Environmental Quality Act and was certified on June 16, 1998. No significant impacts on the environment will result from this transfer.

F. This transfer is in furtherance of the state policy in favor of water transfers (Water Code Section 475) and will provide for the transfer of under-utilized water entitlements from the Agency, reduce Agency water supply costs, and provide for a permanent water supply for other beneficial users.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand eight hundred ninety-two (2,892) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(l) is added to read:

   (l)(1) In accordance with Article 53(a), the Agency is decreasing its Table A and Table A-1 annual entitlements by 10,000 acre-feet beginning in year 2001 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
33	(2000)	1,020,730
~~34~~	~~(2001)~~	~~1,020,730~~
34	(2001)	**1,010,730**

And each succeeding year thereafter, for the term of this contract as an annual entitlement:	~~1,020,730~~ **1,010,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
33 (2000)	105,100	781,030	134,600	1,020,730
~~34 (2001)~~	~~105,100~~	~~781,030~~	~~134,600~~	~~1,020,730~~
34 (2001)	105,100	**771,030**	134,600	**1,010,730**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:				~~1,020,730~~ **1,010,730**

(I)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2001 and each year thereafter shall commence January 1, 2001, and be identified by the State and included in a revised Statement of Charges for the year 2001 and in future annual Statement of Charges to the Agency.

(b) Any over and under adjustments to payments made by the Agency for 2000 and prior years attributable to the 10,000 acre-feet of annual entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by Alameda County Flood Control and Water Conservation District, Zone 7 for 2001 and future years attributable to the 10,000 acre-feet of annual entitlement shall be paid by or credited to Alameda County Flood Control and Water Conservation District, Zone 7.

(c) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the

proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 21, between the State and the District. If either amendment ceases to be effective for any reason, including but not limited to any court order or judgment entered in *Planning and Conservation League v. DWR & CCWA*, Agency agrees that the State may, in its discretion and consistent with the law then in effect as determined by the State, after meeting and conferring with the Agency, identify the date on which this Amendment shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. Except as amended herein, the provisions of the Contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

Signature

President
Title

12-07-00
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer		Entitlement Transferred to Zone 7 (c	Capacity Transferred to Zone 7 (c	After Transfer	
	Annual Entitlement (AF)	Capacity (cfs)	(AF)	(cfs)	Total Annual Entitlement (AF)	Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 2A	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 2B	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 3	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 4	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 5	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 6	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 7	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 8C	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 8D	1,020,730	2,910	10,000	18	1,010,730	2,892
Reach 9	943,714	2,700	10,000	18	933,714	2,682
Reach 10A	897,074	2,560	10,000	18	887,074	2,542
Reach 11B	665,620	1,852	10,000	18	655,620	1,834
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	83,416	d) 224			83,416	d) 224

a) Includes agricultural and municipal & industrial values. Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Despcriptions".
c) From the Delta to Belridge Water Storage District's service area.
d) Pursuant to Article 53(d)(2) of the Monterey Amendment, Kern County Water Agency is not obligated to sell any transportation right in the Coastal branch Aqueduct. Accordingly, Kern County Water Agency retains the right use Reach 31A for delivery at a capacity of 283 cfs, subject to the limitation of Article 12(c).

State Water Project Analysis Office
November 22, 2000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 33 TO THE WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND KERN COUNTY WATER AGENCY

635.5143
KCWA

THIS AMENDMENT to the Water Supply Contract is made this 8TH day of DECEMBER, 2000, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the "Contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contract was amended to add the Monterey Amendment; the Monterey Amendment and the Environmental Impact Report for the Monterey Agreement were challenged in a lawsuit and addressed by the Court of Appeal in *Planning and Conservation League, et al.* v. *Department of Water Resources and Central Coast*

Water Agency, (2000) 83 Cal. App. 4th 892; and petitions for review of the Court of Appeal's decision are now pending before the Supreme Court.

C. The State and the Agency wish to set forth their agreement as to such matters as (i) the 5,756 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Contract.

D. The State and Solano County Water Agency, herein referred to as "Solano," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 17 to the Water Supply Contract between Solano and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

E. Separate environmental impact reports were prepared by Berrenda Mesa Water District and Belridge Water Storage District, member units of the Agency, in compliance with the California Environmental Quality Act and certified on February 29, 1996 and June 16, 1998, respectively. No significant impacts on the environment will result from this transfer.

F. This transfer is in furtherance of the state policy in favor of water transfers (Water Code Section 475) and will provide for the transfer of under-utilized water entitlements from the Agency, reduce Agency water supply costs, and provide for a permanent water supply for other beneficial users.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand eight hundred seventy-nine (2,879) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(m) is added to read:

   (m)(1) In accordance with Article 53(a), the Agency is decreasing its Table A and Table A-1 annual entitlements by 5,756 acre-feet beginning in year 2001 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
33	(2000)	1,020,730
~~34~~	~~(2001)~~	~~1,010,730~~
34	(2001)	**1,004,974**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:		~~1,010,730~~ **1,004,974**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
33 (2000)	105,100	781,030	134,600	1,020,730
~~34 (2001)~~	~~105,100~~	~~771,030~~	~~134,600~~	~~1,010,730~~
34 (2001)	105,100	**765,274**	134,600	**1,004,974**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:				~~1,010,730~~ **1,004,974**

(m)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2001 and each year thereafter shall commence January 1, 2001, and be identified by the State and included in a revised Statement of Charges for the year 2001 and in future annual Statement of Charges to the Agency.

(b) Recognizing Reach 31A of the Coastal Branch of the California Aqueduct will not be used for delivery of any of the 5,756 acre-feet of annual entitlement purchased from the Agency, effective January 1, 2001, the Agency is relieved of and Solano is liable to the State for all prospective Delta Water Charges, Transportation Charges, and the Water System Revenue Bond Surcharge for Reach 31A related to the applicable portion of the 5,756 acre-feet of annual entitlement purchased from the Agency. However, the Agency shall retain the right to use the transportation capacity in Reach 31A associated with the 5,756 acre-feet being transferred. For delivery of water to the Agency in Reach 31A, the Agency shall remain responsible for any applicable portion of the variable operation, maintenance, power, and replacement component of the Transportation Charge and any applicable portion of the Off-Aqueduct Power Facilities Charge of the

minimum operation, maintenance, power and replacement component of the Transportation Charge.

(c) Any over and under adjustments to payments made by the Agency for 2000 and prior years attributable to the 5,756 acre-feet of annual entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by Solano County Water Agency for 2001 and future years attributable to the 5,756 acre-feet of annual entitlement shall be paid by or credited to Solano County Water Agency.

(d) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 17, between the State and Solano. If either amendment ceases to be effective for any reason, including but not limited to any court order or judgment entered in *Planning and Conservation League v. DWR & CCWA*, Agency agrees

that the State may, in its discretion and consistent with the law then in effect as determined by the State, after meeting and conferring with the Agency, identify the date on which this Amendment shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. This Amendment shall not be used as precedent.

5. Except as amended herein, the provisions of the Contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

for Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

Signature

President
Title

12-07-00
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer		Entitlement Transferred to Solano (c	Capacity Transferred to Solano (c	After Transfer	
	Annual Entitlement (AF)	Capacity (cfs)	(AF)	(cfs)	Total Annual Entitlement (AF)	Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 2A	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 2B	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 3	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 4	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 5	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 6	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 7	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 8C	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 8D	1,010,730	2,892	5,756	13	1,004,974	2,879
Reach 9	933,714	2,682	4,049	8	929,665	2,674
Reach 10A	887,074	2,542	4,049	8	883,025	2,534
Reach 11B	655,620	1,834	3,237	6	652,383	1,828
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	83,416	d) 224	1,707	d) 5	81,709	d) 219

a) Includes agricultural and municipal & industrial values. Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Despcriptions".
c) From the Delta to Belridge Water Storage District's service area (3,237 AF in Reach 11B) and to Berrenda Mesa Water District's service area (812 AF in Reaches 9 and 10A, and 1,707 AF in Reach 31A).
d) Pursuant to Article 53(d)(2) of the Monterey Amendment, Kern County Water Agency is not obligated to sell any transportation right in the Coastal branch Aqueduct. Accordingly, Kern County Water Agency retains the right use Reach 31A for delivery at a capacity of 283 cfs, subject to the limitation of Article 12(c).

State Water Project Analysis Office
November 22, 2000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 34 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

632.51431
KCWA

THIS AMENDMENT to the Water Supply Contract is made this 8th day of DECEMBER, 2000, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract, herein referred to as the 'Contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contract was amended to add the Monterey Amendment; the Monterey Amendment and the Environmental Impact Report for the Monterey Agreement were challenged in a lawsuit and addressed by the Court of Appeal in *Planning and Conservation League, et al.* v. *Department of Water Resources and Central Coast*

Water Agency, (2000) 83 Cal. App. 4th 892; and petitions for review of the Court of Appeal's decision are now pending before the Supreme Court.

C. The State and the Agency wish to set forth their agreement as to such matters as (i) the 4,025 acre-feet per year decrease in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Contract.

D. The State and Napa County Flood Control and Water Conservation District, herein referred to as the "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 21 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

E. Separate environmental impact reports were prepared by Berrenda Mesa Water District and Belridge Water Storage District, member units of the Agency, in compliance with the California Environmental Quality Act and certified on February 29, 1996 and June 16, 1998, respectively. No significant impacts on the environment will result from this transfer.

F. This transfer is in furtherance of the state policy in favor of water transfers (Water Code Section 475) and will provide for the transfer of under-utilized water entitlements

from the Agency, reduce Agency water supply costs, and provide for a permanent water supply for other beneficial users.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the contract:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand eight hundred seventy (2,870) cubic-feet-per-second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(n) is added to read:

   (n)(1) In accordance with Article 53(a), the Agency is decreasing its Table A and Table A-1 annual entitlements by 4,025 acre-feet beginning in year 2001 and each succeeding year thereafter for the term of the contract. The reduction is part of the 130,000 acre-feet made available to Urban Contractors under Article 53(a). Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
KERN COUNTY WATER AGENCY

(Acre-feet)

Year		
1	(1968)	46,600
2	(1969)	95,700
3	(1970)	145,100
4	(1971)	190,300
5	(1972)	270,700
6	(1973)	310,500
7	(1974)	347,000
8	(1975)	410,820
9	(1976)	442,150
10	(1977)	483,600
11	(1978)	534,300
12	(1979)	583,900
13	(1980)	634,500
14	(1981)	691,400
15	(1982)	745,300
16	(1983)	805,100
17	(1984)	860,600
18	(1985)	915,000
19	(1986)	933,646
20	(1987)	1,023,500
21	(1988)	1,074,600
22	(1989)	1,112,300
23	(1990)	1,153,400
24	(1991)	1,153,400
25	(1992)	1,153,400
26	(1993)	1,153,400
27	(1994)	1,153,400
28	(1995)	1,153,400
29	(1996)	1,117,060
30	(1997)	1,112,730
31	(1998)	1,087,730
32	(1999)	1,087,730
33	(2000)	1,020,730
~~34~~	~~(2001)~~	~~1,004,974~~
34	(2001)	**1,000,949**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:		~~1,004,974~~ **1,000,949**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL ENTITLEMENTS TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amount
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
33 (2000)	105,100	781,030	134,600	1,020,730
~~34 (2001)~~	~~105,100~~	~~765,274~~	~~134,600~~	~~1,004,974~~
34 (2001)	105,100	**761,249**	134,600	**1,000,949**

And each succeeding year thereafter,
for the term of this contract as an annual entitlement: ~~1,004,974~~ **1,000,949**

3. (n)(2) The following apply to this permanent transfer:

(a) Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual entitlement for agricultural use for the year 2001 and each year thereafter shall commence January 1, 2001, and be identified by the State and included in a revised Statement of Charges for the year 2001 and in future annual Statement of Charges to the Agency.

(b) Recognizing Reach 31A of the Coastal Branch of the California Aqueduct will not be used for delivery of any of the 4,025 acre-feet of annual entitlement purchased from the Agency, effective January 1, 2001, the Agency is relieved of and the District is liable to the State for all prospective Delta Water Charges, Transportation Charges, and the Water System Revenue Bond Surcharge for Reach 31A related to the applicable portion of the 4,025 acre-feet of annual entitlement purchased from the Agency. However, the Agency shall retain the right to use the transportation capacity in Reach 31A associated with the 4,025 acre-feet being transferred. For delivery of water to the Agency in Reach 31A, the Agency shall remain responsible for any applicable portion of the variable operation, maintenance, power, and replacement component of the Transportation Charge and any applicable portion of the Off-Aqueduct Power Facilities Charge of the

minimum operation, maintenance, power and replacement component of the Transportation Charge.

(c) Any over and under adjustments to payments made by the Agency for 2000 and prior years attributable to the 4,025 acre-feet of annual entitlement shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by Napa County Flood Control and Water Conservation District for 2001 and future years attributable to the 4,025 acre-feet of annual entitlement shall be paid by or credited to Napa County Flood Control and Water Conservation District.

(d) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

4. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 21, between the State and the District. If either amendment ceases

to be effective for any reason, including but not limited to any court order or judgment entered in *Planning and Conservation League v. DWR & CCWA*, Agency agrees that the State may, in its discretion and consistent with the law then in effect as determined by the State, after meeting and conferring with the Agency, identify the date on which this Amendment shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

5. This Amendment shall not be used as precedent.
6. Except as amended herein, the provisions of the Contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

for Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

KERN COUNTY WATER AGENCY

Signature

President
Title

12-07-00
Date

KERN COUNTY WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH (a
FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

Repayment Reach (b	Before Transfer		Entitlement Transferred to Napa (c	Capacity Transferred to Napa (c	After Transfer	
	Annual Entitlement (AF)	Capacity (cfs)	(AF)	(cfs)	Total Annual Entitlement (AF)	Total Capacity (cfs)
	[1]	[2]	[3]	[4]	[5]	[6]
California Aqueduct						
Reach 1	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 2A	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 2B	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 3	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 4	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 5	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 6	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 7	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 8C	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 8D	1,004,974	2,879	4,025	9	1,000,949	2,870
Reach 9	929,665	2,674	2,831	6	926,834	2,668
Reach 10A	883,025	2,534	2,831	6	880,194	2,528
Reach 11B	652,383	1,828	2,263	4	650,120	1,824
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Coastal Aqueduct						
Reach 31A	81,709	d) 219	1,194	d) 3	80,515	d) 216

a) Includes agricultural and municipal & industrial values. Does not include capacity for outages and losses.
b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Despcriptions".
c) From the Delta to Belridge Water Storage District's service area (2,263 AF in Reach 11B) and to Berrenda Mesa Water District's service area (568 AF in Reaches 9 and 10A, and 1,194 AF in Reach 31A).
d) Pursuant to Article 53(d)(2) of the Monterey Amendment, Kern County Water Agency is not obligated to sell any transportation right in the Coastal branch Aqueduct. Accordingly, Kern County Water Agency retains the right use Reach 31A for delivery at a capacity of 283 cfs, subject to the limitation of Article 12(c).

State Water Project Analysis Office
November 22, 2000

It, 22

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 35 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

This Amendment is made this 28th day of May, 2003, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, hereinafter referred to as the "State," and Kern County Water Agency, hereinafter referred to as the "Agency."

RECITALS

A. The State and the Agency entered into and subsequently amended a water supply contract (the "contract") providing that the State shall supply certain quantities of water to the Agency and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payments.

B. On December 1, 1994, the State and representatives of certain State Water Project contractors executed a document entitled "Monterey Agreement – Statement of Principles – By The State Water Contractors And The State Of

California Department Of Water Resources For Potential Amendments To The State Water Supply Contracts" (the "Monterey Agreement").

C. The State, the Central Coast Water Authority ("CCWA") and those contractors intending to be subject to the Monterey Agreement subsequently negotiated an amendment to their contracts to implement provisions of the Monterey Agreement, and such amendment was named the "Monterey Amendment."

D. In October 1995, an environmental impact report ("EIR") for the Monterey Amendment was completed and certified by CCWA as the lead agency, and thereafter the Agency and the State executed the Monterey Amendment.

E. The EIR certified by the CCWA was challenged by several parties (the "Plaintiffs") in the Sacramento County Superior Court and thereafter in the Third District Court of Appeal, resulting in a decision in Planning and Conservation League, et al. v. Department of Water Resources, 83 Cal.App.4th 892 (2000), which case is hereinafter referred to as "PCL v. DWR."

F. In its decision, the Court of Appeal held that (i) the Department of Water Resources ("DWR"), not CCWA, had the statutory duty to serve as lead agency, (ii) the trial court erred by finding CCWA's EIR sufficient despite its failure to discuss implementation of Article 18, subdivision (b) of the State Water Project contracts, as a no-project alternative, (iii) said errors mandate preparation of a new EIR under the direction of DWR, and (iv) the trial court erroneously dismissed the challenge to DWR's transfer of title to certain lands to Kern County

Water Agency (the "Validation Cause of Action") and execution of amended State Water Project contracts for failure to name and serve indispensable parties. The Court of Appeal remanded the case to the trial court, ordering it to take the following five actions: (1) vacate the trial court's grant of the motion for summary adjudication of the Validation Cause of Action; (2) issue a writ of mandate vacating the certification of the EIR; (3) determine the amount of attorney fees to be awarded Plaintiffs; (4) consider such orders it deems appropriate under Public Resources Code Section 21168.9(a) consistent with the views expressed in the Appellate Court's opinion; and (5) retain jurisdiction over the action until DWR, as lead agency, certifies an environmental impact report in accordance with CEQA standards and procedures, and the Superior Court determines that such environmental impact report meets the substantive requirements of CEQA.

G. The State, the contractors, and the Plaintiffs in PCL v. DWR reached an agreement to settle PCL v. DWR, as documented by that certain Settlement Agreement dated MAY 05 2003, 2003 (the "Settlement Agreement"), and in such Settlement Agreement have agreed that the contracts should be amended, for clarification purposes, to delete terms such as "annual entitlement" and "maximum annual entitlement" so that the public, and particularly land use planning agencies, will better understand the contracts.

H. Pursuant to the Settlement Agreement, the State and the Agency desire to so amend the Agency's contract, with the understanding and intent that the amendments herein with respect to subsections (k), (l), and (m) of Article 1,

subsection (b) of Article 6, and subsection (a) of Article 16, and to Table A of the Agency's contract are solely for clarification purposes and that such amendments are not intended to and do not in any way change the rights, obligations or limitations on liability of the State or the Agency established by or set forth in the contract.

I. Pursuant to the Settlement Agreement, the State, the contractors and the Plaintiffs in PCL v. DWR also agreed that the contracts should be amended to include a new Article 58 addressing the determination of dependable annual supply of State Water Project water to be made available by existing Project facilities, and the State and Agency desire to so amend the Agency's contract.

NOW THEREFORE, IT IS MUTUALLY AGREED, as follows:

1. Article 1(l) is amended to read:

(l) Annual Table A Amount

"Annual Table A Amount" shall mean the amount of project water set forth in Table A of this contract that the State, pursuant to the obligations of this contract and applicable law, makes available for delivery to the Agency at the delivery structures provided for the Agency. The term Annual Table A Amount shall not be interpreted to mean that in each year the State will be able to make that quantity of project water available to the Agency. The Annual Table A Amounts and the terms of this contract reflect an expectation that under certain conditions the Agency will receive its full Annual Table A Amount; but that under other

conditions only a lesser amount, allocated in accordance with this contract, may be made available to the Agency. This recognition that full Annual Table A Amounts will not be deliverable under all conditions does not change the obligations of the State under this contract, including but not limited to, the obligations to make all reasonable efforts to complete the project facilities, to perfect and protect water rights, and to allocate among contractors the supply available in any year, as set forth in Articles 6(b), 6(c), 16(b) and 18, in the manner and subject to the terms and conditions of those articles and this contract. Where the term "annual entitlement" appears elsewhere in this contract, it shall mean "Annual Table A Amount." The State agrees that in future amendments to this and other contractor's contracts, in lieu of the term "annual entitlement," the term "Annual Table A Amount" will be used and will have the same meaning as "annual entitlement" wherever that term is used.

2. Article 1(m) is amended to read:

(m) Maximum Annual Table A Amount

"Maximum annual entitlement" shall mean the maximum annual amounts set forth in Table A of this contract, and where the term "maximum annual entitlement" appears elsewhere in this contract it shall mean "Maximum Annual Table A Amounts."

3. Article 1(k) is amended to read:

(k) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available assuming completion of the initial project conservation facilities and additional project conservation facilities. The project's capability of providing the minimum project yield shall be determined by the State on the basis of coordinated operations studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon factors including but not limited to: (1) the estimated relative proportion of deliveries for agricultural use to deliveries for municipal use assuming Maximum Annual Table A Amounts for all contractors and the characteristic distributions of demands for these two uses throughout the year; and (2) agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the division of utilization of waters of the Delta or streams tributary thereto.

4. Article 6(b) is amended to read:

(b) Agency's Annual Table A Amounts

Commencing with the year of initial water delivery to the Agency, the State each year shall make available for delivery to the Agency the amounts of project water

designated in Table A of this contract, which amounts shall be subject to change as provided for in Article 7(a) and are referred to in this contract as the Agency's Annual Table A Amounts.

5. Article 16(a) is amended to read:

(a) Limit on Total of all Maximum Annual Table A Amounts

The Agency's Maximum Annual Table A Amount hereunder, together with the maximum Table A amounts of all other contractors, shall aggregate no more than 4,185,000 acre-feet of project water.

6. Article 57 is intentionally left blank for future use.

7. Article 58 is added to read:

58. Determination of Dependable Annual Supply of Project Water to be Made Available by Existing Project Facilities.

In order to provide current information regarding the delivery capability of existing project conservation facilities, commencing in 2003 and every two years thereafter the State shall prepare and mail a report to all contractors, and all California city, county, and regional planning departments and agencies within the contractors' project service areas. This report will set forth, under a range of hydrologic conditions, estimates of overall delivery capability of the existing project facilities and of supply availability to each contractor in accordance with other provisions of the contractors' contracts. The range of hydrologic conditions shall include the delivery capability in the driest year of record, the average over

the historic extended dry cycle and the average over the long-term. The biennial report will also include, for each of the ten years immediately preceding the report, the total amount of project water delivered to all contractors and the amount of project water delivered to each contractor.

8. Add the following language at the bottom of Table A:

In any year, the amounts designated in this Table A shall not be interpreted to mean that the State is able to deliver those amounts in all years. Article 58 describes the State's process for providing current information for project delivery capability.

9. Add the following language at the bottom of Table A-1:

In any year, the amounts designated in this Table A-1 shall not be interpreted to mean that the State is able to deliver those amounts in all years. Article 58 describes the State's process for providing current information for project delivery capability.

10. Except for Article 58, the changes made by this amendment are solely for clarification purposes, and are not intended to nor do they in any way change the rights, obligations or limitations on liability of the State or the Agency established by or set forth in the contract, and this amendment shall be interpreted in accordance with this intent.

11. At the time of execution of this Agreement and thereafter, the effectiveness of this Amendment is dependent upon the effectiveness of the Agency's Monterey Amendment (all provisions therein) and the Kern Fan Element Transaction.

IN WITNESS WHEREOF, the parties hereto have executed this amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER
RESOURCES

Director

KERN COUNTY WATER AGENCY

Name

President

Title

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 36 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
KERN COUNTY WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31ST day of October, 2003, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Kern County Water Agency, herein referred to as the "Agency," and collectively herein referred to as "Parties."

RECITALS:

A. The Parties have entered into and subsequently amended a Water Supply Contract, herein referred to as the "Contract," providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The Parties wish to set forth their agreement as to such matters as (i) the 2,219 acre-feet per year decrease in the Agency's annual Table A amounts,

(ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Contract. "Table A amounts" shall mean the amount of project water set forth in Table A of the Agency's Water Supply Contract, which the State makes available for delivery to the Agency at the delivery structures provided for the Agency.

C. The State and Alameda County Flood Control and Water Conservation District, Zone 7, herein referred to as the "District," are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 25 to the Water Supply Contract between the District and the State in order to reflect (i) the transfer of Table A amounts described herein, (ii) the transfer of related transportation repayment obligations, (iii) the delivery priority for the permanently transferred Table A amounts, and (iv) the revision of proportionate use of facilities factors.

D. An Initial Study and Negative Declaration was prepared by the District, as lead agency, in compliance with the California Environmental Quality Act and certified on November 20, 2002. It concluded that no significant impacts on the environment will result from this transfer. The Director of the Department of Water Resources, acting as a responsible agency, has reviewed and considered the Initial Study and Negative Declaration prepared by the District prior to approving this agreement.

E. This transfer is in furtherance of the state policy in favor of water transfers (Water Code Section 475) and will provide for the transfer of under-utilized Table A amounts from the Agency, reduce Agency water supply costs, and provide for a permanent water supply for other beneficial users.

F. The State has further concluded that this transfer is operationally feasible, will not impair the security of its bondholders, and provides for full repayment of transportation costs.

NOW, THEREFORE, the Parties agree:

1. Article 12(c) is revised to read as follows:

   In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding two thousand eight hundred sixty-six (2,866) cubic feet per second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

2. Article 45(o) is added to read:

   In accordance with Article 41, the Agency is decreasing its annual Table A amounts by 2,219 acre-feet beginning in year 2004 and each succeeding year thereafter for the term of the contract. As a result of this reduction, Table A as designated in Article 6(b) and Table A-1 as designated in Article 45(b) are amended as follows:

TABLE A

ANNUAL AMOUNTS
KERN COUNTY WATER AGENCY

Year	(acre-feet)
1 (1968)	46,600
2 (1969)	95,700
3 (1970)	145,100
4 (1971)	190,300
5 (1972)	270,700
6 (1973)	310,500
7 (1974)	347,000
8 (1975)	410,820
9 (1976)	442,150
10 (1977)	483,600
11 (1978)	534,300
12 (1979)	583,900
13 (1980)	634,500
14 (1981)	691,400
15 (1982)	745,300
16 (1983)	805,100
17 (1984)	860,600
18 (1985)	915,000
19 (1986)	933,646
20 (1987)	1,023,500
21 (1988)	1,074,600
22 (1989)	1,112,300
23 (1990)	1,153,400
24 (1991)	1,153,400
25 (1992)	1,153,400
26 (1993)	1,153,400
27 (1994)	1,153,400
28 (1995)	1,153,400
29 (1996)	1,117,060
30 (1997)	1,112,730
31 (1998)	1,087,730
32 (1999)	1,087,730
33 (2000)	1,020,730
34 (2001)	1,000,949
35 (2002)	1,000,949
36 (2003)	1,000,949
~~37 (2004)~~	~~1,000,949~~
37 (2004)	**998,730**
And each succeeding year thereafter, for the term of this contract:	**998,730**

TABLE A-1

PROJECTED PORTIONS OF ANNUAL TABLE A AMOUNTS
TO BE PUT TO AGRICULTURAL AND MUNICIPAL USE
KERN COUNTY WATER AGENCY
(Acre-feet)

Year	Agricultural Use (Coastal Aqueduct)	Agricultural Use (San Joaquin Valley-Southern California Aqueduct)	Municipal Use	Total Annual Amounts
1 (1968)	13,313	33,287	0	46,600
2 (1969)	30,303	65,397	0	95,700
3 (1970)	61,000	55,400	28,700	145,100
4 (1971)	35,500	119,100	35,700	190,300
5 (1972)	31,800	199,700	39,200	270,700
6 (1973)	37,500	229,500	43,500	310,500
7 (1974)	52,600	246,400	48,000	347,000
8 (1975)	57,000	301,120	52,700	410,820
9 (1976)	61,800	324,250	56,100	442,150
10 (1977)	66,000	357,000	60,600	483,600
11 (1978)	70,800	399,400	64,100	534,300
12 (1979)	75,300	441,000	67,600	583,900
13 (1980)	79,400	484,000	71,100	634,500
14 (1981)	83,800	532,800	74,800	691,400
15 (1982)	87,700	578,000	79,600	745,300
16 (1983)	90,800	630,800	83,500	805,100
17 (1984)	94,500	662,500	103,600	860,600
18 (1985)	97,100	709,000	108,900	915,000
19 (1986)	100,100	720,146	113,400	933,646
20 (1987)	102,200	802,200	119,100	1,023,500
21 (1988)	103,800	846,900	123,900	1,074,600
22 (1989)	104,700	879,400	128,200	1,112,300
23 (1990)	105,100	913,700	134,600	1,153,400
24 (1991)	105,100	913,700	134,600	1,153,400
25 (1992)	105,100	913,700	134,600	1,153,400
26 (1993)	105,100	913,700	134,600	1,153,400
27 (1994)	105,100	913,700	134,600	1,153,400
28 (1995)	105,100	913,700	134,600	1,153,400
29 (1996)	105,100	877,360	134,600	1,117,060
30 (1997)	105,100	873,030	134,600	1,112,730
31 (1998)	105,100	848,030	134,600	1,087,730
32 (1999)	105,100	848,030	134,600	1,087,730
33 (2000)	105,100	781,030	134,600	1,020,730
34 (2001)	105,100	761,249	134,600	1,000,949
35 (2002)	105,100	761,249	134,600	1,000,949
36 (2003)	105,100	761,249	134,600	1,000,949
~~37 (2004)~~	~~105,100~~	~~761,249~~	~~134,600~~	~~1,000,949~~
37 (2004)	105,100	759,030	134,600	998,730

And each succeeding year thereafter,
for the term of this contract as an annual Table A amounts: **998,730**

3. Reductions in the Agency's Delta Water Charge, Transportation Charge, and the Water System Revenue Bond Surcharge resulting from the decrease in the Agency's annual Table A amounts for agricultural use for the year 2004 and each year thereafter shall commence January 1, 2004, and be identified by the State and included in a revised Statement of Charges for the year 2004 and in future annual Statement of Charges to the Agency.

4. Any over and under adjustments to payments made by the Agency for 2003 and prior years attributable to the 2,219 acre-feet of annual Table A amounts shall be paid by or credited to the Agency, including refunds or credits for Off-Aqueduct and Water System Revenue Bond reserves. Any over and under adjustments to payments made by the District for 2004 and future years attributable to the 2,219 acre-feet of annual Table A amounts shall be paid by or credited to the District.

5. For cost allocation and repayment purposes, Exhibit A attached hereto shows Table A amounts and capacity amounts for each aqueduct reach in which the Agency participates consistent with the limits of Articles 12(b) and 12(c). These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this contract under Article 28.

6. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 25, between the State and the District. If either amendment ceases

to be effective for any reason, the Agency agrees that the State may, in its discretion and consistent with the law then in effect as determined by the State, after meeting and conferring with the Agency, identify the date on which this Amendment shall be deemed inoperative for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

7. DWR agrees to consider the applicability of Article 53(a) to this transfer on or before January 1, 2011, or earlier if any State Water Contractor seeks to enforce Agency's responsibilities under that article.

8. The Agency agrees to indemnify, defend, and hold harmless the State and any of its officers, agents, or employees from any liability, expenses, defense costs, attorney fees, claims, actions, liens and lawsuits of any kind arising from or related to this Amendment and associated agreements.

9. Except as amended herein, the provisions of the Contract, including but not limited to Articles 12(b) and 12(c) (as amended herein), will remain in full force and effect.

10. This amendment shall not be used as precedent.

IN WITNESS WHEREOF, the Parties hereto have executed this Amendment on the date first above written.

Approved as to legal form
and sufficiency:

Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

for Director

KERN COUNTY WATER AGENCY

Signature

President
Title

September 24, 2003
Date

EXHIBIT A

KERN COUNTY WATER AGENCY
ANNUAL TABLE A AMOUNTS AND CAPACITY VALUES FOR EACH REACH a) FOR COST ALLOCATION AND REPAYMENT PURPOSES

The values related to this transfer are estimated to be as follows:

Repayment Reach b)	Before Transfer		Table A Transferred to Zone 7 c) (AF)	Flow Capacity Transferred to Zone 7 c) (cfs)	After Transfer	
	Table A Capacity (AF)	Flow Capacity (cfs)			Total Table A Capacity (AF)	Total Flow Capacity (cfs)
California Aqueduct						
Reach 1	1,000,949	2,870	2,219	4	998,730	2,866
Reach 2A	1,000,949	2,870	2,219	4	998,730	2,866
Reach 2B	1,000,949	2,870	2,219	4	998,730	2,866
Reach 3	1,000,949	2,870	2,219	4	998,730	2,866
Reach 4	1,000,949	2,870	2,219	4	998,730	2,866
Reach 5	1,000,949	2,870	2,219	4	998,730	2,866
Reach 6	1,000,949	2,870	2,219	4	998,730	2,866
Reach 7	1,000,949	2,870	2,219	4	998,730	2,866
Reach 8C	1,000,949	2,870	2,219	4	998,730	2,866
Reach 8D	1,000,949	2,870	2,219	4	998,730	2,866
Reach 9	926,834	2,668	2,219	4	924,615	2,664
Reach 10A	880,194	2,528	2,219	4	877,975	2,524
Reach 11B	650,120	1,824	2,219	4	647,901	1,820
Reach 12D	558,655	1,528			558,655	1,528
Reach 12E	554,955	1,517			554,955	1,517
Reach 13B	346,755	986			346,755	986
Reach 14A	234,755	683			234,755	683
Reach 14B	213,572	614			213,572	614
Reach 14C	165,391	464			165,391	464
Reach 15A	135,508	374			135,508	374
Reach 16A	80,794	214			80,794	214
Reach 17E	5,000	9			5,000	9
Reach 31A	80,515	d) 216			80,515	d) 216

a) Includes agricultural and municipal & industrial values. Does not include capacity for outages and losses.

b) These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."

c) From the Delta to Belridge Water Storage District's service area.

d) Pursuant to Article 53(d)(2) of the Monterey Amendment, Kern County Water Agency is not obligated to sell any transportation right in the Coastal branch Aqueduct. Accordingly, Kern County Water Agency retains the right to use Reach 31A for delivery at a capacity of 283 cfs, subject to the limitation of Article 12(c).

State Water Project
Analysis Office: 12/9/2002

D. SETTLEMENT AGREEMENT

SETTLEMENT AGREEMENT

by and among

Planning and Conservation League, Plumas County Flood Control and Water Conservation District, Citizens Planning Association of Santa Barbara County, Inc.

and

The State of California Department of Water Resources, Central Coast Water Authority, Kern Water Bank Authority and those State Water Project Contractors identified herein.

MAY 0 5 2003
_____, 2003

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SETTLEMENT AGREEMENT

This **SETTLEMENT AGREEMENT** is entered into as of MAY 0 5 2003, 2003, by and among Planning and Conservation League, Plumas County Flood Control and Water Conservation District, Citizens Planning Association of Santa Barbara County, Inc., The State of California Department of Water Resources, Central Coast Water Authority, Kern Water Bank Authority and those SWP Contractors who have executed this Settlement Agreement. Certain terms used herein are defined in Section I.

RECITALS

WHEREAS, in 1951, the State of California Legislature authorized the construction of the State Water Project ("**SWP**");

WHEREAS, eight years later, the Legislature authorized the submission for voter approval of a general obligation bond issue to build the SWP, which voters subsequently approved (California Water Code, Section 12930 et seq.);

WHEREAS, commencing in the early 1960's, DWR, as operator of the SWP, entered into certain SWP Contracts with various water districts throughout California;

WHEREAS, in 1994, as a result of disputes arising from water shortages experienced during an extended drought period, DWR and certain of the SWP Contractors entered into an agreement known as the Monterey Agreement and thereafter implemented the terms of the Monterey Agreement by execution of the so-called Monterey Amendments;

WHEREAS, pursuant to CEQA, the environmental impact report for the Monterey Amendments was prepared in 1995 by CCWA as "lead agency," and adopted by DWR as "responsible agency" (as those terms are defined in CEQA) (the "**1995 EIR**");

WHEREAS, on December 27, 1995, PCL filed the PCL Complaint against DWR and CCWA challenging the sufficiency of the 1995 EIR;

WHEREAS, on February 12, 1996, Plaintiffs filed a First Amended Complaint adding the Validation Cause of Action;

WHEREAS, the trial court ultimately determined that although CCWA was not the appropriate lead agency for the 1995 EIR, such designation of CCWA was not fatal to the EIR, and ruled against Plaintiffs with respect to their challenge to the sufficiency of the 1995 EIR. The trial court also granted summary adjudication in favor of DWR and CCWA on the Validation Cause of Action. Plaintiffs appealed the trial court's rulings;

WHEREAS, in Planning and Conservation League v. Department of Water Resources, 83 Cal. App. 4th 892 (2000), the Court of Appeal held that (i) DWR, not CCWA, had the statutory duty to serve as lead agency, (ii) the trial court erred by finding CCWA's EIR sufficient despite its failure to discuss implementation of Article 18, subdivision (b) of the SWP Contracts, as a no-project alternative, (iii) said errors mandate preparation of a new EIR under the direction of DWR, and (iv) the trial court erroneously dismissed the challenge to DWR's transfer of title to the KWB Lands (the Validation Cause of Action) and execution of amended SWP Contracts for failure to name and serve indispensable parties. The Court of Appeal remanded the case to the trial court, ordering it to take the following five actions: (1) vacate the trial court's grant of the motion for summary adjudication of the Validation Cause

of Action; (2) issue a writ of mandate vacating the certification of the 1995 EIR; (3) determine the amount of attorney fees to be awarded Plaintiffs; (4) consider such orders it deems appropriate under Public Resources Code Section 21168.9(a) consistent with the views expressed in the Appellate Court's opinion; and (5) retain jurisdiction over the action until DWR, as lead agency, certifies an environmental impact report in accordance with CEQA standards and procedures, and the Superior Court determines that such environmental impact report meets the substantive requirements of CEQA;

WHEREAS, since the Court of Appeal ruling, representatives of the Parties to this Settlement Agreement have engaged in extensive settlement negotiations, mediated by retired Judge Daniel Weinstein, with the intent of avoiding further litigation and associated fees and providing for an effective way to cooperate in the preparation of a new environmental impact report and make such other improvements in the operation and responsiveness of the SWP as set forth in this Settlement Agreement;

WHEREAS, on July 22, 2002, an agreement was reached regarding the principles for a settlement; and

WHEREAS, the Parties now desire to formally enter into this Settlement Agreement.

AGREEMENT

NOW, THEREFORE, in exchange for the following covenants and agreements and other valuable and sufficient consideration, the receipt of which is acknowledged, the Parties agree as follows:

I. **Definitions**. Certain terms, as used in this Settlement Agreement, are defined as follows.

A. **"Attachment A Amendments"** means those amendments in the substantive form of Attachment A hereto (conformed to the format of each individual SWP Contract and the parties thereto), to be executed by DWR and the SWP Contractors who are signatories to this Settlement Agreement pursuant to and in accordance with the terms and conditions of this Settlement Agreement.

B. **"Attachment B Principles"** means those principles set forth in Attachment B hereto regarding SWP reliability.

C. **"Attachment C Guidelines"** means the guidelines set forth in Attachment C hereto regarding review of proposed permanent transfers of Annual Table A Amounts (as such latter term is used in the SWP Contracts).

D. **"Attachment D Principles"** means those principles set forth in Attachment D hereto regarding public participation in SWP Contract negotiations.

E. **"Attachment E Transfers"** means those water transfers identified on Attachment E hereto.

F. **"CEQA"** means the California Environmental Quality Act, California Public Resources Code Section 21000 et seq.

G. **"Citizens Planning Association"** means Citizens Planning Association of Santa Barbara County, Inc.

H. **"CCWA"** means Central Coast Water Authority.

I. **"Consent to Entry of Order Discharging Writ"** has the meaning given in Section VII(H)(1).

J. **"DWR"** means The State of California Department of Water Resources.

K. **"EIR Committee"** means a committee of no more than four (4) SWP Contractor representatives, and no more than four (4) Plaintiff representatives, chaired by a DWR representative, which has been formed for the purposes set forth in Section III(B).

L. **"HCP"** means the Habitat Conservation Plan/Natural Community Conservation Plan prepared for the Kern Water Bank Authority and approved through an Implementation Agreement dated October 2, 1997, with the United States Fish and Wildlife Service and California Department of Fish and Game.

M. **"Interim Implementation Order"** has the meaning given in Section VII(C).

N. **"JAMS Trust Account"** means the account established by DWR with, and maintained by, the Mediator for the purpose set forth in Section VI.

O. **"Kern-Castaic Transfer"** means the transfer of 41,000 acre-feet of water from Kern County Water Agency to the Castaic Lake Water Agency approved by DWR on March 31, 1999.

P. **"Kern Environmental Permits"** means the HCP and certain other permits, approvals and agreements relating to the Kern Water Bank, as set forth in and contemplated by the Addendum to the 1995 EIR, including those specified in Exhibit 2 hereto and similar, related permits, approvals and agreements.

Q. **"Kern Fan Element Transaction"** means DWR's transfer of the KWB Lands to Kern County Water Agency, as described in Article 52 of the Monterey

Amendments. Kern County Water Agency subsequently conveyed the KWB Lands to KWBA. Each of the stated conveyances occurred on August 9, 1996, based upon separate agreements dated December 13, 1995.

R. **"KWB Lands"** means the property known as the Kern Fan Element, as more specifically described in that certain Deed, executed by the Kern County Water Agency in favor of KWBA, dated August 9, 1996, and recorded in the Official Records of Kern County as Instrument No. 0196101606.

S. **"KWBA"** means Kern Water Bank Authority.

T. **"Mediator"** means retired Judge Daniel Weinstein, unless Judge Weinstein is unavailable, in which case the Mediator shall be another retired jurist mutually agreed to by DWR and the other members of the EIR Committee with respect to matters referred to the Mediator under Section III(H), and for all other matters another retired jurist approved by agreement of the Parties.

U. **"Mediation Issue"** means any issue relating exclusively to the compliance of the New EIR with any of the following requirements: (a) the requirements of CEQA; (b) the direction of the courts in the underlying litigation; or (c) the terms and conditions of this Settlement Agreement.

V. **"Monterey Agreement"** means the formal agreement, dated as of December 1, 1994, by and among DWR and certain SWP Contractors that memorializes fourteen principles to address the distribution of water during shortages and various other issues under the SWP Contracts.

W. **"Monterey Amendment"** means the amendment to the SWP Contracts entered into by DWR and certain SWP Contractors for purposes of implementing the Monterey Agreement.

X. **"New EIR"** has the meaning given in Section III.

Y. **"Party"** and "**Parties**" mean the signatories, individually and collectively, to this Settlement Agreement.

Z. **"PCL"** means Planning and Conservation League.

AA. **"PCL Complaint"** means the Complaint for Declaratory and Injunctive Relief and Petition for Writ of Mandate filed December 27, 1995, by PCL in the Superior Court, as amended and supplemented by the First Amended Complaint filed February 12, 1996.

BB. **"Plaintiffs"** means PCL, Citizens Planning Association and Plumas.

CC. **"Plaintiffs' Expenses Trust Account"** means the account maintained by JAMS for the purposes set forth in Section III(G).

DD. **"Plumas"** means Plumas County Flood Control and Water Conservation District.

EE. **"Plumas Amendment"** means an amendment to the Plumas SWP Contract to be entered into by DWR and Plumas pursuant to Section IV(C).

FF. **"Plumas Arrearages"** means any amount owed by Plumas to DWR under its SWP Contract that accrued prior to the resumption of payments by Plumas under Section IV(F).

GG. **"Return to Writ"** has the meaning given in Section VII(G).

HH. **"Rossmann"** means the Law Offices of Antonio Rossmann.

II. "**Section VI Trust Account Agreement**" means a trust account agreement regarding the disbursement by JAMS to Plaintiffs of those funds delivered by DWR pursuant to Section VI of this Settlement Agreement, the form of which agreement is attached hereto as Exhibit 4.

JJ. **"Superior Court"** means the Superior Court of the State of California, County of Sacramento.

KK. **"SWP"** means the State Water Project, officially called the State Water Resources Development System, as defined in Water Code Section 12931.

LL. **"SWP Contracts"** means those long-term contracts entered into by and between DWR, as the operator of the SWP, and individual SWP Contractors for the delivery of water from the SWP.

MM. **"SWP Contractors"** for purposes of this Settlement Agreement, means those contracting agencies identified in Table 1-6 of the DWR Bulletin 132-00, dated December 2001. All references to "SWP Contractors who are parties to this Settlement Agreement" are meant to exclude Plumas. Specific issues relating to Plumas are addressed in Section IV.

NN. **"Validation Cause of Action"** means the fifth cause of action of the PCL Complaint.

OO. **"Watershed Forum"** means a newly formed stakeholder group consisting of one or more representatives from each of Plumas, local community-based groups, DWR and the SWP Contractors who are parties to this Settlement Agreement, established for the purposes set forth in Section IV(B).

PP. **"Watershed Programs"** means programs, studies or projects approved by the Watershed Forum and implemented in pursuit of the goals set forth in Section IV, and other such activities approved by the Watershed Forum that are consistent with such purposes and goals.

QQ. **"1995 EIR"** means the Final Programmatic Environmental Impact Report for the Implementation of the Monterey Agreement Statement of Principles by State Water Project Contractors and the State of California Department of Water Resources for Potential Amendments to State Water Supply Contracts, prepared in October, 1995 by CCWA, as lead agency, and reviewed and considered in December 1995, by DWR, as a responsible agency, as each of those terms is defined in CEQA.

II. Administration of the State Water Project Pending New Environmental Impact Report and Discharge of Writ of Mandate.

Pending the Superior Court's issuance of an order discharging the writ of mandate in the underlying litigation, the Parties will jointly request that the Superior Court enter an order approving this Settlement Agreement, and an order, pursuant to California Public Resources Code Section 21168.9, authorizing on an interim basis the administration and operation of the SWP and the Kern Water Bank in accordance with the Monterey Amendments, the terms of this Settlement Agreement and the Attachment A Amendments, as more specifically set forth in Section VII of this Settlement Agreement.

III. New Environmental Impact Report

A. Preparation. As lead agency (as defined in CEQA), DWR shall cause a new environmental impact report to be prepared with respect to the proposed "project" (as that term is defined in Public Resources Code Section 21065 and Section

15378 of the CEQA Guidelines), in accordance with and as further described in Section III(C) below (the "**New EIR**").

B. EIR Committee. To effectuate the desire of the Parties that the New EIR be the product of a cooperative effort and comply with the requirements of CEQA and the direction of the courts in the underlying litigation, the EIR Committee has been formed to provide advice and recommendations to DWR in connection with the preparation of the draft and final versions of the New EIR.

C. New EIR Content. The proposed project to be analyzed in the New EIR will be specifically defined during the scoping process. Under all circumstances, in order to provide DWR, the responsible agencies, and the public with adequate disclosure to consider the potential environmental impacts of the Monterey Amendments, and the additional actions set forth in this Settlement Agreement, the environmental analysis in the New EIR shall evaluate, as components of the proposed project, the Monterey Amendments (including the provisions relating to the transfer of the KWB Lands) and the Attachment A Amendments. DWR shall ensure that the New EIR evaluates all proposed actions that are necessary to implement this Settlement Agreement. The New EIR shall include the following:

1. Information on water deliveries of the SWP over the relevant historical period (at least 1991 -2002), as well as data regarding the deliveries in the last extended drought (1987-1992), to be included in the description of the setting and the background for the proposed project;

2. As part of the CEQA-mandated "no-project" alternative analysis, and in light of the Court of Appeal's opinion, an analysis of the effect of pre-

Monterey Amendment SWP Contracts, including implementation of Article 18 therein. This analysis shall address, at a minimum, (a) the impacts that might result from application of the provisions of Article 18(b) of the SWP Contracts, as such provision existed prior to the Monterey Amendments, and (b) the related water delivery effects that might follow from any other provisions of the SWP Contracts;

3. Analysis of the potential environmental impacts of changes in SWP operations and deliveries resulting from implementation of the proposed project. If the proposed project results in modifications to the water sources relied upon for the SWP, those sources will be identified and the resulting environmental effects will be assessed;

4. Analysis of the potential environmental effects relating to (a) the Attachment E Transfers and (b) the Kern-Castaic Transfer, in each case as actions that relate to the potential environmental impacts of approving the Monterey Amendments; and

5. Analysis of the potential environmental effects relating to the implementation of this Settlement Agreement, including:

    a. Evaluation of the potential environmental impacts arising from the payments to Plumas as described in Section IV; and

    b. Analysis of the potential environmental effects relating to implementation of the provisions of this Settlement Agreement relating to the Kern Water Bank as discussed in Section V.

D. Acknowledgement and Agreement Regarding Attachment E Transfers. With respect to Section III(C)(4)(a), notwithstanding the analysis of the potential impacts of the Attachment E Transfers in the New EIR and without specifically endorsing or opposing those transfers or any prior environmental assessments of them, the Parties recognize that such water transfers are final. Each of the Parties agrees not to, and it shall be a condition to the initial and continuing effectiveness of this Settlement Agreement that Plaintiffs do not, hereafter challenge the effectiveness or validity of such water transfers.

E. Acknowledgement and Agreement Regarding Kern-Castaic Transfer. With respect to Section III(C)(4)(b) regarding the Kern-Castaic Transfer, the Parties recognize that such water transfer is subject to pending litigation in the Los Angeles County Superior Court following remand from the Second District Court of Appeal (*See* Friends of the Santa Clara River v. Castaic Lake Water Agency, 95 Cal. App. 4th 1373, 116 Cal. Rptr. 2d 54 (2002); *review denied* April 17, 2002). The Parties agree that jurisdiction with respect to that litigation should remain in that court and that nothing in this Settlement Agreement is intended to predispose the remedies or other actions that may occur in that pending litigation.

F. Acknowledgement and Agreement Regarding Kern Water Bank. With respect to Section III(C)(5)(b) relating to the Kern Water Bank, the Parties acknowledge that the Kern Water Bank is currently operating under the Kern Environmental Permits, which were entered into based on an Addendum to the 1995 EIR. The Parties recognize that the Addendum has been completed and agree not to challenge it in any manner. KWBA agrees that it will not rely on the Addendum

to the 1995 EIR for any new KWBA project to the extent that such reliance is based on data or analysis incorporated into the Addendum from the 1995 EIR. In addition, the New EIR shall include an independent study by DWR, as the lead agency, and the exercise of its judgment regarding the impacts related to the transfer, development, and operation of the Kern Water Bank in light of the Kern Environmental Permits. Such study shall identify SWP and any non-SWP sources of water deliveries to the Kern Water Bank. The views of the trustee agencies, as evidenced by the requirements of the HCP, will be used to provide guidance to DWR. Finally, the Parties agree that this Settlement Agreement is not intended to and shall not affect the continuing effectiveness of the Kern Environmental Permits.

G. Reimbursement of Plaintiffs' Expenses for Participation in the Preparation of New EIR .

1. *DWR Obligation to Reimburse Plaintiffs*. Subject to and in accordance with clauses (2) and (3), DWR will provide up to $300,000 to Plaintiffs for expenses actually incurred as needed to support Plaintiffs' participation in DWR's preparation of the New EIR, including service on the EIR Committee.

2. *Deposit into Trust Account*. The Parties acknowledge that in accordance with the principles of settlement, DWR caused to be deposited $300,000 into the Plaintiffs' Expenses Trust Account at JAMS on August 22, 2002.

3. *Disbursement of Funds to Plaintiffs*. Funds provided by DWR under this Section III(G) are available for disbursement and will be disbursed to

Plaintiffs by JAMS from the Plaintiffs' Expenses Trust Account in accordance with that certain Plaintiff's Expenses Trust Account Agreement dated August 15, 2002, attached hereto as Exhibit 1 and incorporated herein by this reference.

H. Disputes Regarding Mediation Issues.

1. *Referral to Director of DWR.* If the Plaintiffs' or SWP Contractors' representatives on the EIR Committee, or both, disagree with DWR's proposed approach with respect to a Mediation Issue, such representatives may refer the issue in writing to the Director of DWR.

2. *Referral to Mediator.* If (a) two-thirds of Plaintiffs' representatives or (b) three-fourths of the SWP Contractors' representatives, or both, disagree with the DWR Director's written decision with respect to a Mediation Issue (which issue shall have first been referred to the Director pursuant to Section III(H)(1)), such representative(s) may refer the issue in writing for consideration to the Mediator.

3. *Notices to Other Parties.* DWR shall inform the Parties to this Settlement Agreement of any referrals made pursuant to this Section III(H).

4. *Advisory Opinion by Mediator.* In the event of a referral as described above, the Mediator will consider the views of the representatives of the EIR Committee and the DWR Director, and will provide a written advisory opinion on the issue to the EIR Committee and DWR Director.

5. *Final Decision by DWR.* After receipt of an advisory opinion from the Mediator, the DWR Director shall make a final decision on the issue.

6. *Mediator's Costs and Expenses*.

a. *Referrals by Plaintiffs' Representatives*. On any matter referred to the Mediator by Plaintiffs' representatives on the EIR Committee, the costs of the Mediator's services will be borne one-third (1/3) by the Plaintiffs and two-thirds (2/3) by DWR.

b. *Referrals by SWP Contractors' Representatives*. For any referral by the SWP Contractors who are representatives on the EIR Committee, the SWP Contractors who are signatory to this Settlement Agreement will compensate the Mediator for his services.

c. *Frivolous or Harassing Referrals*. In the event of frivolous or harassing matters referred to him/her, the Mediator shall have the authority to award costs to the prevailing party, as well as reasonable attorney fees in accordance with Section IX of this Settlement Agreement.

I. Filing of New EIR upon Completion. Upon completion of the New EIR, in accordance with the procedure set forth in CEQA, and after final consideration by and good faith consultation with the EIR Committee, DWR shall cause the New EIR to be filed with the Superior Court as a return to the writ of mandate issued by such court in connection with this case.

IV. **Plumas Matters.**

A. Monetary Settlement.

1. *Agreement to Pay*. In accordance with the procedures and subject to the conditions described herein, DWR shall pay to Plumas the sum of $8,000,000.

2. *Schedule of Payments*.

a. *Annual Payments*. A total sum of Four Million Dollars ($4,000,000) shall be paid in accordance with this Section IV(A)(2)(a). DWR shall pay to Plumas One Million Dollars ($1,000,000) within 30 days after approval of this Settlement Agreement by the Superior Court (or the first business day after said 30th day if the 30th day is not a business day).

On each anniversary date of the first $1,000,000 payment until (and inclusive of) the third (3rd) anniversary, DWR shall pay to Plumas One Million Dollars ($1,000,000).

b. *Post Notice-of-Determination Payments*. Subject to Section IV(A)(2)(c), the remaining Four Million Dollars ($4,000,000) shall be paid in four annual installments of $1,000,000 each, beginning on the later to occur of: (1) the date that is seventy days after the Notice of Determination (as defined in CEQA) has been filed for the New EIR (or the first business day after said 70th day if the 70th day is not a business day); or (2) the date that is one year after the last payment made under Section IV(A)(2)(a).

c. *Effects of Litigation on Payment Obligation*.

(1) Suspension of Payment Obligation. If litigation is commenced by anyone challenging CEQA compliance for, or the validity of, any Monterey Amendment (or any portion thereof), including matters pertaining to the Kern Fan Element Transaction, the monetary obligations of DWR under Section IV(A)(2)(b) shall be suspended until the date that is forty-five (45) days after final conclusion of that litigation (without further right of appeal) in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction. Within thirty (30) days after final conclusion of any such litigation in said manner, DWR shall pay to Plumas any amounts then owed by DWR under this Section IV.

(2) Termination of Payment Obligation. If any such litigation results in a final judgment (without further right of appeal) that invalidates any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction, the obligation for payments under Section IV(A)(2)(b) shall automatically terminate.

3. *Use of Funds*.

a. *Funding of Watershed Programs*. Plumas shall apply a majority of all funds received each year pursuant to Section IV(A) to Watershed Programs.

b. *Balance of Funds to General Purposes*. Plumas may apply the balance of funds received each year to other district-related purposes, as determined by Plumas with due consideration for the needs of the Watershed Forum.

c. *Annual Carry-Over*. Funds received but not spent in any given year may be carried over to the succeeding year(s), provided, however, that any such funds shall continue to be subject to the restrictions under Sections IV(A)(3)(a) and (b).

B. Watershed Forum and Programs.

1. *Formation of Watershed Forum*. Prior to the date hereof, the Watershed Forum was formed. The Watershed Forum is locally driven but includes the active and committed participation of the SWP Contractor and DWR members of the Forum.

2. *Purpose and Goals*

a. *Generally*. The Watershed Forum's purpose is to implement watershed management and restoration activities for the mutual benefit of Plumas and the SWP. Forum activities include design of, participation in, implementation of, and review of studies and demonstration projects related to watershed restoration.

b. *Specific Goals*. The specific focus of the Watershed Forum's activities is to implement programs designed to achieve the following benefits:

(1) Improved retention (storage) of water for augmented base-flow in streams;

(2) Improved water quality (specifically, reduced sedimentation), and stream bank protection;

(3) Improved upland vegetative management; and

(4) Improved groundwater retention/storage in major aquifers.

c. *Emphasis on Feather River Watershed*. The Watershed Forum specifically promotes and encourages restoration of the Feather River watershed, with particular focus on the drainages of the three SWP Upper Feather River reservoirs. The Watershed Forum seeks to obtain funding and investments in the Feather River watershed in order to facilitate programs that will generate significant local environmental and water supply benefits.

d. *Technical Advisors*. The Watershed Forum will retain a committee of technical advisors to assist the Watershed Forum in identifying activities that can provide timely and practical benefits based on the best scientific and technical information.

3. *General Watershed Forum Issues*

a. *Cooperation*. The Watershed Forum shall seek to foster mutual cooperation and support among Plumas, DWR and other SWP Contractors in achieving local and state-wide goals.

b. *Dispute Resolution*. Any disputes between members of the Watershed Forum, or between Plumas and the Watershed Forum, with respect to Watershed Forum activities and funding will be resolved by retention of a third party neutral expert reasonably acceptable to all members of the Watershed Forum.

c. *Interruption in Funding*. If payments by DWR are interrupted due to litigation challenging any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction, as set forth in Section IV(A)(2)(c), the Parties shall, depending on the success of the watershed work and the litigation situation, give due consideration to the importance of funding watershed work in consecutive years without interruption.

d. *No Limitation on DWR Obligations*. DWR's participation in the Watershed Forum shall not compromise DWR's obligation to be impartial in the distribution of matching funds from public funding sources under its jurisdiction.

C. Plumas Amendment. Upon completion of any necessary environmental review(s), DWR shall offer to Plumas the Plumas Amendment which shall include (1) DWR's agreement that water supplied to Plumas shall be determined

based on availability of water supply from Lake Davis, and (2) DWR's agreement that water deliveries to Plumas will not be reduced during SWP shortages so long as sufficient water is available from Lake Davis. The Plumas Amendment shall apply only to the maximum Table A amount in Plumas' SWP Contract on the date that this Settlement Agreement is executed. The Plumas Amendment shall also contain assurances that Plumas' claim to area-of-origin rights will not be affected by the Amendment. The Plumas Amendment may also contain the Monterey Amendment, as modified to reflect current conditions relating to Plumas, and the Attachment A Amendments.

D. Dialogue between Plumas and DWR. Subject to Plumas' execution of this Settlement Agreement and compliance with the terms herein, DWR agrees to confer with Plumas to develop strategies and actions for the management, operation, and control of SWP facilities in Plumas County in order to increase water supply, recreational, and environmental benefits to Plumas from such facilities. In furtherance thereof, DWR and Plumas agree to evaluate and give due consideration to:

1. the potential re-operation of SWP facilities in Plumas County to increase the water supply available to Plumas;
2. the potential release of water from reservoirs, as part of planned operations, for Plumas' benefit; and
3. the appropriateness of certain charges in Plumas' SWP Contract in light of current circumstances and whether amendments thereto are warranted.

E. Future Relations. Upon the Superior Court's approval of this Settlement Agreement, Plumas agrees to maintain a positive relationship with the SWP Contractors and DWR, and to support the Monterey Amendments and the Attachment A Amendments. Plumas reserves the right to review critically the New EIR.

F. Contract Payments. Plumas shall resume and maintain timely payments under its SWP Contract. Such payments shall begin upon the earlier of (1) the first payment under Section IV(A)(2)(a) or (2) the date that Plumas or its member unit resumes taking water from Lake Davis, and shall cover the period beginning January 1 of that same year. DWR will not seek to collect the amount of any Plumas Arrearages.

V. Kern Water Bank.

A. Title. KWBA shall retain title to the KWB Lands. KWBA may continue to operate and administer the KWB Lands including the water bank, subject to the restrictions herein.

B. Restrictions on Use of KWB Lands.

1. *Continued Use as Water Bank.* As noted in Section III(F), the KWB Lands are subject to the HCP, which documents a plan to accomplish, among other things, certain water conservation and environmental objectives. Except as provided in Sections V(B)(2) and (3), the KWB Lands shall continue to be used for the operation of a water bank and other uses authorized by the HCP, so long as such use remains legally and economically feasible.

2. *Use of KWB Lands for other SWP Purposes*. If (a) the use of the KWB Lands as a water bank is determined by KWBA to no longer be economically and/or legally feasible, (b) DWR concurs with such determination, (c) the KWB Lands can be feasibly used for any of the SWP purposes provided in California Water Code §12930 et seq., and (d) DWR and KWBA agree on terms and conditions for such use, then the KWB Lands may be so used.

3. *Use of KWB Lands for other than SWP Purposes*. If (a) the KWB Lands can not feasibly be used for any of the SWP purposes provided in California Water Code §12930 et seq., or (b) KWBA and DWR are unable to agree on terms and conditions for such use, or (c) DWR determines not to use the KWB Lands for such purposes, then KWBA may transfer or develop all or a portion of the KWB Lands for alternative use(s), provided that any alternate use will not result in unmitigated environmental impacts. A finding by KWBA that such impacts will not occur will be subject to DWR's concurrence.

4. *The 490 Acres*. The approximately 490 acres currently subject to restrictions in the HCP, permitting use thereof as Conservation Bank Lands (as defined in the HCP), but which may be developed under the HCP, will continue to be subject to the restrictions in the HCP but may not be developed.

5. *Application of HCP Restrictions*. All of the KWB Lands, including the 490 acres, will remain subject to the restrictions contained in the HCP.

The restrictions will remain in effect regardless of amendment to, or termination of, the HCP, unless, in the event of such amendment or termination, DWR, after consultation with Plaintiffs, finds that such amendment or termination will not result in unmitigated environmental impacts. The provisions of this clause shall not apply to "Minor Amendments" to the HCP as that term is utilized in the HCP.

6. *Land Use Changes Subject to CEQA.* Changes to the allowable uses of the KWB Lands shall be subject to appropriate environmental review under CEQA.

C. Transfer/Development Proceeds. If all of the KWB Lands are transferred or developed by KWBA, the proceeds of such transfer or development (net of transaction or development costs) will be used for water management purposes identified by KWBA, subject to concurrence by DWR that such use is for bona fide water management purposes; provided, however, so long as the KWB Lands continue to be used for operation of a water bank, the proceeds (net of transaction or development costs) resulting from the transfer or development of a portion of the KWB Lands (which must be consistent with Section V(B)(5)) will be used for water management purposes identified by KWBA, subject to concurrence by DWR that the expenditure is consistent with such purposes.

D. Consultation with Plaintiffs.

1. Except as provided in Section V(D)(2), with respect to any matter that requires DWR's concurrence pursuant to Section V(B) and (C), DWR

shall consult with Plaintiffs prior to making any decision with respect thereto.

2. In lieu of consulting with Plaintiffs, following the conclusion of all litigation challenging CEQA compliance for, or the validity of, the Monterey Amendments, DWR may first provide notice and opportunity to comment to Plaintiffs and the public, and then, at Plaintiffs' request, shall consult with Plaintiffs.

E. Scope of Restrictions. The foregoing restrictions shall only apply to the KWB Lands and shall not affect the use or disposition of water stored under or withdrawn from the KWB Lands.

F. Effective Date of Restrictions. The foregoing restrictions in this Section V shall not be effective unless and until the court in the above-referenced litigation issues an order approving this Settlement Agreement and the Interim Implementation Order (as defined in Section VII(c)). The restrictions in this Section V shall become final only upon (1) filing of the Notice of Determination following the completion of New EIR, (2) discharge of the writ of mandate in the underlying litigation as provided below, and (3) conclusion of all litigation in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction. The continuing effectiveness of the restrictions in this Section V, and the obligations under this Settlement Agreement to comply with these restrictions, are subject to the terms of Section VII(K) below.

VI. Funding To Plaintiffs

A. Agreement to Pay. In accordance with the procedures and subject to the conditions described herein, DWR shall pay to Plaintiffs, collectively, the sum of $5,500,000 (in addition to the $300,000 paid pursuant to Section III(G)).

B. Schedule of Payments.

1. On or before the date that is thirty (30) days after approval of this Settlement Agreement by the Superior Court and issuance of the Interim Implementation Order under Section VII, DWR shall pay to Plaintiffs One Million Eight Hundred Seventy-Five Thousand Dollars ($1,875,000).

2. On or before the first anniversary after the date upon which delivery of funds are made by DWR pursuant to Section VI(B)(1), DWR shall pay to Plaintiffs One Million Eight Hundred Seventy-Five Thousand Dollars ($1,875,000).

3. Subject to Section VI(C), on or before the seventieth (70th) day after the Notice of Determination has been filed for the New EIR (or the first business day after said 70th day if the 70th day is not a business day), DWR shall pay to Plaintiffs One Million Seven Hundred Fifty Thousand Dollars ($1,750,000).

4. All amounts to be paid by DWR under this Section VI(B) shall be paid by wire transfer, in immediately available funds, to a JAMS Trust Account from which funds are to be disbursed therefrom to Plaintiffs in accordance with the Section VI Trust Account Agreement.

C. Effects of Litigation on Payment Obligations.

1. *Suspension of Payment Obligation*. If litigation is commenced by anyone challenging CEQA compliance for, or the validity of, any Monterey Amendment (or any portion thereof), including matters pertaining to the Kern Fan Element Transaction, the monetary obligations of DWR under Section VI(B)(3) shall be suspended until the date that is forty-five (45) days after conclusion of such litigation (without further right of appeal) in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction. Within thirty (30) days after final conclusion of any such litigation in said manner, DWR shall pay to Plaintiffs any amounts then owing under this Section VI.

2. *Termination of Payment Obligation*. If any such litigation results in a final judgment that invalidates any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction, the obligation for payments under Section VI(B)(3) shall automatically terminate.

D. Use of Funds. The funds paid to Plaintiffs under this Section VI shall be used to implement this settlement, as determined by Plaintiffs in their reasonable judgment, including watershed restoration projects, follow-up actions arising from this settlement, and technical studies.

E. Unrelated to Attorney Fees. The payments under this Section VI are exclusive of, and in addition to, any amounts owing by DWR with respect to Plaintiffs' attorney fees, the latter of which are addressed by Section VIII.

VII. Sequence and Process for Implementation of Settlement

This Section VII addresses the process of implementing the terms of this Settlement Agreement to the extent not already addressed in this Settlement Agreement. All issues relating to the implementation of this Settlement Agreement not addressed by this Section VII or elsewhere herein shall be resolved through good faith discussions and mutual agreement among the Parties. If the Parties are unable to agree, the disputed matter shall be referred to and resolved by the Mediator.

A. Non-Reliance on 1995 EIR. DWR and the SWP Contractors who are signatories to this Settlement Agreement agree that they will not approve any new project or activity in reliance on the 1995 EIR, that was not approved, initiated or implemented prior to March 26, 2001, and the approval, initiation or implementation of which would require a separate environmental impact report or negative declaration under CEQA (other than, or in addition to, the 1995 EIR).

B. Attachment A Amendments. Within sixty (60) days after this Settlement Agreement is executed by all of the Parties, each of the SWP Contractors who are parties to this Settlement Agreement shall cause a duly authorized representative to execute an Attachment A Amendment, and deliver the executed Amendment to DWR. Upon approval of this Settlement Agreement by the Superior Court and issuance of the Interim Implementation Order, as discussed in Section VII(C), DWR shall execute the Attachment A Amendments. Thereupon, the Attachment A Amendments shall be deemed effective on an interim basis, and will not thereafter be modified without the written consent of the Plaintiffs, prior to the discharge of the writ of mandate. The Attachment A Amendments shall become

final upon (1) the filing of the Notice of Determination following the completion of the New EIR, (2) discharge of the writ of mandate in the underlying litigation as provided below, and (3) conclusion of all litigation in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction.

C. Motion for Order Approving Settlement Agreement and Interim Implementation Order. As soon as practical after the execution of this Settlement Agreement, the Parties shall jointly file with the Superior Court a motion for (1) an order approving this Settlement Agreement, and (2) an order (the "**Interim Implementation Order**") specifically authorizing on an interim basis, pursuant to Public Resources Code Section 21168.9, the administration and operation of the SWP and the KWB Lands, pending discharge of the writ of mandate in the underlying litigation, in accordance with the Monterey Amendments (as limited by Section VII(A) above), as supplemented by the Attachment A Amendments and the other terms and conditions of this Settlement Agreement, including the provisions in Section V(B) regarding the KWB Lands. Said motion shall include the proposed Section 21168.9 order attached hereto as Exhibit 3-A, and the proposed writ of mandate referenced therein and attached hereto as Exhibit 3-B. The parties shall jointly move the Superior Court for approval of said order and writ. Subject to Section VII(J), and except as provided in Section VII(I), Plaintiffs shall not seek any further order or writ concerning the Monterey Amendments or the New EIR.

D. Implementation of New Policies, Procedures and Guidelines. DWR has issued a [draft] Report of State Water Project Supply Reliability in response to paragraph 1 of the Attachment B Principles. Upon the Superior Court's approval of this Settlement Agreement, DWR shall issue Contractors' Memos on (1) the Attachment C Guidelines and (2) the Attachment D Principles. After the Superior Court's approval of this Settlement Agreement, and in no event later than January 1, 2004, DWR shall issue Contractors' Memos on the remainder of the Attachment B Principles (i.e., paragraphs 2 and 3). DWR may rely on DWR publications previously issued to comply with paragraph 2 of the Attachment B Principles, if appropriate.

E. Dismissal of Validation Cause of Action. Upon the execution of this Settlement Agreement by all the Parties and execution of the Attachment A Amendments as set forth in Section VII(B) and issuance by DWR of the Contractor Memos referenced in the second sentence of Section VII(D), Plaintiffs shall file a request for dismissal without prejudice of the Validation Cause of Action. So long as such conditions are timely met, Plaintiffs covenant and agree not to refile the Validation Cause of Action, nor any new cause of action relating thereto, nor a new claim challenging the validity of any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction.

F. Tolling of Statute of Limitations. As between Plaintiffs, DWR and the SWP Contractors who are signatories to this Settlement Agreement, it is agreed that the statute of limitations relating to the Validation Cause of Action shall be tolled as

to Plaintiffs until the date that is forty-five (45) days after the filing of the Notice of Determination for the New EIR.

G. Notice of Determination, Return to Writ and Motion for Order Discharging Writ. Upon completion of the New EIR, DWR will file with the Superior Court (1) a Notice of Determination including a copy of the New EIR, (2) a return to writ of mandate (the "**Return to Writ**"), (3) a request for an order discharging the writ of mandate previously issued by the Superior Court in the underlying case and (4) any other information required by the Superior Court for a discharge of writ.

H. Consent to Entry of Order Discharging Writ.

1. *Obligation to File.* Concurrent with DWR's filings referenced in Section VII(G), subject only to Sections VII(H)(2) and (3), and provided Plaintiffs have not challenged the Return to Writ (under the procedures set forth in Section VII(I)), Plaintiffs shall file with the Superior Court a pleading consenting to entry of an order discharging the writ of mandate (the "**Consent to Entry of Order Discharging Writ**").

2. *Conditions Precedent to Filing.* Plaintiffs' obligation to file the Consent to Entry of Order Discharging Writ shall be subject to, and conditioned upon, satisfaction of the requirement set forth in Section VII(B).

3. *Earliest Effective Date of Discharge of Writ.* The discharge of the writ of mandate shall not be effective until at least forty-five (45) days after the filing of the Notice of Determination for the New EIR.

I. Subsequent CEQA Challenge.

1. *Limited Basis for Challenge.* Plaintiffs may only challenge the Return to Writ if, during the preparation and review of the New EIR, (a) Plaintiffs

objected to the Mediator based on one or more Mediation Issues, (b) the Mediator upheld that objection in a written advisory opinion as described in Section III(H), (c) DWR rejected such written advisory opinion in its final decision, either expressly or as evidenced by the contents of the final New EIR, and (d) the challenge that Plaintiffs file to the Return to Writ is on the same ground(s) as the objection upheld by Mediator in the advisory opinion. Where such an objection was made to the Mediator and Plaintiffs file such a challenge to the Return to Writ, DWR shall maintain the advisory opinion as a public record. With respect to clause (c) of this subsection (I)(1), if the Parties dispute whether DWR has rejected the Mediator's advisory opinion, such matter shall be referred to the Mediator and (s)he shall make a final determination with respect thereto in accordance with Article IX.

2. *Stipulation to Continued Operations*. In the event of such a challenge, the challenging party will stipulate that, pending compliance with such writ as the court may issue, administration and operation of the SWP may continue in accordance with the Interim Implementation Order.

3. *Order for New EIR*. If such a challenge results in an order that DWR must prepare a new or supplemental environmental impact report, the provisions set out in Section III (regarding preparation of New EIR) shall be followed, and at the conclusion of the process, the provisions of Section VII(H) (filing of a Consent to Entry of Order Discharging Writ) and this Section VII(I) shall apply.

J. No Future Challenges. Except as specifically authorized herein, and as a condition to the initial and continuing effectiveness of this Settlement Agreement, Plaintiffs agree not to initiate any future litigation challenging the validity of any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction.

K. Mutual Interdependency. On an interim and final basis, the Attachment A Amendments, the Plumas Amendment, the provisions regarding the KWB Lands described in Section V(B), and the continued operations of the SWP based on the Monterey Amendments are mutually interdependent.

L. Implementation Dispute Resolution. Disputes arising in the implementation of this Settlement Agreement shall be addressed in accordance with Section IX.

VIII. Attorney Fees

Within forty-five (45) days after the execution of this Settlement Agreement by all Parties, the Parties shall engage in arbitration to determine the amount of attorney fees and costs to be paid to Rossmann as Plaintiffs' counsel. Such arbitration shall be conducted pursuant to the following terms and conditions:

A. The arbitrator will be selected by mutual agreement of the Parties. If the Parties cannot agree on the arbitrator, the Mediator will designate the arbitrator. JAMS arbitration rules will apply, providing for limited and focused discovery, but the arbitrator may be anyone the Parties select regardless of his/her professional affiliation.

B. Within five (5) business days after commencement of the arbitration, Rossmann shall file with the arbitrator a petition for fees. The petition for fees shall identify, in sufficient detail acceptable to the arbitrator, all fees for: (1) past service in the underlying litigation; (2) fees for participation in the settlement mediation to the

date thereof; and (3) projected fees for services to be rendered in implementing the Settlement Agreement, including fees incurred in advising Plaintiffs in connection with their participation in, and service on, the EIR Committee.

C. Rossmann may apply for a multiplier on fees earned in the underlying litigation. The award for fees relating to mediation and settlement implementation shall be subject to the lodestar amount and shall not include a multiplier.

D. The costs of the arbitration will be borne one-third (1/3) by Plaintiffs and two-thirds (2/3) by DWR.

E. DWR and CCWA reserve all rights and defenses, except the right to challenge Rossmann's entitlement to fees relating to the mediation and settlement implementation stages.

F. The arbitrator shall determine the amount of the award within thirty (30) days after submission of the fee petition to the arbitrator. The arbitrator's determination shall be binding upon the Parties.

G. DWR shall pay the fee award to Rossmann in accordance with the following schedule:

1. Sixty percent (60%) within thirty (30) days after the award;
2. Thirty percent (30%) within thirty (30) days after the filing of the Return to Writ with the Superior Court; and
3. Ten percent (10%) within thirty (30) days after the Plaintiffs' filing of the Consent to Entry of Order Discharging Writ with the Superior Court.

H. The amount of $100,000 previously paid as attorney fees to Rossmann by DWR will be credited toward the amount owed by DWR hereunder as determined by the arbitrator.

IX. Dispute Resolution

The Parties agree to cooperate in implementing this Settlement Agreement and to try in good faith to resolve any disputes. In addition, until the conclusion of the underlying litigation, as evidenced by the issuance of an order discharging the writ of mandate, the Mediator will decide all unresolved issues involving the interpretation and implementation of this Settlement Agreement and, to the extent permitted by law, will be authorized to enforce its terms, except for those matters properly reserved to the jurisdiction of the Superior Court. Any party may request a conference before the Mediator on seventy-two (72) hours' advance written notice to the Mediator and the other Parties. The Mediator will have the power to award reasonable attorney fees to the prevailing party in the event of frivolous, harassing or untimely motions. The party who initiates a dispute resolution proceeding with the Mediator pursuant to this Section IX shall be solely responsible for the payment of the Mediator's costs and expenses, except as otherwise provided herein.

X. Miscellaneous

A. No Admission. By entering into this Settlement Agreement, the Plaintiffs do not endorse or admit the validity of the Monterey Amendments, and neither DWR, KWBA, nor any of the SWP Contractors who are signatories hereto admit any of the Plaintiffs' allegations in the pending litigation including those concerning the Monterey Amendments and/or the Kern Fan Element Transaction.

B. Compliance with Laws. The Parties agree that nothing in this Settlement Agreement is intended to limit the discretion granted by law, including CEQA, to DWR, as lead agency and as the State agency responsible for administration and operation of the SWP, or the duty of DWR to comply with applicable requirements of law, including those of CEQA and the California Water Code.

C. Authority. Each of the Parties represents that: (1) it has the authority to execute and enter into this Settlement Agreement; (2) the individual executing this Settlement Agreement on behalf of the Party has the authority and has been specifically authorized to execute and deliver this Settlement Agreement on behalf of such Party; (3) upon execution by such person on behalf of the Party, this Settlement Agreement shall be valid and enforceable against such Party in accordance with the terms hereof; (4) the Party is authorized to implement this Settlement Agreement, without further action by the Party or its governing body, board of directors, or any other person or entity, as the case may be; and (5) the execution and entry into this Settlement Agreement and the implementation of its terms by the Party is not in violation of any applicable law or any other contract or agreement by which it is bound or to which it is a party. The Parties acknowledge that although DWR plans to make payments required under this Agreement pursuant to its authority under the State Water Resources Development System (Water Code Sections 12930 et seq.), and that under such authority accruals are continuously appropriated without regard to fiscal years (Water Code Section 12938), any such payments may nevertheless be contingent on the annual Budget Act and, under certain circumstances, payments may be

delayed or halted by non-party government authorities. If any payment under this Settlement Agreement is delayed beyond the date it is due, the amount due shall accrue interest at the rate of the State Pooled Money Investment Fund for the first forty-five (45) days after it is due and at eight percent (8%) per annum thereafter. The foregoing does not limit Plaintiff's rights to seek legal or equitable relief in the event of a breach of this Settlement Agreement.

D. Not a General Appearance or Concession to Jurisdiction. The execution of this Settlement Agreement by the SWP Contractors and KWBA does not constitute a general appearance in the underlying litigation, nor does it constitute a concession to jurisdiction of the Superior Court over the SWP Contractors or KWBA other than for the purpose of enforcing the terms of this settlement.

E. Successors and Assigns. This Settlement Agreement shall be binding upon and inure to the benefit of the Parties and their respective heirs, legal representatives, successors and assigns. No Party may assign their rights under this Settlement Agreement without the prior written consent of the other Parties.

F. Governance. This Agreement shall be construed under and enforced in accordance with the substantive laws of the State of California.

G. Entirety of Agreement; No Amendment. This Settlement Agreement sets forth the entire agreement among the Parties and supersedes all prior oral or written agreements, negotiations, discussions, or understandings concerning the subject matter hereof. The terms of this Settlement Agreement may not be altered, amended, waived or modified, except by a further written agreement signed by all Parties.

H. Mutual Preparation. The Parties each cooperated in the drafting and preparation of this Settlement Agreement. Thus, the language of all parts of this Settlement Agreement shall in all cases be construed as a whole, according to its fair meaning, and not strictly for or against any Party as the drafter thereof.

I. Further Acts. Each Party agrees to make, execute and deliver such other instruments or documents, and to do or cause to be done such further or additional acts, as reasonably may be necessary in order to effectuate the purposes or to implement the terms of this Settlement Agreement.

J. No Waiver. No waiver of any breach of any term or provision of this Settlement Agreement shall be construed to be, nor shall be, a waiver of any other breach of this Settlement Agreement. No waiver shall be binding unless in writing and signed by the Party waiving the breach. With respect to any breach of this Settlement Agreement by Plaintiffs, such breach may only be waived in writing by DWR, KCWA and The Metropolitan Water District of Southern California. With respect to any breach of this Settlement Agreement by the non-Plaintiffs, such breach may only be waived in writing by the Plaintiffs.

K. No Representations or Warranties. Each of Parties represents and declares that in executing this Settlement Agreement, it has relied solely upon its own judgment, belief and knowledge, and on the advice and recommendations of its independently selected counsel, concerning the nature, extent and duration of its rights and claims and that it has not been influenced to any extent whatsoever in executing the same by any representations or statements covering any matters made by any of the Parties or by any person representing them or any of them.

Each Party acknowledges that no other Party nor any of their representatives has made any promise, representation or warranty whatsoever, written or oral, as any inducement to enter into this Settlement Agreement, except as expressly set forth in this Settlement Agreement.

L. Independent Investigations. Each Party has made such investigation of the facts pertaining to this settlement and this Settlement Agreement and of all matters pertaining thereto as it deems necessary.

M. Survival. The representations, warranties and covenants contained in this Settlement Agreement are deemed to and shall survive the execution and delivery of this Settlement Agreement by all of the Parties.

N. Headings. All headings in this Settlement Agreement are included for convenience and reference only and shall not constitute a part of this Settlement Agreement for any purpose.

O. Not Binding on Others. This Settlement Agreement is not intended to, nor shall it (1) bind any non-Party persons or entities as to any claims or defenses they may otherwise now or in the future hold, or (2) waive any claims or defenses any Party hereto may have now or in the future against such non-Party persons or entities.

P. Counterparts. This Settlement Agreement may be executed in counterparts, each of which shall constitute an original, but all of which shall constitute one and the same agreement, provided each signing Party shall have received a copy of the signature page signed by every other Party.

Q. Voluntary and Knowing Execution. EACH PARTY REPRESENTS AND WARRANTS THAT IT HAS THOROUGHLY READ AND CONSIDERED

ALL ASPECTS OF THIS SETTLEMENT AGREEMENT, THAT IT UNDERSTANDS ALL PROVISIONS OF THIS SETTLEMENT AGREEMENT, THAT IT HAS HAD THE OPPORTUNITY TO CONSULT WITH COUNSEL THROUGHOUT THIS PROCESS AND THAT IT IS VOLUNTARILY ENTERING INTO THIS SETTLEMENT AGREEMENT OF ITS OWN FREE WILL, WITHOUT DURESS OR COERCION OF ANY KIND.

R. Obligations Dependent on Validity of Monterey Amendments. With respect to any obligation in this Settlement Agreement that terminates or is suspended upon a challenge to or final judgment that invalidates any portion of any Monterey Amendment, such termination or suspension of such obligation may be avoided if such invalidity is explicitly and irrevocably waived in accordance with the procedures set forth in Paragraph 29 of the Monterey Amendments.

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{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

IN WITNESS WHEREOF, the Parties have executed this Settlement Agreement as of the date first set forth above.

PLANNING AND CONSERVATION LEAGUE

By: Sage Sweetwood
Name: Sage Sweetwood
Title: President

PLUMAS COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

By: B. J. Pearson
Name: B. J. Pearson
Title: Chair, Board of Supervisors
Ex-officio Chair, District Board of Directors

CITIZENS PLANNING ASSOCIATION OF SANTA BARBARA COUNTY, INC.

By: Louise Boucher
Name: Louise Boucher
Title: President,
Citizens Planning association of Santa Barbara, Inc.

[Remainder of Page Intentionally Blank – Additional Signatures Follow]

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

By: _____

Name: Thomas M. Hannigan
Title: Director

Approved as to legal form and sufficiency:

By: _____

Name: Peggy Bernardy
Title: Chief Counsel

ALAMEDA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT, ZONE 7

By: _____

Name: William R. Stevens

Title: President, Board of Directors

Approved as to Form
RICHARD E. WINNIE, County Counsel

By _____

ALAMEDA COUNTY WATER DISTRICT

By: _____

Name: John H. Weed

Title: President

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

ANTELOPE VALLEY-EAST KERN WATER AGENCY

By: Andy D. Rutledge

Name: Andy D. Rutledge

Title: Board President

CASTAIC LAKE WATER AGENCY

By: Dan Masnada

Name: DAN MASNADA

Title: GENERAL MANAGER

CITY OF YUBA

By: William P. Lewis

Name: WILLIAM P. LEWIS

Title: UTILITIES DIRECTOR

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

COACHELLA VALLEY WATER DISTRICT

By: John W. McFadden

Name: John W. McFadden

Title: President of the Board of Directors

COUNTY OF BUTTE

By: R. J. Beeler

Name: R. J. BEELER

Title: Chairman, Board of Supervisors

COUNTY OF KINGS 3-25-03

By: Joe Neves

Name: JOE NEVES

Title: CHAIRMAN

CRESTLINE-LAKE ARROWHEAD WATER AGENCY

By: James J. McCrory

Name: James J. McCrory

Title: President, Board of Directors

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

DESERT WATER AGENCY

By: _____

Name: Dan M. Ainsworth

Title: General Manager

DUDLEY RIDGE WATER DISTRICT

By: _____

Name: Joe MacIlvaine

Title: President

KERN COUNTY WATER AGENCY

By: _____

Name: Terry Rogers

Title: President

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

LITTLEROCK CREEK IRRIGATION DISTRICT

By: Frances Young

Name: _____

Title: President

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

By: Ronald R Gastelum

Name: Ronald R Gastelum

Title: CEO

MOJAVE WATER AGENCY

By: K Brill

Name: Kirby Brill

Title: General Manager

NAPA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

By: Mike Rippey

Name: Mike Rippey

Title: Vice-Chair

APPROVED 3/18/03
FLOOD CONTROL & WATER
CONSERVATION DISTRICT

~~MARY JEAN MCLAUGHLIN~~
SECRETARY OF THE DISTRICT

BY S. Vattuone Deputy

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

OAK FLAT WATER DISTRICT

By: William D. Harrison

Name: WILLIAM D. HARRISON

Title: MANAGER / SECRETARY

PALMDALE WATER DISTRICT

By: Leslie O. Carter

Name: Leslie O. Carter

Title: President, Board of Directors

SAN BERNARDINO VALLEY MUNICIPAL WATER DISTRICT

By:

Name: C. Patrick Milligan

Title: President

SAN GABRIEL VALLEY MUNICIPAL WATER DISTRICT

By:

Name: J. C. Reichenberger

Title: President

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

SAN GORGONIO PASS WATER AGENCY

By: _____

Name: Stephen P. Stockton

Title: General Manager/Chief Engineer

SAN LUIS OBISPO COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

By: _____

Name: MICHAEL P. RYAN

Title: Chairman of the Board of Supervisors

SANTA BARBARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

By: _____

Name: _____

Title: _____

APPROVE AS TO ACCOUNTING:
ROBERT W. GEIS, CPA
AUDITOR-CONTROLLER

BY: _____
Deputy

ATTEST:
MICHAEL F. BROWN
CLERK OF THE BOARD

BY: _____
Deputy

APPROVED AS TO FORM:
STEPHEN SHANE STARK
COUNTY COUNSEL

BY: _____
Deputy

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

SANTA CLARA VALLEY WATER DISTRICT

By: _____

Name: Stanley M. Williams

Title: Chief Executive Officer

SOLANO COUNTY WATER AGENCY

By: _____

Name: Don Holdener

Title: Chairman, Board of Directors

TULARE LAKE BASIN WATER STORAGE DISTRICT

By: _____

Name: THOMAS R. HURLBUTT

Title: PRESIDENT

VENTURA COUNTY FLOOD CONTROL DISTRICT

By: _____

Name: Jeff Pratt

Title: Director - Watershed Protection

{SIGNATURES CONSOLIDATED BY THE STATE WATER PROJECT ANALYSIS OFFICE OF THE DEPARTMENT OF WATER RESOURCES}

CENTRAL COAST WATER AUTHORITY

By: _____

Name: William J. Brennan

Title: Executive Director

KERN WATER BANK AUTHORITY

By: _____

Name: **William D. Phillimore, Chairman**

Title: **Chairman**

ATTACHMENT A

AMENDMENT TO STATE WATER PROJECT CONTRACT

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. ____ TO THE WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND _____

This amendment is made this ____ day of _____, 2003, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, hereinafter referred to as the "State", and _____, hereinafter referred to as the "District" [or "Agency"].

RECITALS

WHEREAS, the State and the District entered into and subsequently amended a water supply contract (the "contract") providing that the State shall supply certain quantities of water to the District and providing that the District shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payments; and

WHEREAS, on December 1, 1994, the State and representatives of certain State Water Project contractors executed a document entitled "Monterey Agreement – Statement of Principles – By The State Water Contractors And The State Of California Department Of Water Resources For Potential Amendments To The State Water Supply Contracts" (the "Monterey Agreement"); and

WHEREAS, the State, the Central Coast Water Authority ("CCWA") and those contractors intending to be subject to the Monterey Agreement subsequently negotiated an amendment to their contracts to implement provisions of the Monterey Agreement, and such amendment was named the "Monterey Amendment"; and

WHEREAS, in October 1995, an environmental impact report ("EIR") for the Monterey Amendment was completed and certified by CCWA as the lead agency, and thereafter the District and the State executed the Monterey Amendment; and

WHEREAS, the EIR certified by the CCWA was challenged by several parties (the "Plaintiffs") in the Sacramento County Superior Court and thereafter in the Third District Court of Appeal, resulting in a decision in *Planning and Conservation League, et al. v. Department of*

Water Resources, 83 Cal.App.4th 892 (2000), which case is hereinafter referred to as "PCL v. DWR"; and

WHEREAS, in its decision, the Court of Appeal held that (i) the Department of Water Resources ("DWR"), not CCWA, had the statutory duty to serve as lead agency, (ii) the trial court erred by finding CCWA's EIR sufficient despite its failure to discuss implementation of Article 18, subdivision (b) of the State Water Project contracts, as a no-project alternative, (iii) said errors mandate preparation of a new EIR under the direction of DWR, and (iv) the trial court erroneously dismissed the challenge to DWR's transfer of title to certain lands to Kern County Water Agency (the "Validation Cause of Action") and execution of amended State Water Project contracts for failure to name and serve indispensable parties. The Court of Appeal remanded the case to the trial court, ordering it to take the following five actions: (1) vacate the trial court's grant of the motion for summary adjudication of the Validation Cause of Action; (2) issue a writ of mandate vacating the certification of the EIR; (3) determine the amount of attorney fees to be awarded Plaintiffs; (4) consider such orders it deems appropriate under Public Resources Code Section 21168.9(a) consistent with the views expressed in the Appellate Court's opinion; and (5) retain jurisdiction over the action until DWR, as lead agency, certifies an environmental impact report in accordance with CEQA standards and procedures, and the Superior Court determines that such environmental impact report meets the substantive requirements of CEQA; and

WHEREAS, the State, the contractors, and the Plaintiffs in *PCL v. DWR* reached an agreement to settle *PCL v. DWR*, as documented by that certain Settlement Agreement dated _____, 2003 (the "Settlement Agreement"), and in such Settlement Agreement have agreed that the contracts should be amended, for clarification purposes, to delete terms such as "annual entitlement" and "maximum annual entitlement" so that the public, and particularly land use planning agencies, will better understand the contracts; and

WHEREAS, pursuant to the Settlement Agreement, the State and the District desire to so amend the District's contract, with the understanding and intent that the amendments herein with respect to subsections (m), (n), and (o) of Article 1, subsection (b) of Article 6, and subsection (a) of Article 16, and to Table A of the District's contract are solely for clarification purposes and that such amendments are not intended to and do not in any way change the rights, obligations or limitations on liability of the State or the District established by or set forth in the contract; and

WHEREAS, pursuant to the Settlement Agreement, the State, the contractors and the Plaintiffs in *PCL v. DWR* also agreed that the contracts should be amended to include a new Article 58 addressing the determination of dependable annual supply of State Water Project water to be made available by existing Project facilities, and the State and District desire to so amend the District's contract.

NOW THEREFORE, IT IS MUTUALLY AGREED, as follows:

1. Article 1(n) is amended to read:[1]

(n) **Annual Table A Amount**

"Annual Table A Amount" shall mean the amount of project water set forth in Table A of this contract that the State, pursuant to the obligations of this contract and applicable law, makes available for delivery to the District at the delivery structures provided for the District. The term Annual Table A Amount shall not be interpreted to mean that in each year the State will be able to make that quantity of project water available to the District. The Annual Table A Amounts and the terms of this contract reflect an expectation that under certain conditions the District will receive its full Annual Table A Amount; but that under other conditions only a lesser amount, allocated in accordance with this contract, may be made available to the District. This recognition that full Annual Table A Amounts will not be deliverable under all conditions does not change the obligations of the State under this contract, including but not limited to, the obligations to make all reasonable efforts to complete the project facilities, to perfect and protect water rights, and to allocate among contractors the supply available in any year, as set forth in Articles 6(b), 6(c), 16(b) and 18, in the manner and subject to the terms and conditions of those articles and this contract. Where the term "annual entitlement" appears elsewhere in this contract, it shall mean "Annual Table A Amount." The State agrees that in future amendments to this and other contractor's contracts, in lieu of the term "annual entitlement," the term "Annual Table A Amount" will be used and will have the same meaning as "annual entitlement" wherever that term is used.

2. Article 1(o) is amended to read:

(o) Maximum Annual Table A Amount

"Maximum annual entitlement" shall mean the maximum annual amounts set forth in Table A of this contract, and where the term "maximum annual entitlement" appears elsewhere in this contract it shall mean "Maximum Annual Table A Amounts."

3. Article 1(m) is amended to read:

(m) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available assuming completion of the initial project conservation facilities and additional project conservation facilities. The project's capability of providing the minimum project yield shall be determined by the State on the basis of coordinated operations studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon factors including but not limited to: (1) the estimated relative proportion of deliveries for agricultural use to deliveries for municipal use assuming Maximum Annual Table A Amounts

[1] The number of the articles is not the same for all the Water Supply Contractors. Article 1(n) is intended to be the article presently entitled "Annual Entitlement", whatever its number may be in each District's contract. The article numbers may have to be changed for each contractor to reflect the numbers in its contract.

for all contractors and the characteristic distributions of demands for these two uses throughout the year; and (2) agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the division of utilization of waters of the Delta or streams tributary thereto.

4. Article 6(b) is amended to read:

(b) District's Annual Table A Amounts

Commencing with the year of initial water delivery to the District, the State each year shall make available for delivery to the District the amounts of project water designated in Table A of this contract, which amounts shall be subject to change as provided for in Article 7(a) and are referred to in this contract as the District's Annual Table A Amounts.

5. Article 16(a) is amended to read:

(a) Limit on Total of all Maximum Annual Table A Amounts

The District's Maximum Annual Table A Amount hereunder, together with the maximum Table A amounts of all other contractors, shall aggregate no more than 4,185,000 acre-feet of project water.

6 Article 58 is added to read:

58. **Determination of Dependable Annual Supply of Project Water to be Made Available by Existing Project Facilities.**

In order to provide current information regarding the delivery capability of existing project conservation facilities, commencing in 2003 and every two years thereafter the State shall prepare and mail a report to all contractors, and all California city, county, and regional planning departments and agencies within the contractors' project service areas. This report will set forth, under a range of hydrologic conditions, estimates of overall delivery capability of the existing project facilities and of supply availability to each contractor in accordance with other provisions of the contractors' contracts. The range of hydrologic conditions shall include the delivery capability in the driest year of record, the average over the historic extended dry cycle and the average over the long-term. The biennial report will also include, for each of the ten years immediately preceding the report, the total amount of project water delivered to all contractors and the amount of project water delivered to each contractor.

7. Add the following language at the bottom of Table A:

In any year, the amounts designated in this Table A shall not be interpreted to mean that the State is able to deliver those amounts in all years. Article 58 describes the State's process for providing current information for project delivery capability.

8. Except for Article 58, the changes made by this amendment are solely for clarification purposes, and are not intended to nor do they in any way change the rights, obligations or

limitations on liability of the State or the District established by or set forth in the contract, and this amendment shall be interpreted in accordance with this intent.

9. At the time of execution of this Agreement and thereafter, the effectiveness of this Amendment is dependent upon the effectiveness of the District's Monterey Amendment (all provisions therein) and the Kern Fan Element Transaction.

IN WITNESS WHEREOF, the parties hereto have executed this amendment on the date first above written.

STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES

By: _____
Name: _____
Title: Director

Approved as to legal form and sufficiency:

By: _____
Name: _____
Title: Chief Counsel

Attest:

_____ DISTRICT

By: _____
Name: _____
Title: _____

ATTACHMENT B

PRINCIPLES REGARDING STATE WATER PROJECT AVAILABILITY

Note: These principles are prepared in connection with the settlement agreement between PCL and DWR and are only effective pursuant to the terms therein.

1. Commencing in 2003, and every two years thereafter, the Department of Water Resources (DWR) shall prepare and deliver to all State Water Project (SWP) contractors, all city and county planning departments, and all regional and metropolitan planning departments within the project service area a report which accurately sets forth, under a range of hydrologic conditions, the then existing overall delivery capability of the project facilities and the allocation of that capacity to each contractor. The range of hydrologic conditions shall include the historic extended dry cycle and long-term average. The biennial report shall also disclose, for each of the ten years immediately preceding the report, the total amount of project water delivered and the amount of project water delivered to each contractor. The information presented in each report shall be presented in a manner readily understandable by the public.

2. DWR shall develop and, by January 1, 2004, publish guidelines to assist Municipal and Industrial Contractors in providing accurate information to land-use planning agencies with jurisdiction within the Contractors' respective service areas regarding local and regional programs to manage or supplement SWP supplies. DWR shall consult with the plaintiffs and contractors in developing the guidelines.

3. DWR shall provide assistance to enable all Municipal and Industrial Contractors to provide complete and accurate information to relevant land-use planning agencies to assure that local land-use decisions reflect accurate information on the availability of water from state, local, and other sources.

ATTACHMENT C

DWR GUIDELINES FOR REVIEW OF PROPOSED PERMANENT TRANSFERS OF STATE WATER PROJECT ANNUAL TABLE A AMOUNTS

Note: These guidelines are prepared in connection with the settlement agreement between PCL and DWR and are only effective pursuant to the terms therein.

1. Purpose: The purpose of these guidelines is to describe the process for DWR's review of proposed permanent transfers of SWP Annual Table A Amounts and by so doing, provide disclosure to SWP Contractors and to the public of DWR's process and policy on approving permanent transfer of SWP Annual Table A Amounts. Such disclosure should assist contractors in developing their transfer proposals and obtaining DWR review expeditiously, and assist the public in participating in that review.

2. Coverage: These guidelines will apply to DWR's approval of permanent transfers of water among existing SWP Contractors and, if and when appropriate, to permanent transfers of water from an existing SWP Contractor to a new SWP Contractor.

3. Interpretation: These guidelines are in furtherance of the state policy in favor of voluntary water transfers and shall be interpreted consistent with the law, including but not limited to Water Code Section 109, the Burns-Porter Act, the Central Valley Project Act, the California Environmental Quality Act, area of origin laws, the public trust doctrine, and with existing contracts and bond covenants. These guidelines are not intended to change or augment existing law.

4. Format: The guidelines shall be issued by DWR as a "Notice to State Water Contractors."

5. Revisions: Revisions may be made to these guidelines as necessary to meet changed circumstances, changes in the law or long-term water supply contracts, or to address conditions unanticipated when the guidelines are adopted. Revisions shall be in accordance with the settlement agreement reached in *Planning and Conservation League vs. Department of Water Resources*.

6. Distribution: The transfer guidelines shall be published by DWR in the next available edition of Bulletin 132, and also as part of the biennial disclosure of SWP reliability as described in the PCL v. DWR Settlement Agreement.

7. Contract Amendment: Permanent transfers of SWP water are accomplished by amendment of each participating contractor's long-term water supply contract. The amendment consists of amending the Table A upwards for a buying contractor and downwards for a selling contractor. The amendment shall be in conformity with all provisions of the long-term water supply contracts, applicable laws, and bond covenants. Other issues to be addressed in the contract amendment will be subject to negotiation among DWR and the two participating contractors. The negotiations will be conducted in public, pursuant to the settlement agreement in PCL vs. DWR.

8. Financial issues: The purchasing contractor must demonstrate to the DWR's satisfaction that it has the financial ability to assume payments associated with the transferred water. If the purchasing entity was not a SWP Contractor as of 2001, special financial requirements pertain as described below, as well as additional qualifications.

9. Compliance with CEQA: Consistent with CEQA, the State's policy to preserve and enhance environmental quality will guide DWR's consideration of transfer proposals (Public Resources Code Section 21000). Identification of the appropriate lead agency will be based on CEQA, the CEQA Guidelines, and applicable caselaw, including *Planning and Conservation League vs. Department of Water Resources, 83 Cal. App. 4th 892 (2000).* CEQA requires the lead agency at a minimum to address the feasible alternatives to the proposed transfer and its potentially significant environmental impacts (1) in the selling contractor's service area; (2) in the buying contractor's service area; (3) on SWP facilities and operations; and (4) on the Delta and areas of origin and other regions as appropriate. Impacts that may occur outside of the transferring SWP Contractors' service areas and on fish and wildlife shall be included in the environmental analysis. DWR will not approve a transfer proposal until CEQA compliance is completed. The lead agency shall consult with responsible and trustee agencies and affected cities and counties; and when DWR is not the lead agency, shall provide an administrative draft of the draft EIR or Initial Study/Negative Declaration to DWR prior to the public review period. A descriptive narrative must accompany a checklist, if a checklist is used. The lead agency shall conduct a public hearing on the EIR during the public comment period and notify DWR's State Water Project Analysis Office of the time and place of such hearing in addition to other notice required by law.

10. Place of Use: The purchasing contractor must identify the place and purpose of use of the purchased water, including the reasonable and beneficial use of the water. Typically this information would be included in the environmental documentation. If a specific transfer proposal does not fit precisely into any of the alternatives listed below, DWR will use the principles described in these Guidelines to define the process to be followed. The information to be provided under this paragraph is in addition to the CEQA information described in paragraph 9 of these guidelines.

a) If the place of use is within the contractor's service area, the contractor should disclose the purpose of the transferred water, such as whether the water is being acquired for a specific development project, to enhance overall water supply reliability in the contractor's service area, or some other purpose. If the transferred water is for a municipal purpose, the contractor should state whether the transfer is consistent with its own Urban Water Management Plan or that of its member unit(s) receiving the water.

b) If the place of use is outside the contractor's service area, but within the SWP authorized place of use, and service is to be provided by an existing SWP Contractor: In addition to Paragraph 10(a) above, the contractor should provide DWR with copies of LAFCO approval and consent of the water agency with authority to serve that area, if any. In some instances, DWR's separate consent is required for annexations in addition to the approval for the transfer.

c) If the place of use is outside the SWP authorized place of use and service is to be provided by an existing SWP Contractor, the contractor should provide information in Paragraph 10(a) and 10(b). Prior to approving the transfer, DWR will consider project delivery capability, demands for water supply from the SWP, and the impact, if any, of the proposed transfer on such demand. If DWR approves the transfer, DWR will petition State Water Resources Control Board for approval of expansion of authorized place of use. Water will not be delivered until the place of use has been approved by the SWRCB and will be delivered in compliance with any terms imposed by the SWRCB.

d) If the place of use is outside the SWP authorized place of use and service is not to be provided by an existing SWP contractor, DWR will consider the transfer proposal as a proposal to become a new state water contractor. Prior to adding a new SWP Contractor, DWR will consider project delivery capability, demands for water supply from the SWP, and the impact, if any, of the proposed transfer on such demand. DWR will consult with existing SWP Contractors regarding their water supply needs and the proposed transfer. In addition to the information in Paragraph 10(a), 10(b), and 10(c), the new contractor should provide information similar to that provided by the original SWP contractors in the 1960's Bulletin 119 feasibility report addressing hydrology, demand for water supply, population growth, financial feasibility, etc. DWR will evaluate these issues independently and ordinarily will act as lead agency for CEQA purposes. In addition, issues such as area of origin claims, priorities, environmental impacts and use of water will be addressed. The selling contractor may not be released from financial obligations. The contract will be subject to a CCP 860 validation action initiated by the new contractor. If DWR approves the transfer, DWR will petition State Water Resources Control Board for approval of expansion of authorized place of use. Water will not be delivered until the place of use has been approved by the SWRCB and will be delivered in compliance with any terms imposed by the SWRCB.

11, DWR Discretion. Consistent with the long-term water supply contract provisions, CEQA, and other provisions of law, DWR has discretion to approve or deny transfers. DWR's exercise of discretion will incorporate the following principles:

(a) As required by CEQA, DWR as an agency with statewide authority will implement feasible mitigation measures for any significant environmental impacts resulting from a transfer, if such impacts and their mitigation are not addressed by other public agencies and are within DWR's jurisdiction.

(b) DWR will invoke "overriding considerations" in approving a transfer only as authorized by law, including but not limited to CEQA, and, to the extent applicable, the public trust doctrine and area of origin laws.

ATTACHMENT D

PRINCIPLES REGARDING PUBLIC PARTICIPATION PROCESS IN SWP CONTRACT NEGOTIATIONS

Note: These principles are prepared in connection with the settlement agreement between PCL and DWR and are only effective pursuant to the terms therein.

1. Policy: Given the importance of the State Water Project to the State of California, and the key role that the long-term water supply contracts play in the administration of the State Water Project, DWR agrees that public review of significant changes to these contracts is beneficial and in the public interest.

2. Types of activities to be covered: Project-wide contract amendments (i.e., contracts with substantially similar terms intended to be offered to all long-term SWP Contractors) and contract amendments to transfer entitlements between existing SWP Contractors will not be offered to the contractors for execution unless DWR has first complied with the public participation process as described in paragraphs (3), (4), (5) and (6).

3. The Public Participation Process.

1) Negotiations will be conducted in public;

2) The public will be provided with advance notice of the time and place of the negotiations; and

3) The public will be provided the opportunity to observe negotiations and comment in each negotiating session

4. Timing of Public Participation: Public participation ordinarily will precede the formulation of the project description in the CEQA process in order to assure that the public participation is meaningful. When DWR is a responsible agency, (e.g., when existing SWP Contractors agree to transfer entitlement between themselves), the public participation will be scheduled to facilitate coordination with the lead agency's CEQA process.

5. Activities that will not be subject to public participation: Informal discussions prior to exchange of formal drafts and discussion of topics that are authorized to be kept confidential by law will not be subject to the public participation process.

6. Contract amendments resulting from litigation: If litigation has been formally initiated, and settlement negotiations result in a proposal to adopt project-wide amendments to settle the litigation, all proposed contract amendments shall be subject to the public participation process before they are approved by DWR.

ATTACHMENT E

FINAL PERMANENT TABLE A AMOUNT TRANSFERS FROM KERN COUNTY WATER AGENCY SUBSEQUENT TO MONTEREY AMENDMENTS (January 1, 2003)

Note: This Exhibit is prepared in connection with the settlement agreement between PCL and DWR.

From (Kern County Water Agency Member Unit)	To	Amount (afy)	Year Effective
Berrenda Mesa Water District	Mojave Water Agency	25,000	1998
Belridge Water Storage District	Palmdale Water Agency	4,000	2000
Berrenda Mesa Water District	Alameda County Flood Control and Water Conservation District Zone 7	7,000	2000
Lost Hills Water District	Alameda County Flood Control and Water Conservation District Zone 7	15,000	2000
Belridge Water Storage District	Alameda County Flood Control and Water Conservation District Zone 7	10,000	2001
Belridge Water Storage District and Berrenda Mesa Water District	Solano County Water Agency	5,756	2001
Belridge Water Storage District and Berrenda Mesa Water District	Napa County Flood Control and Water Conservation District	4,025	2001

EXHIBIT 1

PLAINTIFFS' EXPENSES TRUST ACCOUNT AGREEMENT

This Agreement is entered into this fifteenth day of August 2002, by JAMS and DWR, for the purpose of transferring $300,000 in trust to JAMS for use in accordance with Principles of Settlement in PCL vs. DWR.

WHEREAS, JAMS has acted as mediator between the Department and other parties to the litigation in PCL v. DWR (Superior Court No. 95CS03216).

WHEREAS, the Principles of Settlement as agreed to by the parties on July 22, 2002, provides for the placement of $300,000 in trust with JAMS.

WHEREAS, the money placed in the trust is to be provided to plaintiffs for expenses actually incurred as needed to support plaintiffs' participation in developing the new EIR to be filed as a return to the writ.

WHEREAS, the Principles of Settlement also provides that the funds will be provided based on a budget and participation plan to be submitted by plaintiffs to the mediator specifying the purposes for which the funds will be expended.

The parties agree as follows:

1. JAMS agrees to accept $300,000 in trust in accordance with the Principles of Settlement.

2. JAMS agrees to maintain the monies in trust, and following receipt of a budget and participation plan from plaintiffs, to disburse funds to plaintiffs for actual expenditures incurred for such purpose and pursuant to such schedule, budget, and participation plan, all in conformance with the Principles of Settlement. The funds will be disbursed to the plaintiffs' attorney, Antonio Rossmann, Law Offices of Antonio Rossmann.

3. Costs incurred by JAMS in providing this service will be paid as part of the mediator services as part of the existing contract between JAMS and the California Department of Justice, Office of the Attorney General.

4. This agreement may be amended in writing by agreement of both parties.

5. Funds not disbursed upon termination of the trust shall be returned to DWR.

6. The trust shall terminate upon notice to JAMS by DWR of termination based on the earlier of (a) failure of the parties to the mediation to execute a settlement agreement by January 1, 2003; (b) notice of termination given by the Director of DWR to JAMS and plaintiffs that this trust is terminated, which notice shall not be given without

defendants' consultation with plaintiffs and the mediator; or c) filing of the Notice of Determination on the new EIR.

7. JAMS will incur no liability to DWR arising from any disbursement made pursuant to this agreement.

8. This agreement is not intended to and shall not create any rights in any third party.

APPROVED:

/s/ Steve Macaulay for	8/10/02	/s/ Julie Sager	8/15/02
Thomas M. Hannigan Director	Date	Vice President & CFO JAMS	Date

EXHIBIT 1

AMENDMENT NO. 1

PLAINTIFFS' EXPENSES TRUST ACCOUNT AGREEMENT

Paragraph 6 of this Agreement is amended to read as follows:

6. The trust shall terminate upon notice to JAMS by DWR of termination based on the earlier of (a) failure of the parties to the mediation to execute a settlement agreement by May 1, 2003, (b) notice of termination given by the Director of DWR to JAMS and plaintiffs that this trust is terminated, which notice shall not be given without defendants' consultation with plaintiffs and the mediator; or (c) filing of the Notice of Determination on the new EIR.

APPROVED:

Thomas M. Hannigan Director	Date	JAMS	Date

EXHIBIT 2

KERN WATER BANK AUTHORITY
AGREEMENTS AND PERMITS
WHICH MAY HAVE RELIED ON THE KWBA ADDENDUM

AGREEMENT/PERMIT	DATE	OTHER PARTIES
Incidental Take Permit - PRT-828086	2-Oct-97	Department of Interior, U.S. Fish & Wildlife Service
Approval/Management Authorization pursuant to California Endangered Species Act for Implementation of Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan	2-Oct-97	Calif. Department of Fish & Game
Natural Community Conservation Plan/Habitat Conservation Plan Implementation Agreement	2-Oct-97	U.S. Fish & Wildlife Service; Calif Dept of Fish & Game; Kern Water Bank Authority
Approval, Cultural Resources Assessment and Plan for the KWBA Project	January, 1997	N/A
Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program	26-Oct-95	Numerous
Approval of Kern Water Bank Authority Mosquito Abatement Program	26-Oct-95	Mosquito Abatement Districts
Service Contracts for Operations and Maintenance	1996 - current	Numerous Vendors
Grazing Leases (Sheep and Cattle)	1997- current	Various Stockmen
Minor Amendment No. 1: Hunting/Research to the KWBA HCP/NCCP and Implementation Agreement	6/30/1998	California Department of Fish and Game and U.S. Fish and Wildlife Service
State of California Standard Agreement for "Improving Wildlife Habitat for Doves" (annual contract)	1998 - current	Calif. Department of Fish and Game
Conservation Credit Certificates	1998 - current	Conservation Credit Buyers
Construction and Service Contracts for Master Plan Construction Project - KWB Canal, Head-works, Aqueduct Turnout, New Wells, Well Rehabilitation, Pipelines	7/1999 - 8/2002	Numerous Contractors and Vendors
KWB Canal and Buena Vista Main Canal Joint Use Agreement	7/20/1999	Buena Vista Water Storage District

AGREEMENT/PERMIT	DATE	OTHER PARTIES
Business Loan Agreement ($21,000,000)	7/23/1999	Bank of America, N.A.
Agreement for Grant of Easement	September 1999	State of California Acting Through the Department of Parks and Recreation
Agreement for Construction, Operation, and Maintenance of the Kern Water Bank Turnout, a Permanent Turnout Within the California Aqueduct Right of Way	11/9/1999	Department of Water Resources
License Agreement for Kern River Canal Crossing	11/17/1999	City of Bakersfield
Loan Contract No. E75002 Under the "Safe, Clean, Reliable Water Supply Act Water Conservation and Ground Water Recharge Sub account ($5,000,000)	March 2000	State of California, Department of Water Resources, Division of Planning and Local Assistance
Reclamation Board Permit No. 17147-A GM Authorizing Construction of Pedestrian Bridge Across the Outlet Canal within the Kern River Designated Floodway	10/16/2000	State of California - The Resources Agency, Department of Water Resources
Reclamation Board Permit No. 16821 GM (Revised) Authorizing Construction of a 20-foot Wide Unlined Canal and Reinforced Concrete Gated Turnout Structure on the Right (North) Bank of the Designated Floodway and Install a 108-Inch Diameter, 700-foot long, Reinforced Concrete Pipe Across (Under the Kern River	2/26/2001	State of California - The Resources Agency, Department of Water Resources
Grant Awarded Under the "Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection Act (Proposition 13) - Groundwater Storage Program ($3,375,000)	Jun-02	State of California, Department of Water Resources, Division of Planning and Local Assistance
Service Contracts for Well Testing and Rehabilitation Under the SB5X Program	2002	Various Vendors

Exhibit 2-2

EXHIBIT 3-A

PROPOSED 21168.9 ORDER

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SACRAMENTO

PLANNING AND CONSERVATION LEAGUE, a California not for profit corporation, PLUMAS COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, a California public agency; CITIZENS PLANNING ASSOCIATION OF SANTA BARBARA COUNTY, INC., a California not for profit corporation, Plaintiffs and Petitioners, v. DEPARTMENT OF WATER RESOURCES, a California State Agency, et al., Defendants and Respondents,	Case No: 95CS03216 [PROPOSED] ORDER PURSUANT TO PUBLIC RESOURCES CODE SECTION 21168.9

On remand from the Third District Court of Appeal on January ___, 2003, in Department 53 of the Sacramento Superior Court, the Honorable Loren E. McMaster, presiding, this proceeding came on for a status report and joint motion. Petitioners and Plaintiffs, Planning and Conservation League, Plumas County Flood Control and Water Conservation District, and Citizens Planning Association of Santa Barbara County ("Petitioners"), appeared through Antonio Rossmann and Roger B. Moore. Respondent and Defendant, Central Coast Water Authority (CCWA), appeared through Susan F. Petrovich of the Law Firm of Hatch & Parent. Respondent and Defendant, Department of Water Resources (DWR), appeared through Deputy Attorney General Marian E. Moe. Robert S. Draper of O'Melveny and Myers, LLP and Clifford W. Schulz appeared, respectively, on behalf of the Metropolitan Water District of Southern California and Dudley Ridge Water District, entities that submitted answers to the First

Amended Complaint subsequent to the Court of Appeal's final determination in this action and prior to any further order of this Court on remand.

In light of the direction from the Third District Court of Appeal on remand in Planning and Conservation League v. Department of Water Resources (2000) 83 Cal.App.4th 892, this Court hereby makes the following findings:

1. The parties to this lawsuit and other public agencies have engaged in extensive settlement negotiations, mediated by retired Judge Daniel Weinstein of JAMS Dispute Resolution, with the intent to avoid further litigation and associated expenses, to provide for an effective way to cooperate in the preparation of a new environmental impact report (EIR), and to make other specified improvements in the administration and operation of the State Water Project.

2. The mediation has resulted in an executed Settlement Agreement for approval by this Court, attached to this Order as Exhibit A.

3. DWR as lead agency has commenced the preparation of the new EIR.

4. As part of the Settlement Agreement, DWR and the State Water Project (SWP) contractors who are signatories to the Settlement Agreement have agreed that, pending DWR's filing of a return in satisfaction of the Writ of Mandate and this Court's dismissal of the Writ of Mandate, they will not approve any new project or activity (as defined in section VII.A of the Settlement Agreement) in reliance on the 1995 Environmental Impact Report for the Implementation of the Monterey Agreement.

5. This Order is made pursuant to the provisions of Public Resources Code section 21168.9 and pursuant to this Court's equitable powers. This Court finds that the actions described in this Order, including actions taken in compliance with the Writ of Mandate, comprise the actions necessary to assure DWR's compliance with Division 13 of the Public Resources Code. This Court further finds that this Order includes only those mandates necessary to achieve compliance with Division 13.

THEREFORE, IT IS HEREBY ORDERED as follows:

1. This Court's Final Judgment denying the petition for writ of mandate, entered August 15, 1996, is reversed in accordance with the directive of the Third District Court of Appeal's decision in Planning and Conservation League v. Department of Water Resources (2000) 83 Cal.App.4th 892.

2. This Court's order granting the summary adjudication on the fifth cause of action, entered June 10, 1996, is vacated.

3. The Settlement Agreement attached as Exhibit A is hereby approved.

4. A Peremptory Writ of Mandate directed to Respondents Central Coast Water Authority and DWR shall issue under seal of this Court in the form attached hereto as Exhibit B.

5. In accordance with the Settlement Agreement and this Order, pending DWR's filing of the return in compliance with the Peremptory Writ of Mandate and this Court's Order discharging the Writ of Mandate, DWR and CCWA shall not approve any new project or activity (as defined section VII.A of the Settlement Agreement) in reliance on the 1995 EIR for the Implementation of the Monterey Agreement.

6. In the interim, until DWR files its return in compliance with the Peremptory Writ of Mandate and this Court orders discharge of the Writ of Mandate, the administration and operation of the State Water Project and Kern Water Bank Lands shall be conducted pursuant to the Monterey Amendments to the State Water Contracts, as supplemented by the Attachment A Amendments to the State Water Contracts (as defined in the Settlement Agreement) and the other terms and conditions of the Settlement Agreement.

7. Plaintiffs and petitioners shall recover such costs and attorney's fees as provided in prior court orders and in an amount as determined in the arbitration procedures agreed to in the Settlement Agreement, or as otherwise agreed to by the parties.

8. Except as provided, the Peremptory Writ of Mandate shall not limit or constrain the lawful jurisdiction and discretion of DWR. This Court retains jurisdiction until DWR files a

return that complies with the terms of the Writ of Mandate, and this Court issues an order discharging the Writ of Mandate.

IT IS SO ORDERED.

Dated: _____, 2003 _____ _____

Judge of the Superior Court

EXHIBIT 3-B

PROPOSED WRIT OF MANDATE

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SACRAMENTO

PLANNING AND CONSERVATION LEAGUE, a California not for profit corporation, PLUMAS COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, a California public agency; CITIZENS PLANNING ASSOCIATION OF SANTA BARBARA COUNTY, INC., a California not for profit corporation, Petitioners, v. DEPARTMENT OF WATER RESOURCES, a California State Agency, and CENTRAL COAST WATER AUTHORITY, A Joint Powers Agency Respondents.	Case No: 95CS03216 PROPOSED PEREMPTORY WRIT OF MANDATE (Public Resources Code § 21168.9)

TO: Respondents California Department of Water Resources and Central Coast Water Authority:

The Third District Court of Appeal, in its decision in Planning and Conservation League v. Department of Water Resources (2000) 83 Cal.App.4th 892, having directed this Court to issue a Peremptory Writ of Mandate,

YOU ARE HEREBY COMMANDED to comply with the following:

1. Respondent Central Coast Water Authority shall set aside its October 26, 1995 certification that the Final Programmatic Environmental Impact Report for Implementation of

the Monterey Agreement (the 1995 Monterey Agreement EIR) was completed in compliance with the California Environmental Quality Act [AR 2183].

2. Respondent Department of Water Resources (DWR) shall:

(a) set aside its December 13, 1995 certification, as responsible agency, that the 1995 Monterey Amendment EIR is adequate under the California Environmental Quality Act [AR 1875]; and

(b) as lead agency, prepare and certify a new EIR. in compliance with the Court of Appeal's decision, the California Environmental Quality Act, and the Settlement Agreement.

3. Upon completion and certification of the new EIR, Respondent DWR shall make written findings and decisions and file a notice of determination identifying the components of the project analyzed in the new EIR**,** all in the manner prescribed by sections 15091 – 15094 of the CEQA Guidelines.

4. Respondent DWR shall, upon the filing of a Notice of Determination, submit the new EIR, the written findings, the Notice of Determination, and such additional documents as this Court may order by way of return to this writ of mandate.

5. This Court shall retain jurisdiction over this proceeding until DWR files a return that complies with this Writ of Mandate, and this Court issues an order discharging this Writ of Mandate. Except as provided, this Writ of Mandate shall not limit or constrain the lawful jurisdiction and discretion of the Department of Water Resources.

Dated: _____, 2003

_____

Clerk of the Superior Court

Let the foregoing writ issue:

_____

Judge of the Superior Court

EXHIBIT 4

SECTION VI TRUST ACCOUNT AGREEMENT

This Section VI Trust Account Agreement (this "Trust Agreement") is entered into this _____ day of _____ 2003, by JAMS and the State of California Department of Water Resources (the "Department"), for the purposes of establishing and describing the trust account in accordance with that certain Settlement Agreement entered into in *Planning & Conservation League v. Department of Water Resources* ("PCL v. DWR").

WHEREAS, Judge Daniel Weinstein (ret.) of JAMS has acted as mediator between the Department and other parties to the litigation in *PCL v. DWR* (Sacramento Superior Court No. 95CS03216).

WHEREAS, the Settlement Agreement provides for the placement over time of $5,500,000 in trust with JAMS at the specific times and under the conditions in the Settlement Agreement.

The parties agree as follows:

1. JAMS will establish a trust account for receipt and disbursal of funds received from the Department for payment pursuant to the Settlement Agreement.

2. All funds deposited with JAMS pursuant to this agreement shall be placed into a trust account and shall be disbursed only in accordance with this Trust Agreement and the Settlement Agreement. Section VI of the Settlement Agreement provides that the funds shall be used to implement the Settlement Agreement, as determined by Plaintiffs in their reasonable judgment, including watershed restoration projects, follow-up actions arising from the Settlement Agreement, and technical studies.

3. JAMS agrees to maintain the monies in trust, and after receipt of a written statement executed by all Plaintiffs (as defined in the Settlement Agreement), to disburse funds to Plaintiffs in conformance with such statement. JAMS will provide a copy of the written statement to: Chief Counsel, The Office of the Chief Counsel, Department of Water Resources, P.O. Box 942836, Sacramento, CA 95814.

4. Costs incurred by JAMS in providing this service will be paid as part of the mediator services as part of the existing contract between JAMS and the California Department of Justice, Office of the Attorney General, or any successor contract.

5. This agreement may be amended only in writing by agreement of both parties.

6. Funds not disbursed before termination of this Trust Agreement shall be returned to DWR immediately upon termination of this Trust Agreement.

7. This Trust Agreement shall terminate if and when DWR notifies JAMS that the agreement is terminated, which notice shall not be given without DWR's consultation with Plaintiffs and the mediator.

8. JAMS will incur no liability to DWR arising from any disbursement made pursuant to this agreement.

9. This Trust Agreement is intended solely for the purposes of establishing and describing the trust account at JAMS and is not intended to and shall not create any rights in any third party.

APPROVED:

Thomas M. Hannigan Director	Date	JAMS	Date

E. STUDY OF TRANSFER, DEVELOPMENT, AND OPERATION OF THE KERN WATER BANK

Study of the Transfer, Development, and Operation of the Kern Water Bank

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Introduction

A. Overview of KFE Property

In the early 1980s, the Department began exploring the feasibility of developing a State Water Project (SWP) groundwater storage facility in Kern County, which it called the Kern Water Bank (KWB). As envisioned, the KWB would consist of a series of "elements," which would be geographically separate projects that would be operationally integrated. The largest of these elements, the Kern Fan Element (KFE), was to be developed first, followed by a number of local elements developed with several water districts in Kern County. After evaluating the feasibility of the KFE, in 1988, the Department purchased approximately 20,000 acres of land in the Kern Fan area from Tenneco West, Inc.

However, the Department encountered many legal, institutional, and political impediments to implementation of a groundwater storage facility on the KFE property. SWP contractors also expressed concerns regarding their ongoing costs for feasibility studies and ownership of the KFE property given their assessment of the likelihood of realizing a functional groundwater storage program. In 1993, uncertainties regarding the proposed groundwater storage facility ultimately convinced the Department to halt feasibility studies and design work on the project.[i] The uncertainties included proposed revisions of Delta water quality standards and measures to protect threatened and endangered species, which affected the SWP's ability to pump water from the Delta for recharge on the KFE property. Expected changes in arsenic standards for drinking water also raised questions regarding the ability of the project to meet water quality standards for pump-in to the California Aqueduct.[ii] In addition to environmental and water quality issues, the Department and KCWA could not reach agreement on measures to comply with Water Code Section 11258, which required approval of local agencies for development of the groundwater banks. Later, the Department concluded that these constraints on Delta pumping made development of an SWP groundwater storage facility in the Kern Fan Element infeasible.[iii] In 1994, the potential of the Department's proposed KFE for SWP groundwater storage remained unrealized.

In 1994, the Department and representatives of the agricultural and urban contractors negotiated a set of principles known as the Monterey Agreement. As part of these principles, the parties agreed to the Department's sale or lease of the KFE property to designated SWP agricultural contractors, in exchange for the permanent retirement of 45,000 acre-feet (AF) of these contractors' Table A amount. The Monterey Amendment, which was the amendment to the SWP contractors' long-term water supply contracts that implemented the Monterey Agreement principles, provided for the State's transfer of ownership of the KFE property to Kern County Water Agency (KCWA), and then to the Kern Water Bank Authority (KWBA), for local agency development and use as a groundwater bank.

B. Purpose

The purpose of this report is to provide an independent study by the Department of the KWB, as required under the May 5, 2003 Settlement Agreement between the Planning and Conservation League et al., the Department, and SWP contractors. Section III (F) of the Settlement

Agreement requires the Department to prepare an independent study, and exercise "its judgment regarding the impacts related to the transfer, development, and operation of the KWB in light of the Kern Environmental Permits." The agreement also requires that the study "identify SWP and any non-SWP sources of water deliveries to KWB." To evaluate the impacts, the Department used the KFE property conditions and facilities that existed before the Department conveyed the KFE property to KCWA as the baseline for the evaluation.

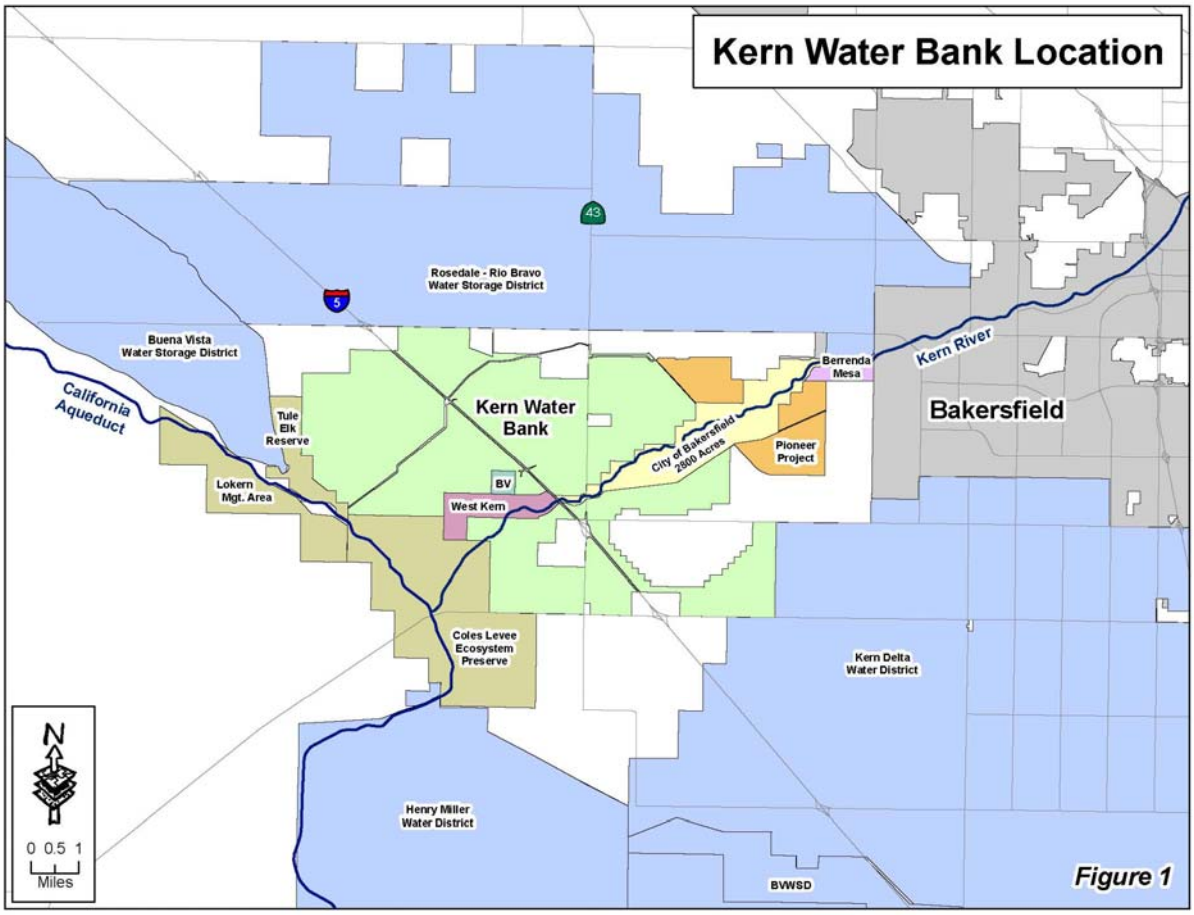
II. Method

Information from three sources was used to evaluate the transfer, development, and operation of the KWB by the Kern Water Bank Authority (KWBA). The first source was the Annual Compliance reports for 1999 through 2005. These reports are prepared each year by the KWBA and submitted to the California Department of Fish and Game (CDFG) and the U.S. Fish and Wildlife Service (USFWS), as required under their environmental permits, and were used in this study to determine what facilities were constructed, how the project is operated (recharge and extraction operation), identify vegetation, terrestrial and aquatic wildlife use of the site, and identify incidences of "take" in light of the Kern Environmental Permits. The second source was staff from KCWA and KWBA, who were consulted to provide additional information on recharge and recovery activities of SWP and non-SWP water at the KWB, and to evaluate where water could have been banked in Kern County in the absence of the KWB. The third source was personnel from CDFG and USFWS, who were contacted to determine if the resources agencies had any concerns with the development or operation of the KWB in light of the KWB environmental permits.

III. Existing Conditions

The KFE property [1] is located in Kern County, about 12 miles southwest of the City of Bakersfield (Figure 1). It consists of approximately 20,000 acres of gently sloping land overlying the Kern River Alluvial Fan. Surrounding lands are used primarily for agriculture, habitat preserves, or other water banking programs. Prior to the development of the KWB, most of the land was used for agriculture, and irrigation water was provided by surface water deliveries by the former James-Pioneer Improvement District of North Kern Water District, and by groundwater pumping. Agricultural water supplies for lands surrounding the KWB are provided by Rosedale – Rio Bravo Water Storage District for most lands to the north, by Kern Delta Water District for lands to the southeast, by Henry Miller Water District for lands to the facilities that existed on the KFE property in early 1995 are shown in Figure 2.

[1] The court referred to the KFE property as the KWB in its decision, dated ___. The KFE property consists of the approximately 20,000 acres acquired by the Department from Tenneco West, Inc. The property was acquired for the purpose of developing the KFE, one of a series of groundwater banking "elements" that together would constitute the KWB. As envisioned, the eight or so elements of the KWB would be geographically separate projects that would be operationally integrated. Therefore, the terms KFE and KWB are not interchangeable, and what is now called the KWB is only a portion of the KWB envisioned by the Department. For simplicity, this document will use the term KWB to refer to the groundwater bank developed by the KWBA on the KFE property, and the term KFE property to refer to the 20,000 acres of land acquired by the Department.



south, and by Buena Vista Water Storage District for lands to the northwest. The Tule Elk State Reserve, Coles Levee Ecosystem Preserve, and Lokern Management Area are located west and south the KWB.

The KWB is one of several groundwater banks in Kern County. Other groundwater banks include: Berrenda Mesa Project (operational since 1983); City of Bakersfield 2,800 Acre Recharge Basin (operational since 1978); Pioneer Project, including Kern River Channel (operational since 1995); West Kern/Buena Vista (operational since 1978); Arvin-Edison Water Storage District (operational for groundwater banking for other districts since 1990); and Semitropic Water Storage District (operational for groundwater banking for other districts since 1990). With the exception of the Arvin-Edison and Semitropic groundwater banks, all of the projects are located adjacent to the KWB on the Kern River Alluvial Fan. While KWB provisions allow for lower priority use by others (see Section V.B.4), such use has only been by KCWA member agencies and has been very limited in scope. The Arvin-Edison and Semitropic banks allow participation by non-Kern County entities; the other banks mentioned above allow participation by Kern County entities only.

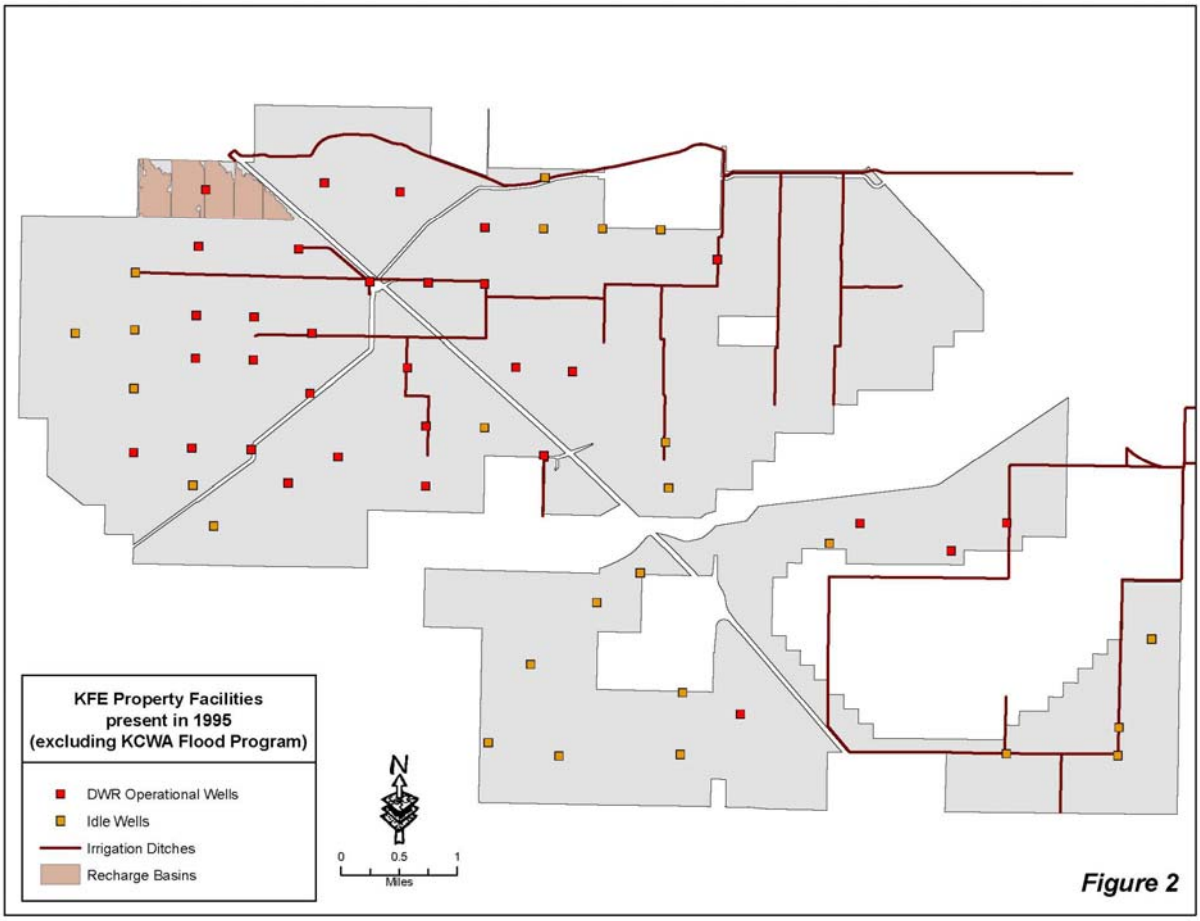


Figure 2

A. Existing KFE Property Facilities

1. Recharge

Tenneco constructed approximately 300 acres of recharge ponds in the northwestern portion of the KFE property prior to its acquisition by the Department in 1988. These ponds are known informally as the Stockdale Highway Ponds. The Department did not construct any recharge ponds on the KFE property during its ownership of the property.

2. Recovery

Sixty-five agricultural wells were present on the KFE property when it was acquired by the Department in 1988. During the Department's ownership of the property, it initiated a program of refurbishing some of these existing wells, so that it could recover water it had purchased from La Hacienda, Inc.[2] At the time the property was transferred to KCWA, 31 of the 65 existing wells were considered operable, although 3 of these were not connected to any conveyance facilities. The remaining 34 were idle wells in various states of disrepair.

[2] The purchase was of 98,000 acre-feet of stored Kern River water, which had originally be recharged at the City of Bakersfield's 2800 acre project. (KWB First Stage KFE Feasibility Report, December 1990)

3. Conveyance

At the time the Department acquired the KFE property in 1988, the property included a number of conveyance facilities that had been constructed primarily for the delivery of irrigation water for the agricultural activity occurring then and historically on the property. These facilities were not constructed for water bank operations of recharge and recovery, and many were not suitable for these purposes. An exception was the Pioneer Canal, which could have been used to deliver water for recharge to the existing approximately 300 acres of Stockdale Highway Ponds. Other nearby facilities, including the Cross Valley Canal, the City of Bakersfield's Kern River Canal, and Buena Vista WSD's Alejandro Canal, could have been used to convey water recovered from the 31 operable wells on the KFE property. However, these facilities were owned by others and could only have been used for banking purposes when unused capacity was available. During the Department's ownership of the property, the Department constructed conveyance facilities of small capacity to convey water recovered from certain of the individual operable wells to these larger nearby conveyance facilities.

B. KCWA Flood Emergency Program

In 1995, KCWA requested and was granted the use of the KFE property for emergency spreading of water to mitigate projected flooding of agricultural lands due to high flows on the Kern and Kaweah Rivers. KCWA requested use of approximately 3,200 acres of the KFE property for the emergency delivery and controlled spreading of local floodwater flows. KCWA proposed spreading water from the Kern and Kaweah Rivers onto existing Kern County spreading basins (including KCWA's Pioneer Project, the City of Bakersfield's 2,800 acres, Berrenda Mesa Ponds, and Rosedale-Rio Bravo Ponds), and diverting the remaining flood flows (up to 500 cubic feet per second (cfs)) onto a portion of the Department's KFE property. KCWA proposed constructing up to 2,300 acres of recharge ponds on 3,200 acres of the property.

The Department conditioned its approval of KCWA's construction plans upon KCWA satisfaction of the endangered species acts requirements. In consultation with the USFWS and CDFG, KCWA performed biological surveys of the areas that it proposed to flood in order to avoid any threatened or endangered species, in compliance with federal and State endangered species acts. KCWA obtained endangered species agreements with USFWS and CDFG to develop 2,300 acres of spreading ponds. The Department added additional conservation conditions in a separate agreement. KCWA prepared a CEQA Negative Declaration and filed a Notice of Exemption for the project's CEQA compliance.. Subsequently, the Department approved[3] a second request by KCWA to divert water onto an additional 1,800 acres of spreading ponds on an additional 5,000 acres of KFE land. The Department also agreed to extend its initial agreement with KCWA to March 31, 1997.[4]

As a result of these agreements, in 1995 KCWA constructed 1,518 acres of recharge ponds on the initial 3,200 acres of KFE property, and 1,516 acres of recharge ponds on the additional 5,000 acres of KFE land (Figure 3). Under the flood emergency program, about 230,00 AF of water was recharged in 1995 and about 144,000 AF in 1996.

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[3] Letter, John J. Silveira, DWR to Thomas Clark, KCWA; June 2, 1995
[4] Letter, Robert G. Potter, DWR to Thomas Clark, KCWA; March 11, 1996

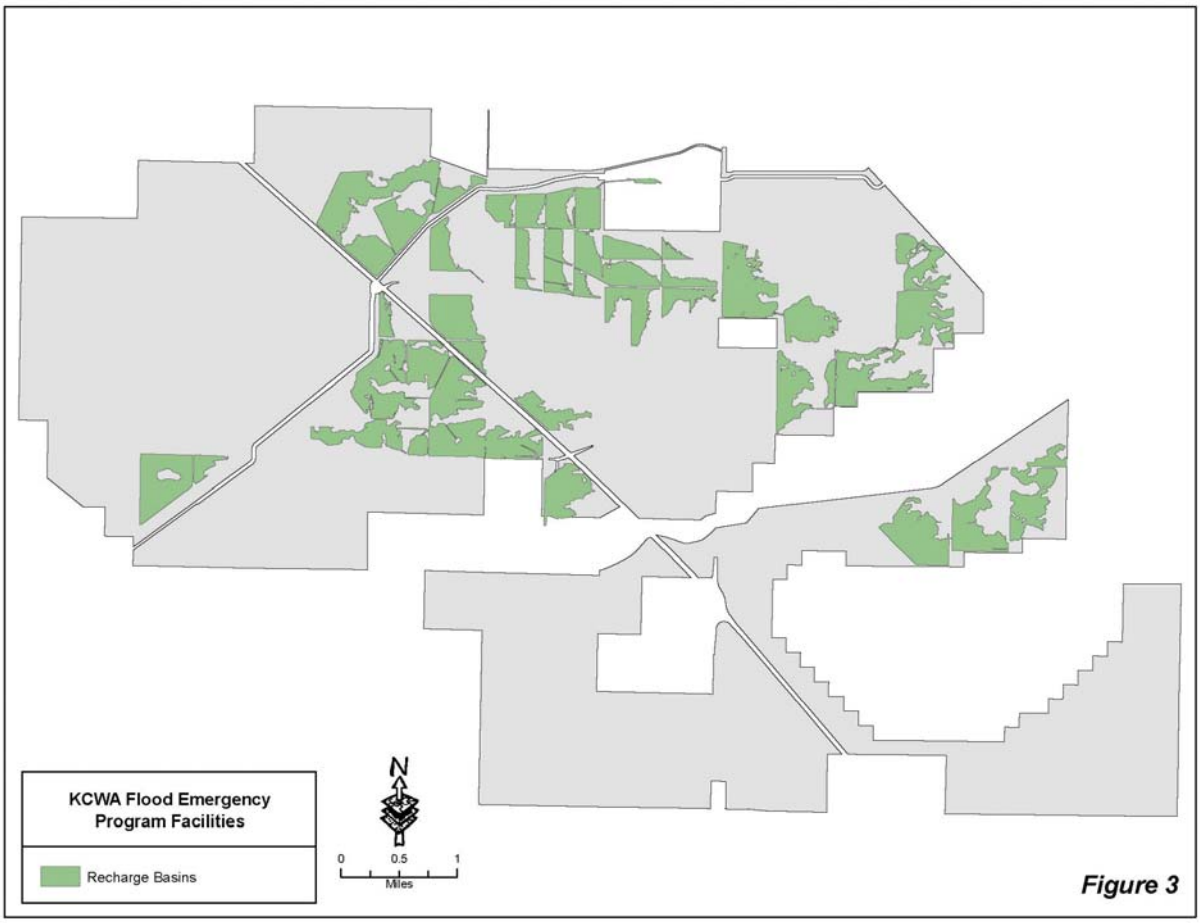

Figure 3

C. Land Use

Prior to the Department's purchase of the KFE property in 1988, approximately 17,068 acres of the property was under extensive cultivation.[iv] The remaining property contained 1,515 acres of isolated sensitive native plant communities (valley saltbush scrub, Great Valley mesquite scrub and valley sacaton grassland) and 1,317 acres of non-native grassland, which had been leased for oil recovery facilities. No wetland habitat was present in the project area, except for the canals used to convey water for agricultural use.

A Memorandum of Understanding was signed between the Department and KCWA on March 25, 1987, that provided for the phase out of all agricultural production on the KFE property by the end of 1993. In fact, one of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenant leases were terminated, and thereafter the agricultural lands were fallowed. The land use on the KFE property in 1995 is shown in Figure 4.

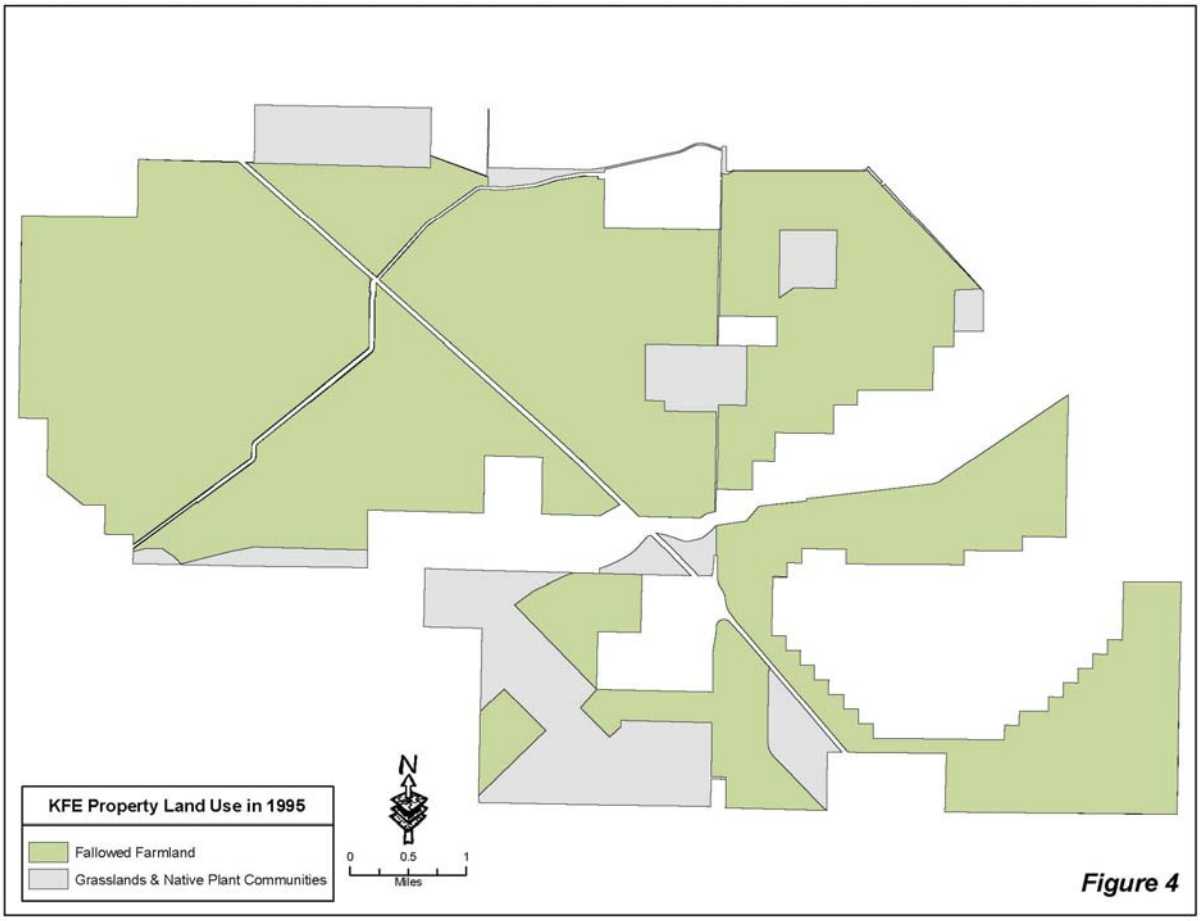

Figure 4

IV. Transfer of KFE Property from the Department

By 1994, the potential of the Department's proposed KFE for SWP groundwater storage remained unrealized. As is described in more detail in Section I.A, by this time the Department had concluded that constraints on Delta pumping and a number of other uncertainties made development of an SWP groundwater storage facility on the KFE property infeasible. In 1994, the Department and representatives of the agricultural and urban contractors negotiated a set of principles, subsequently implemented through the Monterey Amendment, that provided for the State's transfer of the KFE property to KCWA, and then to the KWBA, for local agency development and use as a groundwater bank, as discussed in more detail below.

A. Monterey Amendment

The Department deferred development efforts of the KFE in the early 1990s. Subsequently, the Monterey Amendment provided for the State's transfer of ownership of the KFE property to KCWA for local agency development and use as a groundwater bank, in exchange for the permanent retirement of 45,000 AF of SWP Table A amount by KCWA and Dudley Ridge WD.

Article 52 of the Monterey Amendment states that:

a) The State shall convey to the Kern County Water Agency (KCWA) in accordance with the terms set forth in the agreement between the State of California Department of Water Resource and Kern County Water Agency entitled, "Agreement for the Exchange of the Kern Fan Element of the Kern Water Bank" (the Kern Water Bank Contract), the real and personal property described therein.

b) Subject to the approval of KCWA, other contractors may be provided access to and use the property conveyed to KCWA by the Kern Water Bank Contract for water storage and recovery. Fifty percent (50 %) of any project water remaining in storage on December 31, 1995, from the 1990 Berrenda Mesa Demonstration Program and the La Hacienda Water Purchase Program shall be transferred to KCWA pursuant to the Kern Water Bank Contract. The remaining fifty percent (50%) of any such water (approximately 42,828.5 AF) shall remain as project water and the State's recovery of such project water shall be pursuant to the provisions of a separate recovery contract. Any other Kern Water Bank demonstration program water shall remain as project water and the State's recovery of such water shall be pursuant to the provisions of the respective contracts for implementation of such demonstration programs.

Article 53(i) of the Monterey Amendment states, in part, that:

i) On January 1 following the year in which such Monterey Amendments take effect and continuing every year thereafter until the end of the project repayment period: (i) Kern County Water Agency's (KCWA) annual entitlement for agricultural use as currently designated in Table A-1 of its contract shall be decreased by 40,670 AF; (ii) Dudley Ridge Water District's (DRWD) annual entitlement as currently designated in Table A of its contract shall be decreased by 4,330 AF; and (iii) the State's prospective charges (including any adjustments for past costs) for the 45,000 AF of annual entitlements to be relinquished by KCWA and DRWD thereafter shall be deemed to be costs of project conservation facilities and included in the Delta Water Charge for all contractors in accordance with the provisions of Article 22.

In accordance with the Monterey Amendment, the Department conveyed the KFE property to KCWA in exchange for KCWA and DRWD permanently retiring a total of 45,000 AF of agricultural Table A amounts. On December 13, 1995, the same date the Department executed the Monterey Amendments of KCWA and DRWD, the Department executed the "Agreement for the Exchange of the Kern Fan Element of the Kern Water Bank" between the Department and KCWA. This agreement provided the specific terms and conditions for the transfer of the KFE property to KCWA.

B. Exchange Agreement between the Department and KCWA

The "Agreement for the Exchange of the Kern Fan Element of the Kern Water Bank" between the Department and KCWA was executed on December 13, 1995. This agreement provided for the transfer of the KFE acreage and its fixtures from the Department to KCWA in exchange for

agricultural contractors' permanent reduction and retirement of 45,000 AF of their SWP Table A amount. The agreement transferred the property to KCWA and identified certain KCWA obligations, covenants, and agreements associated with the property, including KCWA assumption of responsibility for the Department's endangered species agreements, in total.

It was intended that KCWA would transfer the KFE property to a joint powers authority made up of those entities that had retired a portion of their Table A amounts. Therefore, the exchange agreement between the Department and KCWA included a provision that stated that the parties' agreed that KCWA could transfer all or a portion of the property and assign its rights and obligations to transferees who concurrently executed an agreement accepting the transfer and assignment and assumption of KCWA's obligations, covenants, and agreements.

C. Conveyance Agreement from KCWA to KWBA

Simultaneous with the December 13, 1995, execution of the exchange agreement between the Department and KCWA, KCWA executed an agreement between it and the Kern Water Bank Authority (KWBA). This agreement transferred the KFE property from KCWA to the KWBA:[5] to develop, operate, and maintain the KFE property as a local groundwater banking project, which they called the Kern Water Bank (KWB); to develop and improve the KWB for the importation, percolation and storage of water in underground aquifers for later extraction, transportation, and; for the beneficial use of Project Participants.[6] KWBA assumed control of the KFE property and prepared a plan for development fo the property as a groundwater bank and an operating plan to bank available water from three sources – the Kern River, the Central Valley Project's (CVP) Friant-Kern Canal, and the SWP.

V. KWBA's Development of KWB

A. Environmental Documents and Permits

1. CEQA

A final programmatic EIR on the Monterey Agreement ("Monterey Agreement EIR") was issued in October 1995. The Monterey Agreement EIR describes, among other things, the environmental impacts of the development of a groundwater bank on the KFE property, including construction of banking facilities and operation of a groundwater bank. The KWBA, as a responsible agency, approved the Monterey Agreement EIR on October 30, 1995. The principles of the Monterey Agreement were implemented through the Monterey Amendment. As described in Section IV above, upon execution of the Monterey Amendment, the Department transferred the KFE property to KCWA, which simultaneously transferred the property to the KWBA.

[5] The Kern Water Bank Authority is a joint power authority formed pursuant to California Government Code section 6500 et seq.

[6] The transfer of the KFE property from KCWA to KWBA was made possible by provisions specified in Section 3, subsection 3.3 (Immediate Reconveyance) of the Kern Water Bank Contract, dated December 13, 1995.

The KWBA prepared specific plans for the development and operation of a groundwater bank on the KFE property, referred to by the KWBA as the Kern Water Bank (KWB). The CEQA guidelines indicate that "subsequent activities in a program must be examined in the light of the programmatic EIR to determine whether an additional environmental document must be prepared." A subsequent EIR is only allowed if certain findings are made, which was not the case for the proposed KWB. Instead, an addendum to the Monterey Agreement EIR was prepared pursuant to §15164 of the guidelines. This addendum addressed the environmental issues related to development and construction of the KWB that had not been addressed in the programmatic EIR. The primary focus of the addendum was the Kern Water Bank Habitat Conservation Plan (HCP) and the Natural Community Conservation Plan (NCCP), which primarily address the impacts of the project on endangered species. However, the addendum also addressed the impact on cultural resources, groundwater impacts on surrounding landowners, and mosquito abatement, among other things. The HCP/NCCP is discussed in more detail below.

After completion of the environmental analysis, and establishment of appropriate mitigation measures, the KWBA concluded that the entire project, as revised by the mitigation measures, would have no significant effect on the environment. A Notice of Determination was filed July 4, 1996, and no legal challenge was filed.

2. CESA/ESA

a. Permits

To allow the management and operation of the KWB in accordance with the incidental take of endangered, threatened and certain other listed species, KWBA applied to the USFWS for two permits pursuant to the federal Endangered Species Act, and to the CDFG for two management authorizations pursuant to the California Endangered Species Act and the Natural Community Conservation Planning Act. One permit and one management authorization (the Project Permit/Authorization) is related to the KWB project. The other permit and management authorization (the Master Permit/Authorization) is related to a conservation bank to be used as potential mitigation for activities by third parties within designated areas of the Southern San Joaquin Valley. The conservation bank can be used to provide mitigation for the incidental take of listed species by qualified third parties for activities that take place within Kern County, the Allensworth area of Tulare County, and the Kettleman Hills area of Kings County. Both Permits and both Master Authorizations are for a period of 75 years. The agencies prepared a Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP), an implementation agreement (IA), and a federal environmental assessment (EA) as part of the permit/authorization process.

b. HCP/NCCP

To protect endangered species on the property, the KWBA, the USGWS, and the CDFG developed the HCP/NCCP to preserve and restore habitat for threatened, endangered, and protected species. The HCP/NCCP permits certain uses for the KFE property and designates general areas (referred to as "sectors") and acreages for those uses (Figure 5 and Table 1).

Table 1. HCP/NCCP Land Use Designations	
	AREA

	(In Acres)
Recharge Basins	5,900
Other Water Banking Facilities	481
Compatible Habitat	5,592
Sensitive Habitat	960
Department Mitigation Land	530
Farming (including recharge ponds)	3,170
Conservation Bank	3,267
TOTAL	19,900

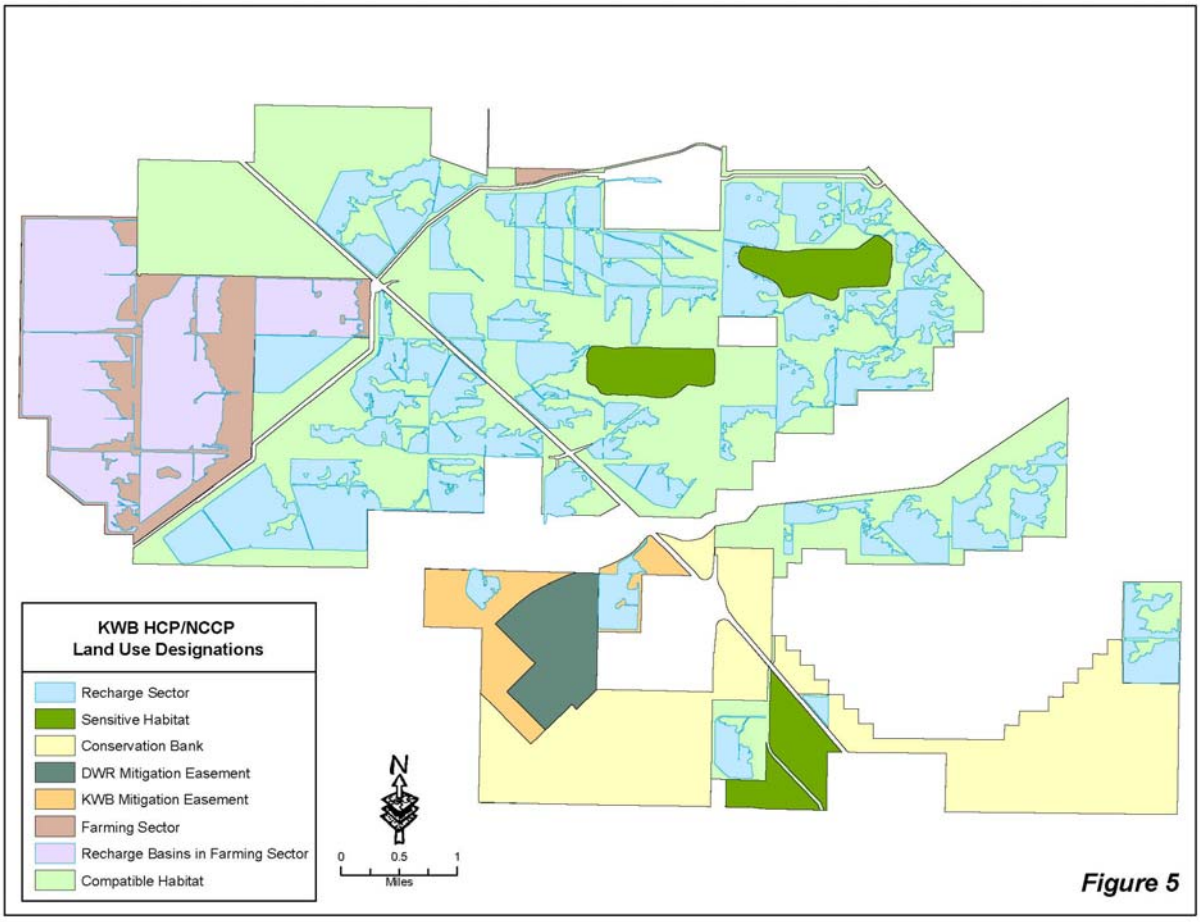

Figure 5

One of the HCP's primary management tools is its Vegetation Management Plan. The Plan incorporates an adaptive management approach to improve upland habitat for the threatened and endangered species that are found on the property. The program uses methods that are compatible with the water banking activities and economically feasible for a large-scale project. Since desert species prefer low-density vegetation, the primary method used to control vegetation has been grazing and burning. To control tumbleweeds (the largest problem), KWBA has timed grazing and burning activities to promote desired native plant growth and retard the growth of the tumbleweeds.

Water banking has also caused a resurgence in wetland habitat and the return of waterfowl to the area. To date, more than 40 new species of birds have been sighted on the KFE property, including the Caspian tern, the white-faced ibis, the double-crested cormorant, and the tri-colored blackbird.

The Implementation Agreement of the KWBA HCP/NCCP requires the KWBA to prepare and submit an Annual Report to the USFWS and the CDFG that includes the following information from the previous year:

- A summary of all activities on the KWB, including construction, and operation and maintenance of water recharge and water extraction facilities;
- A summary of Take of Covered Species and Covered Habitat;
- A summary of mitigation measures implemented;
- Results of studies completed;
- Results from the implementation of monitoring programs;
- Results from the implementation of avoidance and minimization measures;
- A report regarding the status of the Species Viability Fund;
- A copy of the KWBA's financial report evidencing KWBA's ability to fund its affirmative obligations under the KWBA HCP/NCCP and the Implementation Agreement; and
- A certification from a responsible officer of the KWBA.

Exhibit H of the HCP/NCCP requires KWBA to meet the Minimization of Impacts Requirements during construction and repair activities. The following actions are specified in Exhibit H:

- The delineation of all construction zones;
- Oversight of all phases of the construction on a daily basis by KWBA inspectors;
- Compliance with minimum construction standards for canals;
- An orientation program for all KWBA employees and contractors that explains endangered species concerns, notification requirements for dead, injured, or entrapped listed animals, and on-going practices requirements (e.g. construction site review and traffic, food and dog control);
- Monitoring major construction activities by a qualified biologist; and
- Biological surveys to identify San Joaquin kit fox dens, burrows occupied by burrowing owls, and signs of the presence of fully-protected species.

Table 2 shows the amount of land disturbance that was estimated in the HCP/NCCP to accompany the construction of infrastructure on the KWB, and the amount of disturbance that has actually occurred. Land disturbance is tracked in all land use sectors on the KFE property but the Farming Sector.[7] Note that permanent water banking facilities occupy only 258 acres.

[7] Land disturbance in the Farming Sector is not tracked since it was anticipated in the KWB HCP/NCCP to be disturbed from farming or other activities. In fact, with the exception of 45 acres currently farmed for the CDFG for an annual Heritage Game Bird hunt, no farming has occurred in the Farming Sector. Instead, this acreage has developed into exceptional upland and wetland habitat.

Table 2. Estimated versus actual land disturbance resulting from recharge/recovery facilities through December 2005		
	KWB HCP/NCCP Estimated Disturbance (acres)	**Actual Disturbance (through 12/31/2005) (acres)**
Recharge Basins in Recharge Sector*	**5,900**	**4,699**
Permanent Water Banking Facilities		
Recovery Facilities		
Wells - Existing Hooked Up	28	14
Wells - Existing Not Hooked Up	38	6
Wells - Proposed New	66	21
Conveyance Facilities		
Proposed-Lined	87	0
Existing – Unlined	225	117
Supply/Recovery Canal	73	75
Pump Stations	12	2
Kern River Reverse Flow		
Earthwork (levees)	4	0
Pump Stations		
Kern River	10	0
City of Bakersfield	4	0
New Roads	0	23
Subtotal	**547**	**258**
Temporary Disturbed Areas		
Canal Construction	73	68
Recovery Wells	0	16
Pipelines – Proposed	218	144
Subtotal	**291**	**228**
Total	**6,738**	**5,185**
* Does not include 2,415 acres of recharge ponds located in the Farming Sector.		

Source: Kern Water Bank Authority. Annual Report, May 1, 2006

B. Other Agreements and Restrictions

1. Statement of Principles – March 1995

A Statement of Principles (SOP) establishing several guidelines for a later agreement amongst the KWB participants on the establishment of a public agency to own, develop, operate and maintain the KWB project was agreed to on March 31, 1995. The key provisions of the SOP are:

- An allocation of the amount of firm SWP Table A amounts to be permanently retired by each of the participants, and a mechanism for other KCWA Member Units to participant in the KWB as the project moved forward;
- A statement that the KWB's primary purpose is to augment water supplies for KWB participants;
- A statement indicating the proposed public agency will be responsible for all KWB costs;
- The establishment of priorities for the use of the KWB by others;

- A statement that the KWB will be operated pursuant to the pending *Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program* (see V.B.3. below);
- A mechanism to establish agreements to share Cross Valley Canal capacity amongst other banking projects; and
- The establishment of covenants for the limitation on the future consumptive use of groundwater by the property and restrictions on the future sale, transfer, lease, etc., of the property as long as KCWA has determined that the property can be used economically for groundwater storage and recovery.

2. Joint Powers Agreement – October 1995

The entities that permanently retired a portion of their SWP Table A amounts (i.e., SWP contractors KCWA and Dudley Ridge WD, and KCWA member agencies Semitropic WSD, Tejon-Castac WD, and Wheeler Ridge-Maricopa WSD, and Westside Mutual Water Company, LLC) formed a joint powers authority called the Kern Water Bank Authority on October 16, 1995, with the execution of a Joint Powers Agreement (JPA). The JPA:

- Created the KWBA and established its term, purpose and powers;
- Established the internal organization of the KWBA (i.e., governed by a Board of Directors);
- Established procedures for handling KWBA's finances;
- Described the KWBA's KWB project and established participant rights in the project directly proportional to the amount of Table A water each participant retired to acquire the project;
- Established the relationship between the KWBA and its participants (e.g., indemnities, withdrawals, etc.); and
- Established other procedures necessary to the operation of the KWBA (e.g., amendment procedures, dispute resolution procedures, etc.)

Table 3 lists the Table A amounts retired by each KWBA participants and their corresponding ownership allocations.

Table 3. Kern Water Bank Authority Participants

Participants	Table A Amount Retired (AF)	Allocation (%)
Dudley Ridge WD	4,330	9.62
Improvement District 4	4,330	9.62
Semitropic WSD	3,000	6.67
Tejon-Castac WD	900	2.00
Westside Mutual Water Co.[a]	21,625	48.06
Wheeler Ridge-Maricopa WSD	10,815	24.03
Total	45,000	100.00

a. Westside Mutual Water Co. was formed by a landowner that owned land within two KCWA member agencies, for the retirement of a portion of its Table A amounts. The landowner retired 15,335 AF of its Table A amount from Belridge WSD and 6,290 AF of its Table A amount from Lost Hills WD.

3. Operations and Monitoring MOU – October 1995

The KWBA operates the KWB under the requirements of the *Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program* (KWB MOU; Appendix B). Negotiation and execution of the KWB MOU was a prerequisite of the KWBA Member Entities' agreement to retire the 45,000 AF of Table A amounts in exchange for the transfer of the KFE lands from the Department for the Member Entities' development of a water bank.

a. Impact Mitigation

The overall objective of the KWB MOU parties (KWBA, its Member Entities, and the districts surrounding the property [Adjoining Entities]) is that the "… design, operation and monitoring of the Project be conducted and coordinated in a manner to insure that the beneficial effects of the Project to the Project Participants [Member Entities] are maximized but that the Project does not result in significant adverse impacts to water levels, water quality or land subsidence within the boundaries of Adjoining Entitles." The adjoining entities include Buena Vista WSD, Rosedale-Rio Bravo WSD, Kern Delta WD, Henry Miller WD, and West Kern WD.

Some of the measures prescribed in the KWB MOU to protect water levels include: 1) spread out recovery area; 2) provide buffer areas between recovery wells and neighboring overlying users; 3) limit the monthly, seasonal, and/or annual recovery rate; 4) provide sufficient recovery wells to allow rotation of use of recovery wells or the use of alternate wells; 5) provide adequate well spacing; 6) adjust pumping rates or terminate pumping to reduce impacts, if necessary; 7) impose time restrictions between recharge and extraction to allow for downward percolation of water to the aquifer; and 8) provide recharge of water that would otherwise not recharge the Kern Fan Basin.

Some of the measures prescribed in the KWB MOU to protect water quality include: 1) giving recharge priority to the best quality water available, 2) removing more salts than are recharged, 3) controlling the migration of poor quality water, and 4) extracting poorer quality groundwater where practicable (and where blending with excellent quality water from elsewhere in the project results in the water quality objectives of downstream users being met).

In order to ensure that the above goals are met, the MOU provides for the establishment of a Monitoring Committee to oversee banking operations and the results of an extensive monitoring program. The committee is made up of several basin stakeholders including KCWA and all adjoining water districts. This committee has completed a number of tasks required by the MOU, including:

- Preparation of a monitoring plan;
- Specification of monitoring wells;
- Preparation of annual water balance studies and other interpretive studies of sources and uses of water within the project area and within adjoining water districts;
- Determination of the impacts of project operations on surrounding areas; and

- Development of criteria for identifying, verifying, avoiding, eliminating, or mitigating significant adverse impacts from project operations.

b. Loss Factors

The KWB MOU prescribes loss factors for banking operations. Evapotranspiration losses are assumed to be 6 percent of the gross amount of all water recharged. A study conducted by the KWBA using a methodology developed by the Department and KCWA for the KFE indicates actual losses by evapotranspiration will typically range from 2 percent to 4 percent. The 6 percent loss factor provides assurance that KWB banking operations will not recover more water than that actually recharged.

The KWB MOU provides that an additional 5 percent loss factor will apply to any sales of water to entities outside of Kern County. This additional water provides an overall benefit to the groundwater basin, and cannot be recovered for other uses.

In addition to these losses, 4 percent of the water recharged and stored in the KWB can be purchased by adjoining groundwater districts for overdraft correction purposes.

4. Covenants, Conditions, & Restrictions between KCWA and KWBA – December 1995

A declaration of covenants, conditions, and restrictions (CC&Rs) on the use of the KFE property was executed by the KWBA for the benefit of the KCWA on December 14, 1995, and subsequently recorded as a covenant running with the property. The CC&Rs provided for several of the provisions of the *Statement of Principles*, including:

- A limitation on consumptive use of groundwater by the KWB project of 0.3 AF/acre;
- Restrictions on the sale, transfer, lease, etc., of parts of the KFE property as long as KCWA has determined that the property can be used economically for groundwater storage and recovery,
- Restrictions on the use of any proceeds from approved KFE property sales, transfers, leases, etc.;
- Remedies for violations of the CC&Rs; and
- Priorities for the use of the KFE property.

The priorities for the use of the KFE property as described in the CC&Rs are as follows: 1st priority – KWBA Member Entities; 2nd priority – KCWA Basic Contract Member Units; 3rd priority – KCWA Non-Basic Contract Member Units; and 4th priority – Kern County entities. Any excess capacity beyond that needed for the first four priorities can be used by others under terms and conditions acceptable to KWBA and KCWA.

5. Limitations of Exports and Sales

All transfers from member districts of KCWA require the approval of KCWA. Current KCWA policy places limitations on the sale of banked SWP water. Department approval is required for

conveyance of banked SWP water through SWP facilities. CVP contracts place limitations on potential sales of Friant-Kern CVP water. A place-of-use restriction requires the use of banked Friant-Kern groundwater to be within the CVP place of use. Consequently, these agreements and restrictions limit the classification of water that may be transferred to non-Kern County agencies.

C. Facilities

1. Facilities Development Plans

KWBA's purpose for development of the KWB was to permit the delivery, percolation, and storage of water in aquifers for later extraction, conveyance, and use for the benefit of the project participants.[8] KWBA's construction plans for the KWB included the completion of a Master Plan, the repair and rehabilitation of existing wells under an energy conservation program funded in part by the State of California (SB 583), the expansion of the turnout and channel providing water to the W-4 pond, and the River Area Construction Project, as described in Table 4.

Table 4. KWBA Development Projects

Project	Years	Activity
KCWA Flood Emergency Program	1995	Construction of 3,034 acres of recharge ponds.
KWBA pond construction	1998-2002	Construction of 4,080 acres of recharge ponds.
Master Plan	1999-2002	Rehabilitation of 10 existing wells, installation of 31 new wells, installation of pipeline to the new wells, and the construction of the Kern Water Bank Canal, that connects the Kern River and the California Aqueduct.
SB 583 Pump Repair and Well Rehabilitation Program	2002-2003	Repair and/or rehabilitation of 10 existing wells pursuant to this program, including the removal of existing well pumping equipment, well-testing, well-casing rehabilitation of some wells, pump repair or replacement, and the reassembly of the wells.
Expansion of the W-4 Pond Turnout and Channel	2003	Enlarged turnout structures and channel to the W-4 pond.
River Area Construction Project	2004	Construction of eight additional recovery wells, pipelines for these eight wells and an additional seven wells, a conveyance pipeline to route the recovered water from these 15 wells to the Kern Water Bank Canal, and a lift station (100 cfs capacity) to convey water for recharge purposes to River Area ponds.

Source: The Kern Water Bank Authority, HCP/NCCP 2003 Annual Report and 2004-2005 Management Plan. May 1, 2004.

[8] The Kern Water Bank, Dec. 14, 2004, Appendix A, p. 2

2. Facilities Constructed

Since the transfer of the KFE property, KWBA has constructed recharge ponds, the Kern Water Bank Canal, extraction wells, and pipelines to convey recovered water from operational wells, and has rehabilitated some existing wells (Figure 6).

a. Recharge Ponds

In 1995, under the KCWA flood emergency program (see Section III.B) and prior to the formation of the KWBA, KCWA and the other future participants of the KWBA constructed 3,034 acres of recharge ponds (Figure 3). From 1998 through 2003, KWBA constructed an additional 4,080 acres of recharge ponds, for a total of 7,114 acres. Of this total, 4,699 acres of the recharge ponds constructed are located within the Recharge Sector and 2,415 acres within the Farming Sector. The ponds consist of low earthen levees that pond water to depths of a few feet. This water percolates into the alluvial fan for recharge into the aquifer. Water flows between the ponds in small channels; operators control the flow with small weir boxes.

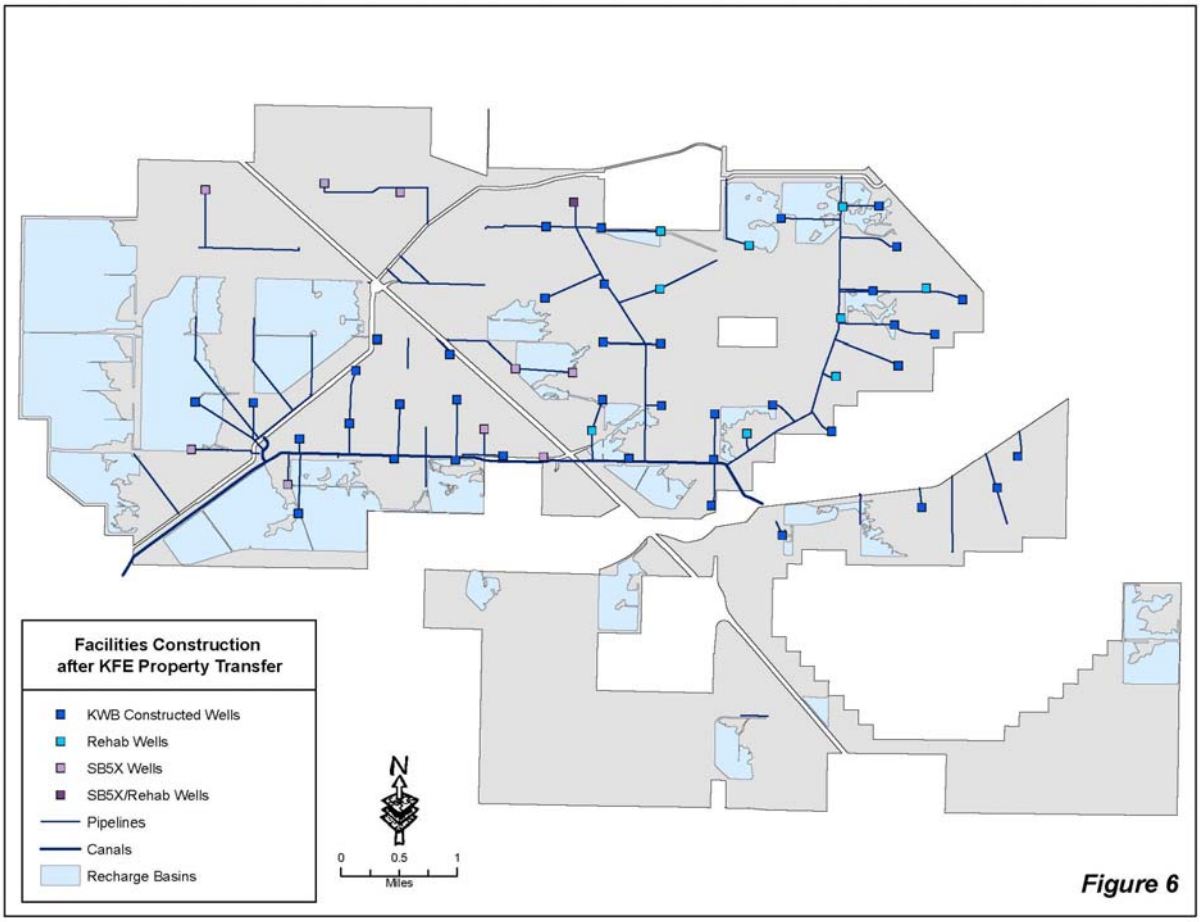

Figure 6

b. Recovery Wells

Sixty-five agricultural wells were present on the KFE property when it was acquired by the Department in 1988. At the time the property was transferred to KCWA, 31 of these wells were

considered operable, although 3 of these were not connected to any conveyance facilities. The remaining 34 were idle wells in various states of disrepair.

KWBA installed 39 new wells in two phases to accommodate groundwater recovery. The first phase of 31 wells was completed in 2001. Eight additional wells were completed in early 2005. KWBA also rehabilitated ten existing wells and repaired an additional 13 wells. As of December, 2006, a total of 79 wells are operable. All KWB well pumps are electric.

c. Conveyance Facilities

The KWBA constructed the Kern Water Bank Canal from the Kern River to the California Aqueduct; the canal is approximately 6 miles long and 90 feet wide. Associated structures include headworks at the Kern River, a check structure, a 545 cfs pump station, and diversion facilities at the California Aqueduct. The canal is bi-directional and will receive or deliver about 800 cfs from or to the California Aqueduct or from the Kern River. The western reach of the canal is at the same elevation as the California Aqueduct; therefore, conveyance of water through the western reach does not require pumping energy. KWBA began construction of the Kern Water Bank Canal in 1999 and completed the canal in October 2000.[9]

The KWBA installed small diameter (15” to 24”) PVC pipelines to transport water recovered from extraction wells to existing canals or to large diameter (60”) high-density polyethylene pipelines.

D. Land Use

The KWBA utilizes the lands of the KFE property for various purposes. The KFE property is used primarily as a water recharge and recovery facility. Numerous recharge ponds, wells, conveyance facilities, etc. (see Facilities section above) have been constructed on the property.

In 1997, the KWBA initiated vegetation and restoration programs. The goal of these programs is to protect existing and newly established sensitive habitats for long-term management. Exotic pest plant control is also an important long-term management activity. Annual mowing, livestock grazing (both cattle and sheep), and prescribed burning are all utilized for vegetation management. Limited applications of selective herbicides are used in most years to help control exotic pest plants.

On a limited basis, KWBA has planted various plant species based on the HCP/NCCP. Cottonwoods, willows, and grasses are examples of species planted to enhance percolation within the recharge basins and for wildlife habitat. In retired farm areas that are returning to natural conditions, there is an increase in the number of species and individuals at the KWB, including listed species like Tipton kangaroo rats, and San Joaquin kit foxes.

Under the direction of CDFG, safflower is farmed annually, usually around 70 acres, to enhance dove habitat and to be utilized in an annual dove hunt. In years with sufficient water, there is also a CDFG sponsored waterfowl hunt on designated recharge ponds on the KFE property.

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[9] The Kern Water Bank: Infrastructure Development, the Kern Fan Monitoring Committee, and Groundwater Conditions. December 14, 2004

Various oil and gas companies maintain use of parcels on the KFE property to exercise their mineral rights on the property. Since 1996, several oil company-related construction projects have occurred. For example, Chevron Pipeline Company in 1998 removed 44,227 feet of pipeline, of which 27,000 was on the KFE property. Various companies enter the KFE property regularly to conduct maintenance-related surveys of their equipment and to ensure environmental compliance. If environmental issues are observed by the KWBA related to any oil or gas facilities, the representative companies are contacted immediately to ensure proper action.

As part of the monitoring undertaken by the KWBA in compliance with the HCP/NCCP, annual reports are issued summarizing land use by wildlife, any environmental take related to activities on KFE property, and habitat and vegetation restoration efforts. There has been only one occurrence of the take of an endangered species on the KFE property; Tipton kangaroo rats were temporarily relocated during the construction of the Kern Water Bank Canal, then placed back in the area alive and well after the construction was complete.

1. Mitigation Lands

The HCP/NCCP establishes permanent mitigation lands on the KWB. These lands include a DWR Mitigation Parcel of 530 acres, and a KWBA Mitigation Parcel of 635 acres (which is part of the Compatible Habitat acreage shown in Table 1). As part of the mitigation effort laid out in the HCP/NCCP, agencies and qualified third parties are allowed to purchase Conservation Credits for projects that may cause temporary or permanent disturbance to lands that includes much of the San Joaquin Valley portions of Kern, Kings, and Tulare counties.[10] For more information on this process, refer to the "Conservation Bank Agreement" included in Volume II of the HCP/NCCP.

VI. KWBA's KWB Operations

A. Overview of Kern County Water Operations

This section provides an overview of general water operations within Kern County. While these operations are not directly related to the KWBA's KWB operations, this is intended to provide some background for general water operations within the county, and some context for how KWB operations fit within that.

1. Water Sources

Kern County residents have historically used surface water primarily from three sources: the Kern River and other local streams, SWP, and CVP. The SWP delivers water from the north via the California Aqueduct. The CVP delivers water from the north via the California Aqueduct and Cross Valley Canal, and from the central Sierra via the Friant-Kern Canal. The Kern River system and other local streams drain the southern Sierra. Local conveyance facilities, including

[10] More information on this process is contained in the "Conservation Bank Agreement" included in Volume II of the HCP/NCCP, on file with the Department.

the Kern Water Bank Canal, Cross Valley Canal, and Pioneer Canal, can be used convey water from these primary sources to various parts of the KFE property.

a. Kern River and Other Local Streams

The Kern River has historically been a primary source of surface water to Kern County. North Kern WSD, Kern Delta WD, Buena Vista WSD, KCWA, and the City of Bakersfield are the major holders of Kern River surface water rights.

In most years, water users divert all Kern River flow downstream from its entrance to the valley, northeast of Bakersfield, and as a result the river channel through the KFE property is typically dry. However, in extremely wet years, the Kern River Intertie diverts Kern River flows into the California Aqueduct to prevent downstream flooding. Since 1978, over 1,000,000 AF of Kern River water has flowed through the Kern River-California Aqueduct Intertie. During the same period, an additional 430,000 AF of Kern River water bypassed the Intertie via the Kern River flood channel. These flood flows have exceeded the available capacity of recharge facilities in Kern County since KCWA constructed the Intertie in 1977.

In very wet years the significant quantities of flood waters that otherwise would be diverted into the Intertie are available for recharge in the KFE area. At other times, other pre-1914 appropriative water right holders can provide Kern River water for recharge in the KWB. Although these right holders are not partners in the KWB, KWBA participants may purchase Kern River water from them for storage in the KWB.

Water users can divert the flows of the Kaweah, Tule, and Kings Rivers stream groups on the east side of the San Joaquin Valley and convey the water via the Friant-Kern Canal to its terminus. From the terminus, water users can release the water into the Kern River channel or through various connections into the Cross Valley Canal. As with Kern River water, pre-1914 appropriative water right holders can provide Kaweah, Tule, and Kings Rivers water for recharge in the KWB. Although these right holders are not partners in the KWB, KWBA participants may purchase water from them for storage in the KWB.

b. SWP

The SWP is a large source of non-local water for Kern County. KCWA has a SWP Table A amount of 998,730 AF. Thirteen Kern County member agencies contract for this water from KCWA, and KCWA has retained a portion for itself and its Improvement District No. 4 (Table 5). Dudley Ridge WD, an SWP contractor located in Kings County, currently has a SWP Table A amount of 57,343 AF.

KCWA and Dudley Ridge WD can recharge SWP Table A and Article 21 water when they have SWP water in excess of their immediate in-district demands. They can also transfer or exchange water with other agencies to increase or reduce their water supplies in a year, or participate in arrangements that change the year of water deliveries.

Table 5. KCWA Member Units That Hold Contracts With KCWA to Receive SWP Table A Water	
Agency	**Contractual Table A Amount (AF)**
Belridge WSD	121,508
Berrenda Mesa WD	108,600
Buena Vista WSD	21,300
Cawelo WD	38,200
Henry Miller WD	35,500
KCWA	8,000
Kern Delta WD	25,500
Lost Hills WD	119,110
Improvement District No. 4	82,946
Rosedale-Rio Bravo WSD	29,900
Semitropic WSD	155,000
Tehachapi-Cummings County WD	19,300
Tejon-Castac WD	5,278
West Kern WD	31,500
Wheeler Ridge-Maricopa WSD	197,088
Total	**998,730**
Source: KCWA, 2006.	

c. CVP

CVP contractors in Kern County may receive water via the Friant-Kern Canal or the Cross Valley Canal, either directly or by exchange or transfer according to contract provisions with Reclamation .[11] Arvin-Edison WSD, Delano-Earlimart ID, Shafter-Wasco ID, and Southern San Joaquin MUD have Friant Division long-term contracts with USBR.

Reclamation's contracts with Friant-Kern contractors include a two-class system of water allocation. Municipal and industrial (M&I) and agricultural water users who have limited access to good-quality groundwater have Class 1 contracts, which are based on a firm water supply. Reclamation delivers the Friant-Kern's first 800 TAF of annual water supply under Class 1 contracts.[12] Class 2 water is a supplemental supply; Reclamation delivers Class 2 water directly for agricultural use or for groundwater recharge, and these are areas that generally experience groundwater overdraft.

In addition to Class 1 and Class 2 water deliveries, Reclamation delivers water that would otherwise be released for flood control purposes. Section 215 of the Reclamation Reform Act of 1982 authorizes the delivery of unstorable irrigation water that would be released in accordance with flood control criteria or unmanaged flood flows. Reclamation's delivery of Section 215 water has enabled contractors to recharge more water for groundwater replenishment than could otherwise be supported with only Class 1 and Class 2 contract deliveries.

[11] While CVP water can be delivered to the KWB through the Cross Valley Canal, such deliveries are not considered further in this study because, to date, no excess water has been made available for KWB recharge from this source.
[12] USBR and DWR, 2003, Upper San Joaquin River Basin Storage Investigation, Phase 1 Investigation Report

In addition to the Class 1, Class 2, and conjunctive management aspects of Friant Division operations, some districts often arrange annual water transfers with other districts. These transfers provide opportunities to improve water management within the Friant service area. In wet years, districts that have water surplus to their needs can transfer water to other districts with the ability to recharge groundwater. Conversely, in dry years, districts that store water can return water to districts with little or no groundwater supply; these arrangements provide an informal groundwater banking program within the Friant Division.

KWBA participants do not have long term contracts for CVP water, but have purchased Section 215 and other flood waters from the CVP system through temporary contracts with Reclamation.

2. Water Management Exchanges and Landowner Transfers

Water transfers and exchanges have historically been and continue to be a regular part of water management in the San Joaquin Valley. Transfers are one-way transactions, where water from one agency is transferred to another, with no future return of that water. For KCWA, transfers with another agency are typically "landowner transfers," where a landowner that owns land within both KCWA and another agency's service area wants to transfer the water available to it from one agency for use on its land in the other agency's service area. Exchanges are two-way transactions, where water from one agency or source is delivered to another agency, in exchange for the return of a specified quantity of water. An exchange may involve a change in the timing of delivery of water (e.g., water from one agency is delivered to another, in exchange for water from the other agency delivered later that year or in a following year), or a change in the source of water delivered (e.g., water from a source available to one agency is delivered to another, in exchange for water from a different source). These transactions can provide a number of benefits, including improved water management, reduced costs for water delivery, and/or improved water quality.

3. Water Sales

Table 6 gives an account of water sales by KCWA member agencies and other entities within Kern County to the Environmental Water Account (EWA) in the years 2000 and 2001. The table gives the SWP water exchange total for both 2000 and 2001, lists the seller and their amount (in AF), the type of water banked, which facility or agency banked the water, and the date the water was released to the EWA. These sales are representative examples of the types of water sales that occur from Kern County groundwater banks.

In addition to these types of sales, 4 percent of the water recharged and stored at the KWB can be purchased by adjoining groundwater districts within Kern County for overdraft correction purposes.

Table 6. Sales by Kern County Entities to the Environmental Water Account in 2000 and 2001				
Seller	**Amount (AF)**	**Banked Groundwater Type**	**Groundwater Banking Facility or Agency**	**Date Water Released to EWA**
2000 SWP Table A Allocation Exchange Water Purchased and Delivered in 2000				
Kern Water Bank Participants	31,555	Friant-Kern Flood	KWB	7/00
Kern Water Bank Participants	40,725	Kern River Flood	KWB	8/00
2000 SWP Carryover Table A Allocation Exchange Water Purchased and Delivered in 2001				
Arvin-Edison	10,000	Friant-Kern Flood	Arvin-Edison WSD	3/01
Rosedale Rio Bravo	19,036	Friant-Kern Flood	Rosedale Rio Bravo WSD	3/01
Westside Mutual Water Co.	15,000	SWP Table A Allocation	KWB	3/01
2000 SWP Exchange Subtotal		**116,316**		
2000 SWP Table A Allocation Exchange Water Purchased and Delivered in 2001				
KCWA for Nickel Family LLC[1]	10,000	Kern River Flood	Pioneer Project	5/01
KCWA/ID 4	10,000	Kern River Flood	KWB	6/01
Buena Vista/ Rosedale/ West Kern	20,218	SWP Table A Allocation	Buena Vista WSD	5/01
Buena Vista/ Rosedale/ West Kern	1,000	SWP Table A Allocation	Buena Vista WSD	5/01
Buena Vista/ Rosedale/ West Kern	2,500	SWP Table A Allocation	Buena Vista WSD	7/01
Semitropic WSD	10,767	SWP Table A Allocation	KWB	10/01
Semitropic/ Tulare ID	4,233	Friant-Kern[2]	Semitropic WSD	11/01
Westside Mutual/Tejon Castaic	21,000	SWP Table A Allocation	KWB	10/01
Cawelo WD	5,000	SWP Table A Allocation	KWB[3]	11/01
2001 SWP Exchange Subtotal		**84,718**		
2000 & 2001 Total		**201,034**		

[1] The Nickel Family LLC is a private company primarily invested in farming. Nickel was the owner of a pre-1914 Kern River Water Right, referred to as the Lower River Water Rights. KCWA recently purchased the Lower River Rights from Nickel, and as part of the deal, Nickel is supplied with 10,000 AF of water per year by KCWA. Nickel banks this water in KCWA's portion of the Pioneer Project.
[2] Tulare ID delivered non-CVP water to Semitropic WSD via a Friant-Kern exchange.
[3] Westside Mutual pumped its KWB account in exchange for a like amount of Cawelo's 2800-acre account that was assigned to Belridge on behalf of Westside Mutual.
Source: KCWA 2002

B. KWB Banking Operations

1. Recharge Operations

From 1995 through 2005, KWBA delivered approximately 1.3 million AF of water for recharge. Most of this recharge occurred during 1995-1998 and 2005 (see Figure 7). As would be

expected, the volumes of water available for recharge are dependant upon California's annual water conditions. Table 7 shows the annual variability of statewide precipitation, Tulare Lake regional precipitation, SWP allocations, and CVP allocations.

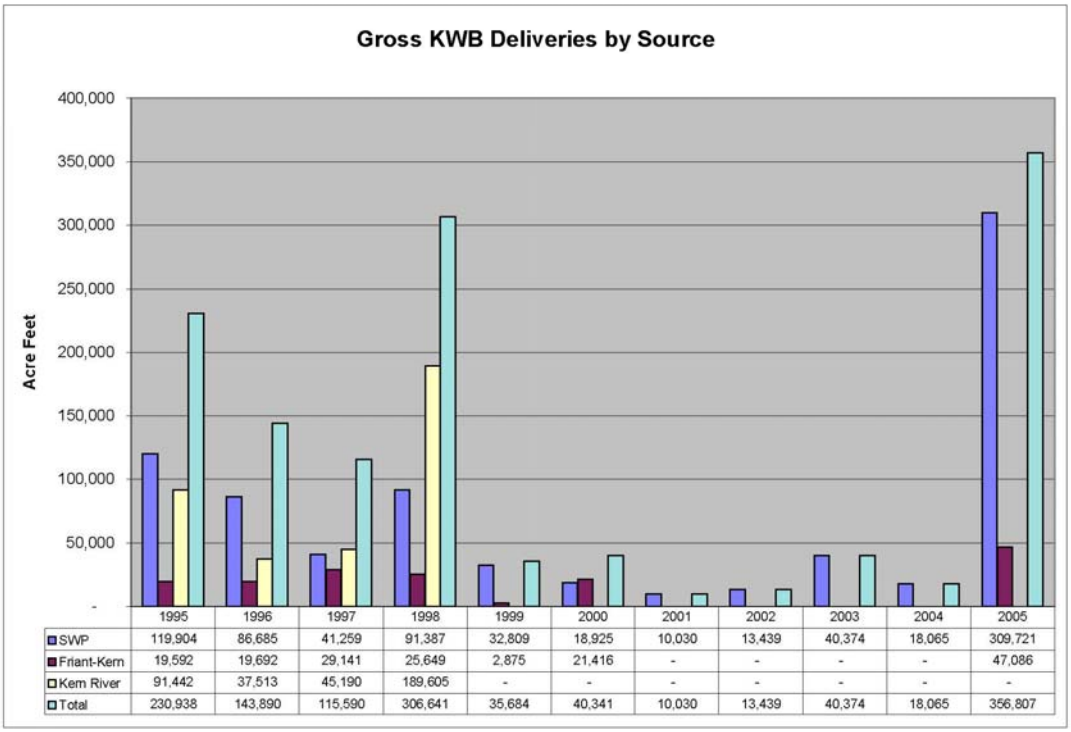


Figure 7

Table 7. California Water Conditions Data Relevant to Kern County					
Year	**State-wide Precipitation (% of average)**	**Tulare Lake Hydrolog. Region Precipitation (% of average)**	**SWP Allocation (% of Table A request)**	**CVP Friant-Kern Allocation (Class 1/ Class 2)**	**Kern River Flows[13] (AF)**
1995	165	165	100	100/100	1,240,895
1996	115	105	100	100/58	953,127
1997	125	130	100	100/60	1,160,099
1998	170	190	100	100/10	1,533,906
1999	95	80	100	100/20	410,403
2000	100	95	90	100/17	465,213
2001	75	60	39	100/5	495,616
2002	75	80	70	100/8	350,547
2003			90	100/5	457,176
2004			65	100/8	421,423

[13] Kern River downstream of Lake Isabella (Source: CDEC)

Table 8 provides a summary of gross deliveries for recharge by source, as of December 31, 2005. Sixty percent of the deliveries were SWP water, 27 percent were Kern River water, and 13 percent were Friant-Kern water.

Table 8. Gross Deliveries for Recharge by Source Through December 2005			
SWP (AF)	**Friant - Kern (AF)**	**Kern River (AF)**	**Total (AF)**
782,598	165,451	363,750	1,311,799
60%	13%	27%	na

Water delivered to recharge ponds is subject to losses by evapotranspiration. As prescribed in the KWB MOU, 6 percent evapotranspiration losses are deducted from all gross deliveries to KWB recharge ponds to determine the net amount of these deliveries that is recharged and stored. Annual gross deliveries for recharge and net recharge after losses are shown in Table 9, rows 1 and 2. Other changes to storage accounts, including miscellaneous acquisitions of stored water and exchanges between KWB participants, are shown in rows 3 and 4.

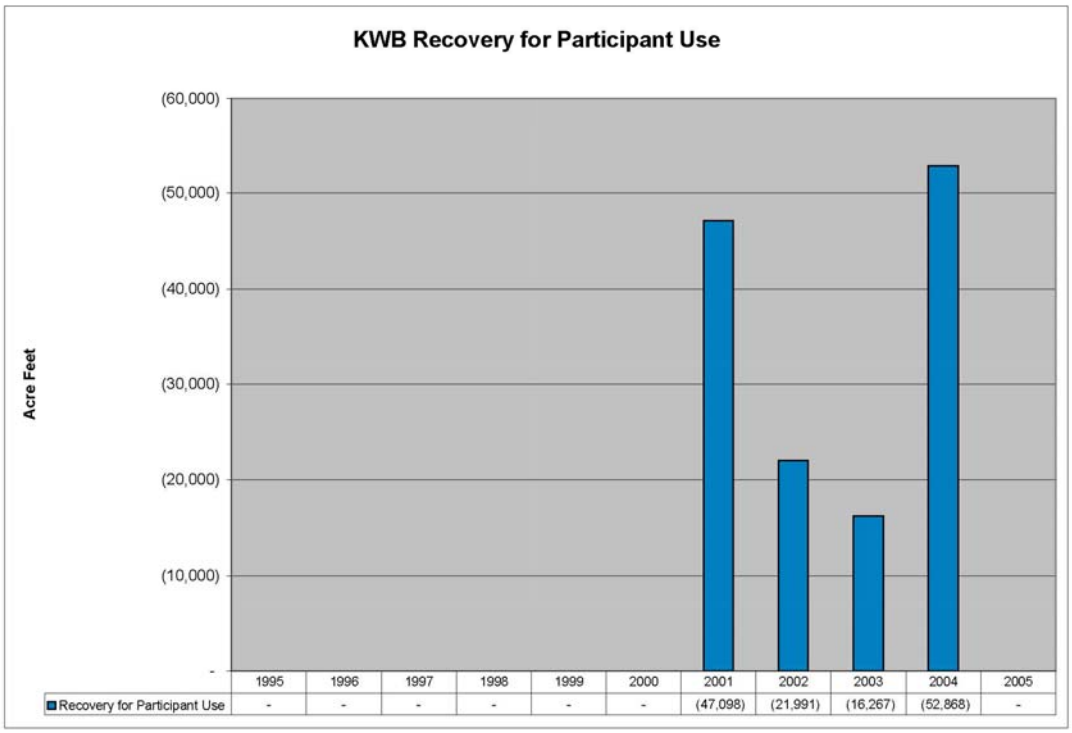
2. Recovery Operations

Water stored in the KWB has been recovered by the KWB participants either for their direct use or for sale to others. From 1995 through 2005, recovery for participant use totaled 138,224 AF. All of this water was recovered during the dry years from 2001 through 2004 (see Figure 8). During this same 1995 through 2005 period, water sales totaled 423,320 AF. About three quarters of these sales were to the EWA, with the remaining sales to:

- agricultural entities within the San Joaquin Valley,
- a wildlife refuge,
- a power plant located within Kern County,
- and the “4%” water made available to adjoining water districts for overdraft correction pursuant to the KWB MOU (see Figure 9).

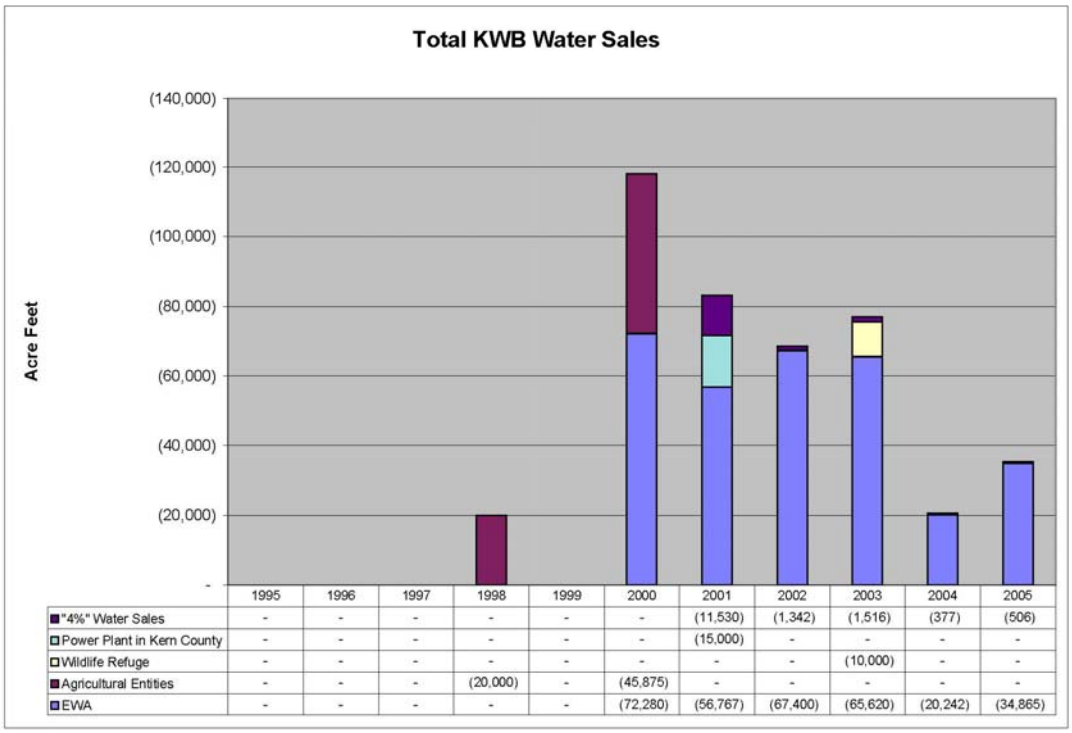
All of these sales occurred in 1998 and 2000 through 2005.

Water stored in the KWB can be recovered by one of two mechanisms, 1) recovery by pumping or, 2) recovery by exchange. Recovery by pumping entails the physical pumping of water from the aquifer using the KWB’s groundwater wells. This type of recovery occurred in the dry years of 2001 through 2004. From 1995 through 2005, a total of 204,639 AF was recovered by pumping. Of this total, 132,099 AF was recovered for participant use and 72,540 AF for water sale (see Table 9, rows 6 and 9).



Data from Table 9, row 8. Includes Recovery by Pumping for Participant Use and Recovery by Exchange for Participant Use.
See Figure 9 for further explanation for Recovery by Exchange for Participant Use.

Figure 8



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
"4%" Water Sales	-	-	-	-	-	-	(11,530)	(1,342)	(1,516)	(377)	(506)
Power Plant in Kern County	-	-	-	-	-	-	(15,000)	-	-	-	-
Wildlife Refuge	-	-	-	-	-	-	-	-	(10,000)	-	-
Agricultural Entities	-	-	-	(20,000)	-	(45,875)	-	-	-	-	-
EWA	-	-	-	-	-	(72,280)	(56,767)	(67,400)	(65,620)	(20,242)	(34,865)

Data from Table 9, rows 14 through 18. Includes Recovery by Exchange for Water Sales.
See Figure 11 for further explanation of Recovery by Exchange for Water Sales.

Figure 9

Stored water can also be recovered by exchange. For example, West Kern WD, which operates a separate banking project adjacent to the KWB, may need to recharge water at times when KWB participants need to recover water. Rather than recharge and recover water at the same time in adjacent projects, West Kern WD's surface water is made available for KWB participant use, and a like amount of KWB stored water is shifted in the groundwater storage accounts from the KWB to West Kern WD. Such exchanges may also occur between KWB participants. These exchanges reduce energy consumption and costs to both parties. From 1995 through 2005, a total of 326,634 AF was recovered by exchange. Of this total, 6,125 AF was recovered for participant use and 320,509 AF for water sales (see Table 9, rows 7 and 10).

3. Water Exchanges

Operational exchanges may be used to increase the efficiency of both recharge and recovery operations. These exchanges can occur at two levels. The first would be a local exchange within Kern County coordinated entirely by KCWA. For example, one of the KWB participants might have Kern River water available to it at the same time that a participant in one of the adjacent Kern Fan banking projects has SWP water available to it. In this situation, the SWP water would be delivered to western banking facilities (e.g., the KWB) to reduce energy consumption costs,

and the Kern River water would be delivered to eastern banking facilities (e.g., the Berrenda Mesa Project). However, the water recharged at the KWB would be accounted for as Kern River water, as if the exchange did not occur.

The second level of exchange that can occur uses facilities outside of Kern County, and typically requires the approval of the Department and/or Reclamation. For example, one of the KWBA participants might exchange its SWP Table A water for a like amount of CVP water available to a CVP contractor, such as Westlands Water District (WWD). In this situation, the Department would deliver the SWP Table A water to WWD via Reach 7 of the California Aqueduct in Kings County for use within the SWP service area, and Reclamation would deliver a like amount of CVP water to KCWA via the Friant-Kern Canal for recharge in Kern County banking facilities. As in the case of the local exchange described above, the water would be accounted for as if the exchange did not occur, or in this example, as SWP water.

4. Storage Accounting

The KCWA oversees all water transactions in Kern County and provides important water accounting for the banking projects in the Kern Fan area. An accounting of KWB storage activities from 1995 through 2005 is shown in Table 9. The table shows:

- Additions to Storage
    - Gross deliveries for recharge
    - Net amount recharged, after 6 percent evapotranspiration losses
    - Acquisitions (e.g., the portion of the Hacienda Program water transferred to KCWA as part of the KFE property transfer)
    - Exchanges between KWB participants
- Recovery for Participant Use
    - Recovered by pumping
    - Recovered by exchange (see Figure 10 for an explanation of the accounting for this type of exchange)
- Water Sales
    - Categorized by method of recovery
        - Recovered by pumping
        - Recovered by exchange (see Figure 11 for an explanation of the accounting for this type of exchange)
        - Placed in trust (15,000 AF of stored water placed in trust for use by a power plant located within the service area of KWBA participant Wheeler Ridge-Maricopa WSD)
        - “4%” water sales (4 percent of stored water made available for purchase by water districts adjoining the KWB, for overdraft correction pursuant to the KWB MOU)

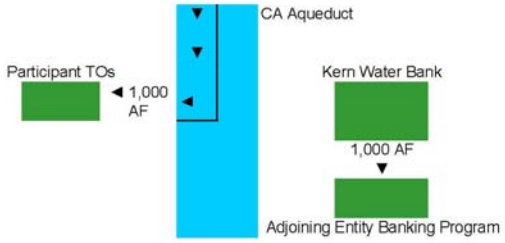
- Categorized by use
  - EWA
  - Agricultural entities in San Joaquin Valley
  - Wildlife refuge
  - Power plant located in Kern County (15,000 AF of stored water placed in trust)
  - "4%" water sales
- Losses for water sales (5 percent losses are applied to all sales of water leaving Kern County, for the overall benefit of the groundwater basin pursuant to the KWB MOU)
- Total storage reduction for sales (recovery by pumping for water sale, plus water placed in trust, plus"4%" water sales, plus losses for water sales)

The KWB storage balance is the net of additions to storage, minus recovery for participant use and total reductions for sales. These KWB activities and total storage balances are shown on an annual and cumulative basis in Figures 12 and 13, respectively. As of December 31, 2005, the KWB participants had a total cumulative balance of 1,050,778 AF of water stored in the KWB.

Recovery by Exchange for Participant Use

Recovery by exchange for participant use is used to deliver water at times when a KWB participant wishes to recover water from the KWB at the same time an adjoining entity with a groundwater banking program has SWP water available in the California Aqueduct that it would have otherwise recharged. The exchange allows the delivery to occur without incurring energy costs or wear and tear on equipment. In the example below, 1,000 AF of water from an adjoining entity is physically delivered to the KWB participant's turn-outs. The 1,000 AF of water is deducted from the KWB participant's previously recharged supply and the adjoining entity's groundwater account is credited with 1,000 AF of water.

Physical Delivery and Accounting



Net KWB Account Change is -1,000 AF

Figure 10

Recovery by Exchange for Water Sale

Recovery by exchange for water sale is used to deliver water at times when a KWB participant wishes to recover an exportable water supply from the KWB for sale to another entity, at the same time it has SWP water available in the California Aqueduct that it would have otherwise recharged. The exchange allows the delivery to occur without incurring energy costs or wear and tear on equipment. In the example below, 1,000 AF of water is physically delivered to the EWA in San Luis Reservoir. The KWB MOU prescribes a 5% loss to the groundwater basin for sales leaving Kern County. Therefore, in this example, a 5% loss of 50 AF is applied. For accounting purposes: 1,000 AF of water is deducted from the KWB Participant's previously recharged exportable supply for "delivery" to San Luis Reservoir, 50 AF is deducted from the KWB Participant's account for the 5% loss factor, and 1,000 AF is added to the KWB Participants account as stored SWP water. In Table 9, the amount exchanged is shown as Recovery by Exchange for Water Sale (row 10), and for sales of water leaving Kern County, the 5% reduction for losses is shown as Losses for Sales (row 20).

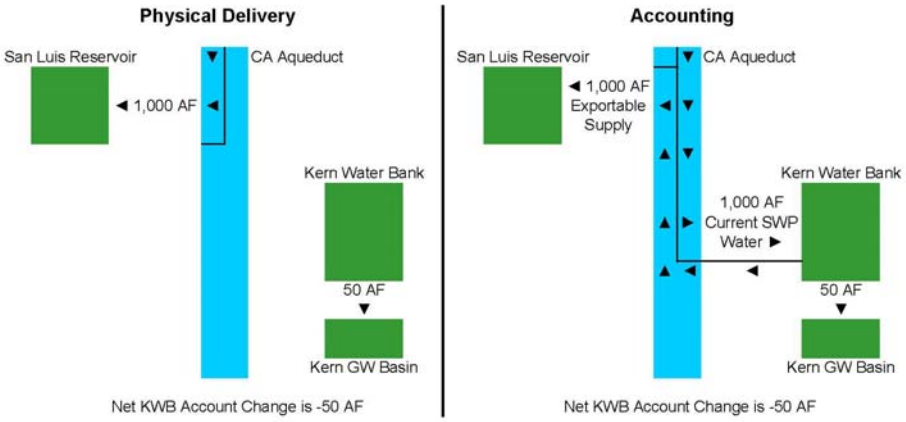
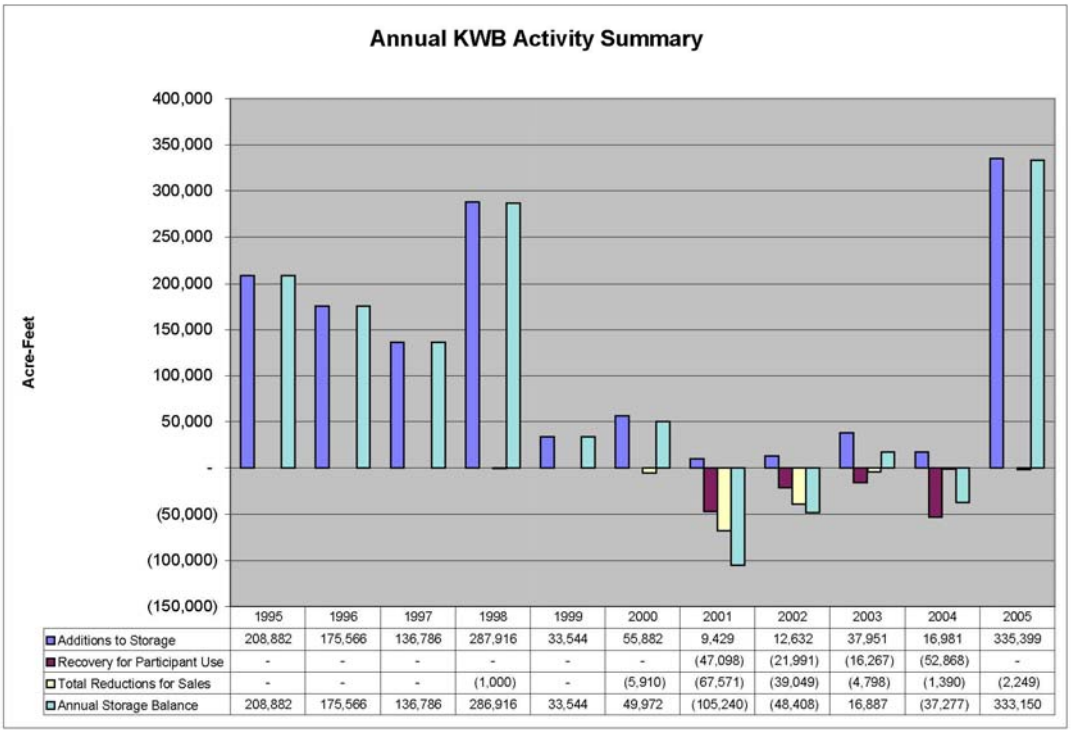


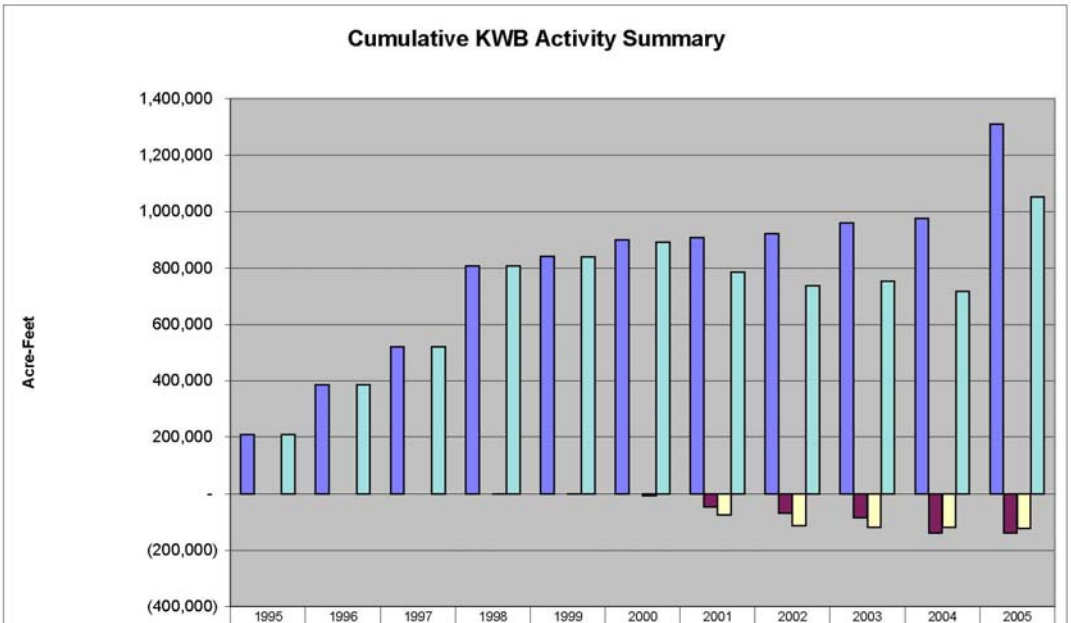
Figure 11



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Additions to Storage	208,882	175,566	136,786	287,916	33,544	55,882	9,429	12,632	37,951	16,981	335,399
Recovery for Participant Use	-	-	-	-	-	-	(47,098)	(21,991)	(16,267)	(52,868)	-
Total Reductions for Sales	-	-	-	(1,000)	-	(5,910)	(67,571)	(39,049)	(4,798)	(1,390)	(2,249)
Annual Storage Balance	208,882	175,566	136,786	286,916	33,544	49,972	(105,240)	(48,408)	16,887	(37,277)	333,150

Data from Table 9, row 5, 8, 21, and 22.

Figure 12



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Additions to Storage	208,882	384,448	521,234	809,150	842,694	898,576	908,005	920,637	958,588	975,569	1,310,968
Recovery for Participant Use	-	-	-	-	-	-	(47,098)	(69,089)	(85,356)	(138,224)	(138,224)
Total Reductions for Sales	-	-	-	(1,000)	(1,000)	(6,910)	(74,481)	(113,530)	(118,328)	(119,717)	(121,966)
Cumulative Storage Balance	208,882	384,448	521,234	808,150	841,694	891,666	786,426	738,018	754,905	717,628	1,050,778

Figure 13

Table 9.
KWB Account Summary

	Row	Formula	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[9]	2005[9]	Totals
Additions to Storage														
Recharge														
Gross Deliveries	1		230,938	143,890	115,590	306,641	35,684	40,341	10,030	13,439	40,374	18,065	356,807	1,311,799
Net Recharge (after 6% losses)[1]	2	row 1 x .94	217,082	135,256	108,654	288,243	33,544	37,920	9,429	12,632	37,951	16,981	335,399	1,233,091
Acquisitions	3		-	49,518	28,359	-	-	-	-	-	-	-	-	77,877
Exchanges Between Participants[2]	4		(8,200)	(9,208)	(227)	(327)	-	17,962	-	-	-	-	-	-
Total Additions to Storage	5	rows 2 + 3 + 4	208,882	175,566	136,786	287,916	33,544	55,882	9,429	12,632	37,951	16,981	335,399	1,310,968
Recovery for Participant Use														
Recovery By Pumping for Participant Use[3]	6		-	-	-	-	-	-	(47,098)	(21,991)	(16,267)	(46,743)	-	(132,099)
Recovery By Exchange for Participant Use[4]	7		-	-	-	-	-	-	-	-	-	(6,125)	-	(6,125)
Total Recovery for Participant Use	8	rows 6 + 7	-	-	-	-	-	-	(47,098)	(21,991)	(16,267)	(52,868)		(138,224)
Water Sales														
Sales by Method														
Recovery By Pumping for Water Sale[3]	9		-	-	-	-	-	-	(38,203)	(34,337)	-	-	-	(72,540)
Recovery By Exchange for Water Sale[4]	10		-	-	-	(20,000)	-	(118,155)	(18,564)	(33,063)	(75,620)	(20,242)	(34,865)	(320,509)
Trust Accounts[5]	11		-	-	-	-	-	-	(15,000)	-	-	-	-	(15,000)
"4%" Water Sales[6]	12		-	-	-	-	-	-	(11,530)	(1,342)	(1,516)	(377)	(506)	(15,271)
Total Sales	13	sum rows 9 - 12	-	-	-	(20,000)	-	(118,155)	(83,297)	(68,742)	(77,136)	(20,619)	(35,371)	(423,320)
Sales by Use														
EWA	14		-	-	-	-	-	(72,280)	(56,767)	(67,400)	(65,620)	(20,242)	(34,865)	(317,174)
Agricultural Entities	15		-	-	-	(20,000)	-	(45,875)	-	-	-	-	-	(65,875)
Wildlife Refuge	16		-	-	-	-	-	-	-	-	(10,000)	-	-	(10,000)
Power Plant in Kern County[5]	17		-	-	-	-	-	-	(15,000)	-	-	-	-	(15,000)
"4%" Water Sales[6]	18		-	-	-	-	-	-	(11,530)	(1,342)	(1,516)	(377)	(506)	(15,271)
Total Sales	19	sum rows 14 - 18	-	-	-	(20,000)		(118,155)	(83,297)	(68,742)	(77,136)	(20,619)	(35,371)	(423,320)
Losses for Sales[7]	20	out-of-co sales x .05	-	-	-	(1,000)	-	(5,910)	(2,838)	(3,370)	(3,282)	(1,013)	(1,743)	(19,156)
Total KWB Storage Reduction for Sales[8]	21	rows 9 + 11 + 12 + 20	-	-	-	(1,000)	-	(5,910)	(67,571)	(39,049)	(4,798)	(1,390)	(2,249)	(121,966)
KWB Storage Balance														
Annual Storage Balance	22	rows 5 + 8 + 21	208,882	175,566	136,786	286,916	33,544	49,972	(105,240)	(48,408)	16,887	(37,277)	333,150	1,050,778
Cumulative Storage Balance	23	row 23[0] + row 22[1]	208,882	384,448	521,234	808,150	841,694	891,666	786,426	738,018	754,905	717,628	1,050,778	

1 Net Recharge is the amount of Gross Deliveries stored after deducting 6% for evapotranspiration losses. 2 Exchanges between KWB participants using existing KWB storage accounts. Note that there in no net change to KWB storage resulting from these exchanges. 3 Recovery By Pumping is stored water recovered by physically pumping it from wells. 4 Recovery By Exchange is stored water recovered by exchange with surface water available at the same time. See Figures 9 and 11 for further explanation. 5 Stored water placed in Trust for use by a power plant located within the service area of KCWA member agency Wheeler Ridge-Maricopa WSD. 6 "4%" Water Sales is 4% of stored water made available for purchase by water districts adjoining the KWB for overdraft correction, pursuant to the KWB MOU. 7 Losses for Sales are losses of 5% applied to all sales of water leaving Kern County, pursuant to the KWB MOU. 8 9 Data for 2004 and 2005 are preliminary and subject to minor revision. Total KWB Storage Reduction for Sales is Recovery By Pumping for Water Sale + Trust Account + "4%" Water Sales + Losses for Sales. Recovery By Exchange for Water Sale is not included in this total because it is an exchange with surface water supplies and so does not result in physical storage reductions (see Figure 11 for further explanation).

5. Operations Monitoring

As discussed in Section V.B.3, the KWB is operated under the requirements of the *Memorandum of Understanding Regarding Operation and Monitoring of the Kern Water Bank Groundwater Banking Program*, which provides for the establishment of an extensive monitoring program and a Monitoring Committee to oversee banking operations and the results of said monitoring. The committee is made up of several basin stakeholders including the KCWA and all adjoining water districts.

a. Groundwater Monitoring

KWBA has used extensive monitoring to establish baseline groundwater quality and ensure that groundwater problems are not developing. This monitoring consists of two elements: 1) the regular sampling of 50 dedicated monitoring wells for several potential constituents of concern, and 2) the sampling of all recovery wells according to a Monitoring Schedule developed by the Department of Health Services.

The sampling of the monitoring wells is mandated by the KWB MOU. Under this program, water levels are measured at least semiannually, and water samples are analyzed for several potential constituents of concern at least annually. The results of this monitoring are reported to and reviewed by the Monitoring Committee to ensure that excellent groundwater quality is maintained.

The second element of groundwater monitoring includes sampling the recovery wells according to a DHS Title 22 Monitoring Schedule for wells providing water to municipal purveyors (KCWA, 1997). In addition to providing extensive information regarding groundwater quality, the results of this sampling are used to model expected changes in water quality in conveyance facilities receiving the recovered water.

b. Mitigation

A primary purpose of the Monitoring Committee is to evaluate groundwater information and determine if adverse impacts are likely to occur as a result of project operations. If the Monitoring Committee determines that adverse impacts are likely, then mitigation strategies are developed, as discussed in more detail in Section V.B.3. No mitigation measures have been necessary to date.

C. Maintenance and Other Operations

1. Water Operations Facilities Management

The KWB HCP allows the KWBA to install, construct, repair, maintain, and operate water recharge, water recovery, and water conveyance facilities within the Recharge Basin Sector and the Other Water Banking Facilities Sector of the KWB. The management of these facilities is described in Annual Management Plans submitted to the wildlife agencies. These plans ensure that management activities comply with the HCP's Vegetation Management Plan, the Minimization of Impacts Requirements, and other measures prescribed by the HCP (see Section V.A.2.b.).

Typical activities include grazing, burning, and mowing in conformance with the Vegetation Management Plan, the application of herbicides with hand sprayers at wells and gate structures, road grading, and fence repair.

2. Land Maintenance

The primary tool for managing the habitat and fauna of the Kern Water Bank is the HCPs Vegetation Management Plan, with the primary goal being the minimization of tumbleweed and other noxious non-native plant growth (primarily salt cedar). This in turn encourages native plant growth and the continued conversion of water bank lands into exceptional upland, riparian, and alkali flat habitats. The tools provided in the Vegetation Management Plan include burning, grazing, disking, mowing, and herbicide application. From 1996 through 1999, tumbleweeds were primarily controlled with burning. In 2003, tumbleweeds were primarily controlled with cattle and sheep grazing programs. Other management programs include burning in ditches and chopping old tumbleweed drifts. Chopping removes the dense cover of the drifts and allows for the reestablishment of grasses and forbs which compete with the tumbleweeds. Salt cedar is controlled with herbicide spraying at various locations on an as-needed basis.

3. Habitat Restoration and Enhancement

The creation of the KWB is resulting in the reestablishment and preservation of exceptional wetland and upland habitat that existed historically throughout much of the southwestern San Joaquin Valley. About 17,000 of the 20,000 acres that comprise the KFE property were farmed intensively prior to 1991. Now, the water conservation activities of the KWB are re-creating intermittent wetland habitat. Willows, cottonwoods, sedges, and other wetland vegetation are reemerging, and the recharge basins and basin edges are providing nesting and foraging habitat for waterfowl and other birds. To date, more than 40 species of waterfowl have been sighted on the KFE property, including Caspian terns, the white-faced ibis, double-crested cormorants, and white pelicans.

Recharge activities only occur on about one third of the KFE property; upland habitat is becoming reestablished on the remaining two thirds of the property. Vegetation management in these areas is focusing on regenerating native grasses and plants that help to promote the threatened and endangered species associated with this area. This upland habitat is supporting large populations of raptors, kangaroo rats, rabbits, badgers, bobcats, and coyotes. Of particular importance are the populations of Tipton kangaroo rats, burrowing owls, and tri-colored blackbirds.

4. Clean-up of Areas of Environmental Concern

A *Preliminary Environmental Assessment* report prepared by Luft Environmental Consultants in October 1995 identified “Areas of Potential Environmental Concern” (APECs) on the KFE property. All of the APECs which are KWBAs’ responsibility have been cleaned up, remediated and/or closed. These include:

- *Buena Vista Ranch Headquarters and the HSST Ranch Headquarters:* The pesticides in soil identified at the Buena Vista Ranch Headquarters and the HSST Ranch Headquarters, each an APEC, were remediated by the Kern Water Bank Authority. The scope of the clean-up involved excavating contaminated soil and treating it in a thermal-desorption unit. The Department of Toxic Substances Control certified that the remedial activities were complete in 2001 and that the land could be used for all uses, including the "intended purpose of maintaining a groundwater resource bank."

- *S&M Farms, Tumbleweed Farms, Red Dirt, Two Tanks:* No significant environmental issues were identified at these sites. The trash at S&M farms and the two tanks have been removed.

- *Underground Storage Tanks:* The Kern Water Bank Authority has also removed two underground storage tanks (USTs) not identified in previous environmental reports. The USTs were uncovered at the Buena Vista Ranch Headquarters on April 30, 1999, and removed May 7, 1999 under a Kern County Environmental Health Services Department permit. No soil contamination was detected beneath the USTs, and the county has indicated the tank closure is complete with no further action necessary.

The balance of the APECs identified in the Luft Report are not the responsibility of KWBA. However, KWBA is tracking these issues and coordinating with the appropriate regulatory agency where appropriate. For example, KWBA has been discussing potential impacts at the former Uhler Fire Training Facility with both Kern County and the Regional Water Quality Control Board. (All of the facilities at this site have been removed, and Kern County is in the process of developing a bid to have soil and groundwater at the site assessed). KWBA is also actively tracking assessment and clean-up activities associated with the former Wait-Midway Pipeline and the Strand Oil Field.

D. HCP/NCCP Mitigation and Monitoring

The HCP/NCCP requires the KWBA to be responsible for establishing, maintaining, and enhancing habitat preserves, carrying out site-specific mitigation measures and for monitoring and reporting the results of management activities to the USFWS and CDFG in Annual Reports. KWBA compiles the annual report with input from professional biologists and botanists.

1. Monitoring Compliance

From 1999 through 2005, with the assistance of wildlife biologists and the cooperation of the USFWS and CDFG, KWBA staff have spent many hours in the field observing, photographing, trapping, and enumerating wildlife to document any instances of "take", either though construction activities or KWB operations. These monitoring activities are, in part, prescribed in the HCP. For example, populations of the San Joaquin Kit fox are surveyed with a nighttime spotlighting program, and Tipton Kangaroo rat populations are surveyed with trapping grids. Other surveys are conducted voluntarily (e.g., waterfowl and tumbleweeds). The only instance of "take" ever reported was the temporary relocation of live Tipton kangaroo rats during the

construction of the Kern Water Bank Canal headworks. The kangaroo rats were successfully reintroduced to the area after construction was completed.

2. Mitigation Measures

The HCP prescribes various mitigation measures for construction and repair activities (see Section V.A.2.b.). According to the KWB's annual reports, these measures were adhered to as required.

VII. Alternatives for Recharge at KWB

The following analysis was prepared to determine how much of the SWP water that was recharged in the KWB from 1995 through 2004 could have been recharged in other existing recharge projects in Kern County, assuming no access was available to the KFE property.

A. Method

The amount of SWP water recharged in the KWB was compared to the unused absorptive capacities available in other existing recharge projects in Kern County to which the KCWA had access. If the SWP water was less than the total unused absorptive capacity of the other recharge projects in the Kern Fan area, it was assumed that the SWP water recharged in the KWB could have all been recharged elsewhere. This comparison was done on a monthly basis using delivery records from 1995-2004 and is limited to recharge projects in the Kern Fan area.

The Kern Fan Projects include the: Berrenda Mesa Project (operational since 1983); City of Bakersfield (COB) 2800 Acres (operational since 1978); Pioneer Project, including the Kern River Channel (operational since 1995);[14] and the Kern Water Bank (operational since 1995). The KCWA owns the Pioneer Project, and provides services to operate the KWB, owned by the KWBA, and the Berrenda Mesa Project, owned by the Berrenda Mesa Water District. The KCWA has a contract with the City of Bakersfield for use of the COB 2800 Acres.

This analysis does not include KCWA use of certain KWB facilities that existed and had been used by KCWA for recharge prior to 1995. The KWB facilities that existed prior to 1995 included: KWB canals, which DWR allowed KCWA to use for recharge purposes in 1993; and KWB recharge ponds constructed by Tenneco on the KFE property prior to DWR's purchase of the property from Tenneco. The additional absorptive capacity provided by these KWB facilities and the local districts was not included in this analysis since adequate capacity was available in the other Kern Fan Projects to absorb the SWP water recharged on the KWB.

B. Analysis Assumptions

1. Absorptive capacity

[14] The Kern River Channel is part of the Pioneer Project but is also used by others, in accordance with established priorities for its use. To account for higher priority use by others, the Kern River Channel was analyzed separately from the rest of the Pioneer Project.

a. The absorptive capacity for each Kern Fan Project was determined based on an initial recharge rate for that project, and during periods of continuous use, assumed rates of decline. Declines were determined based on analysis of historic rate declines. Absorptive capacities were determined by project and by month from 1995 through 2004.
b. Initial fill rates, based on historic initial recharge rates, were used for the first month of the first recharge period, and for the first month of any subsequent recharge periods if the project had not been operated for three or more months between recharge periods. If the project had not been operated for less than three months, the initial fill rate for the subsequent recharge period was assumed to be 88% of the initial fill rate.
c. In a month when water had not historically been recharged at a particular Kern Fan Project, the shifting of water that had been recharged on the KWB to that project would trigger a recharge rate decline. The water that had been recharged on the KWB was assumed to be absorbed at the Kern Fan Projects in the following order of priority: 1) Pioneer, 2) COB 2800 Acres, 3) Berrenda Mesa, and 4) Kern River Channel. Recharge rate declines were triggered once that project was needed.
d. Daily deliveries to each recharge project were reviewed. During certain months when Article 21 water was not available for the entire month, absorptive capacities were further reduced to reflect only the number of days when that water was available.
e. Details for each of the other Kern Fan Projects on initial fill rates and assumed rates of decline are included at the end of this section.

2. Unused absorptive capacity available

The unused absorptive capacity available for recharge of the SWP deliveries to the KWB at a project in a given month was calculated as the absorptive capacity that month minus the total of all actual deliveries from all sources to that project in that month.

3. Ability to absorb SWP deliveries to KWB in other recharge projects

The ability to move SWP water recharged on the KWB in a particular month to other months in that same year depends on the type of SWP water delivered. Table A water or other SWP water that can be scheduled, can be rescheduled and shifted to any other month that year. Article 21 water is unregulated water DWR makes available for only temporary periods, and can only be shifted among those months within a year this water is available. For these water types, the following assumptions were made:

a. An “Article 21 period” was identified during which Article 21 water was delivered to KCWA. The timing and duration of this period was determined using DWR Bulletin 132 and KCWA records. When Article 21 water was available for only part of the month, absorptive capacities were limited to the number of days Article 21 water was available. SWP deliveries to the KWB could be shifted to available capacity in the other Kern Fan Projects in any other month Article 21 water was available during that same year.
b. Months that were not in the Article 21 period were assumed to be “regulated”. Table A or other scheduled SWP water could be shifted to available capacity in the other Kern Fan Projects in any other month during that same year.

Absorptive Capacity Assumption Details in Order of Priority

Pioneer Project

- Jan. – Mar. 1995 - Recharge capacity was only available in the James and Pioneer Canal systems. Initial delivery rates were 85 cfs/day, or 5,226 AF/month. Recharge amounts have been adjusted for the number of days in each month.
- Apr. – Jun. 1995 – New construction completed the Pioneer recharge facilities in June of 1995. Initial delivery rates increased to 260 cfs/day.
- Using historical delivery data to the Pioneer Project, and assuming continuous recharge, monthly recharge capacity declines are assumed as follows:
    - 1st month – 100% (initial fill capacity)
    - 2nd month – 6% decline (1st month x 0.94)
    - 3rd - 6th month – 12% decline per month (previous month x 0.88)
    - 7th month forward – 1% decline per month (previous month x 0.99)

City of Bakersfield 2800 Acres

- Initial fill rate in COB 2800 Acres – 500 cfs. Assumption based on actual 30-day average of flow rates to the project at start up.
- Using historical delivery data from the COB 2800 Acres and assuming continuous recharge, monthly recharge capacity declines are assumed as follows:
    - 1st month – 100% (initial fill capacity)
    - 2nd month – 6% decline (1st month x 0.94)
    - 3rd - 8th month – 12% decline per month (previous month x 0.88)
    - 9th – 12th month – 6% decline per month (previous month x 0.94)
    - 13th month forward – 1% decline per month (previous month x 0.99)

Berrenda Mesa Project

- Initial fill rate in Berrenda Mesa Project Ponds – 75 cfs.
- Additionally, initial Kern River losses to COB 2800 Acres – 15 cfs.
- Using historical delivery data to the Berrenda Mesa Project and assuming continuous recharge, monthly recharge capacity declines are assumed as follows:
    - 1st month – 100% (initial fill capacity)
    - 2nd month – 6% decline (1st month x 0.94)
    - 3rd - 6th month – 12% decline per month (previous month x 0.88)
    - 7th month forward – 1% decline per month (previous month x 0.99)

Kern River Channel

- Maximum absorptive capacity – 11,900 AF/month (Approximately 200 cfs)
- Assuming continuous recharge, monthly recharge capacity declines are assumed as follows:
    - 1st month – 100% (initial fill capacity)
    - 2nd month – 6% decline (1st month x 0.94)
    - 3rd - 6th month – 12% decline per month (previous month x 0.88)
    - 7th month forward – 1% decline per month (previous month x 0.99)

Note: The absorptive capacity on the Kern River Channel was needed and evaluated only in 1995 and 1996. Use of this capacity was not needed in the remaining years.

C. Results

A summary of the results of this analysis are presented in Table 16. The summary table shows the ability to absorb the SWP supplies recharged on the KWB considering the unused absorptive capacity of Kern Fan Projects (i.e., the Berrenda Mesa Project, the COB 2800 Acres, and the Pioneer Project, including the Kern River Channel).

Table 10 presents results separately for the Article 21 period (when Article 21 water was determined to be available), the regulated period when only scheduled supplies were available, and the total for January through December.

Within Table 10, actual SWP deliveries to the KWB are shown as negative numbers. The positive numbers for the other projects show the unused absorptive capacity. Therefore, if the total shown at the bottom of each table is positive, it means the unused absorptive capacity available exceeded the amount of SWP water delivered to the KWB, so all of that SWP water could have been recharged in these other projects. If the total shown at the bottom of each table is negative, the unused absorptive capacity available was less than the amount of SWP water delivered to the KWB, so some of that SWP water would not have been recharged.

The results show that all SWP deliveries to the KWB from 1995 through 2004 could have been recharged in the other Kern Fan Projects.

Table 10. Kern Fan Banking Project's Abilitity to Absorb State Water Project Supplies Recharged on Kern Water Bank

YEARLY SUMMARY BY SWP TYPE

NO RECHARGE CAPACITY ON KERN WATER BANK

		ARTICLE 21 PERIOD SUMMARY									
Project	**Year>**	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Berrenda Mesa		3,934	4,404	4,363	0	3,983	4,507	1,964	1,785	295	770
2800 Acres		15,412	5,588	3,189	0	12,523	15,149	8,370	13,594	5,441	12,218
Kern Water Bank		0	-17,237	-9,386	0	-5,970	-18,898	-10,030	-6,380	-4,632	-16,151
Pioneer Property		12,374	7,083	1,866	0	20,085	5,833	4,420	3,723	1,452	4,974
Kern River Channel		3,370	3,740	0	0	0	0	0	0	0	0
	Total	35,090	3,579	32	0	30,620	6,591	4,723	12,723	2,556	1,811

		REGULATED SUMMARY									
Project	**Year>**	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Berrenda Mesa		5,067	17,376	0	19,800	0	0	0	0	5,234	4,527
2800 Acres		47,425	52,822	33,304	100,868	55,143	40,532	0	0	30,403	0
Kern Water Bank		-70,329	-70,255	-30,663	-51,155	-20,041	-557	0	0	-35,742	-1,914
Pioneer Property		29,481	45,402	47,755	37,795	46,413	44,091	0	0	36,484	18,963
Kern River Channel		13,191	4,163	0	0	0	0	0	0	0	0
	Total	24,835	49,508	50,395	107,309	81,514	84,066	0	0	36,378	21,575

		YEARLY SUMMARY									
Project	**Year>**	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Berrenda Mesa		9,002	21,780	4,363	19,800	3,983	4,507	1,964	1,785	5,529	5,297
2800 Acres		62,837	58,411	36,493	100,868	67,665	55,681	8,370	13,594	35,844	12,218
Kern Water Bank		-70,329	-87,492	-40,049	-51,155	-26,011	-19,455	-10,030	-6,380	-40,374	-18,065
Pioneer Property		41,855	52,485	49,620	37,795	66,497	49,925	4,420	3,723	37,935	23,937
Kern River Channel		16,560	7,903	0	0	0	0	0	0	0	0
	Total	59,925	53,087	50,427	107,309	112,134	90,658	4,723	12,723	38,934	23,387

VIII. Effects of KWB Development and Operations

A. Hydrology and Water Quality

1. Existing Conditions in 1995

2. Effects of Transfer, Development, and Operations

B. Groundwater Hydrology and Quality

1. Existing Conditions in 1995

The Department divides the Central Valley of California into two groundwater basins, the Sacramento Valley Groundwater Basin and the San Joaquin Valley Groundwater Basin. It further divides the San Joaquin Valley Groundwater Basin into subbasins, one of which, the Kern County Subbasin, would be affected by the proposed project. Kern County subbasin lies at the south end of the San Joaquin Groundwater Basin.

The San Joaquin Valley was formed by deposition of sediment in a north-northwestern trending trough. The aquifer system in the valley consists of continental and marine deposits several miles deep. The upper 2,000 feet generally contain fresh groundwater. The sediments that contain the aquifer system are primarily Tertiary– and Quaternary–aged continental sediments derived from the Coast Range to the west and the Sierra Nevada to the east. Overlying these formations are flood plain deposits. A significant hydrogeologic feature is the Corcoran Clay. This clay layer divides the aquifer system into two distinct aquifers, an unconfined to semi-confined upper aquifer above the clay layer and a confined aquifer below it.[v] However, the clay layer is not continuous, and is absent in portions of the Kern County Subbasin.

Historically, the upper aquifer system in the Kern County Subbasin was recharged by precipitation, infiltration from rivers and lakes and lateral inflow along the basin boundaries. The main surface water feature in the Kern County Subbasin is the Kern River. Before European settlement the Kern River flowed to Kern and Buena Vista Lakes and extensive wetlands. During wet periods, the lakes overflowed to Tulare Lake to the north, which itself overflowed into the San Joaquin River watershed. Groundwater levels in the basin varied but reached artesian conditions in the lowest parts of the subbasin.

In the 1860s, ranchers raised livestock and dry farmed wheat in the San Joaquin Valley portion of Kern County. In the 1870s, farmers began diverting the waters of the Kern River to irrigate their crops. For two decades, irrigators relied almost exclusively on surface waters for their water supplies, but in the 1890s, some took advantage of improvements in pumping technology and began turning to more reliable groundwater supplies.[vi] Increasing use of groundwater caused the water table in parts of Kern County to fall by as much as 400 feet by 1960. Groundwater extraction between 1926 and 1970 has caused the ground surface to subside by eight to nine feet in the central part of the Kern County Groundwater Subbasin.[vii]

Surface water imports to the area began in 1949 with the completion of the CVP's Friant-Kern Canal and increased in the 1960s and 1970s, as water from the SWP became available. Many irrigators contracted for deliveries of imported surface water and were able to reduce their use of groundwater. As a result, groundwater levels in some parts of the southern San Joaquin Valley began to rise.

KCWA, the largest of the SWP's agricultural contractors, and other agencies in Kern County, manage surface and groundwater in the San Joaquin Valley portion of Kern County. Their surface water sources include flood flows from the Kern River, CVP deliveries from the Friant-Kern Canal and SWP deliveries from the California Aqueduct. Their groundwater source is the aquifer that underlies much of the land within the KCWA boundaries.

For many years, water agencies in Kern County have practiced conjunctive use of their surface and groundwater sources; that is, they actively manage their surface and groundwater sources to take advantage of the unique characteristics of each type of water source. Kern County agencies utilize in-lieu recharge and direct recharge management practices. In-lieu recharge is a water management practice that modifies the irrigation practices of water users who have access to surface water supplies and groundwater supplies. It substitutes surface water for irrigation in-lieu of normal groundwater pumping to increase groundwater supplies and conserve groundwater for use in future years. Direct recharge (artificial recharge) is a water management practice that applies water to percolation ponds to increase groundwater recharge and store water in an aquifer for later extraction.

When surface waters are available from the Kern River, the CVP or the SWP, farmers use surface waters to irrigate crops. When surface water supplies are insufficient, farmers supplement their surface water supplies with groundwater. When surface water availability exceeds farmer's needs, KCWA and those other water agencies with groundwater recharge facilities percolate the surface water to recharge the groundwater basin. Other agencies that manage groundwater banks with in-lieu recharge will then use any excess surface water in lieu of pumped groundwater, with the objective of allowing the basin to recover and/or storing this water for subsequent withdrawal.

Kern County water agencies manage groundwater banks for use by other agencies as well as their own in-county use. The agencies use direct and in-lieu recharge to bank groundwater for their own later recovery. Some Kern County agencies also offer groundwater banking, which is the storage of a non-Kern County agency's water in Kern County groundwater basins for later recovery. The agencies can recover the water for the non-Kern County agency by direct pumping and conveyance of the water to the non-Kern County agency, or the Kern agencies can recover the water through an in-lieu exchange. Under an in-lieu exchange, the SWP or non-SWP water that would otherwise have been delivered to the Kern County agency would instead be delivered to the non-Kern County agency, and the Kern County agency would pump a like amount of the non-Kern County agency's stored water for use within the Kern County agency's service area. The third party could be a water agency located outside Kern County, or it could be a KCWA member agency that has access to the groundwater basin underlying parts of the

KCWA service area. The third party makes an agreement with the groundwater bank operator to store and recover water from the groundwater basin.

Figure 9.2-1 shows total water supplies and water demand in the San Joaquin Valley portion of Kern County between 1970 and 1999. In years when total surface water supplies exceeded demand, the excess supply was added to groundwater storage. In years when total surface water supplies were insufficient to meet demand, groundwater was pumped to meet demand and groundwater storage decreased. Between 1970 and 1995, groundwater storage declined by 6.6 million AF, an average reduction in storage of 264,000 AF per year. Figure 9.2-2 shows cumulative groundwater storage for the period 1970 to 1995. During most of the 1970s, groundwater storage declined as a result of dry conditions and limited access to SWP water due to distribution system limitations. Groundwater storage increased from 1978 until the mid-1980s when a ten-year dry period began, resulting in a decline of approximately 7.3 million AF, compared to 1970 storage levels.[viii]

2. Effects of Transfer, Development, and Operations

For many years, Kern County farmers and water agencies have practiced conjunctive use of surface and groundwater sources. They also practice groundwater banking. Between 1971 and 1994, 1.15 million AF of water was delivered for banking within the San Joaquin Valley portions of Kern County, an average of about 48,000 AFY, using water from local, SWP, and CVP supplies. With a few exceptions, this water was banked for KCWA and its member agencies.

Groundwater banking in Kern County increased after 1995. Between 1995 and 2000, 2.38 million AF of water was delivered for banking within the San Joaquin Valley portions of Kern County, an average of about 397,000 AF per year. There were four reasons for the increase, two of them related to the Monterey Amendment.

A primary reason for increased groundwater banking was recognition by Kern County that they would need to take measures to improve the reliability of their water supplies. The extended drought of 1987 through 1992, including 1991 when agricultural contractors received a zero percent SWP allocation, highlighted the hydrologic uncertainty of SWP supplies. At the same time, the listing in the early 1990s of several Delta fish species as threatened or endangered, along with proposed regulatory and operational constraints to protect them, highlighted the regulatory uncertainty that could further reduce SWP supply reliability. In response, KCWA and its member agencies began aggressive development of banking programs to store wet-year supplies for their use in dry years.

A second reason for increased banking was the series of wet years that followed the drought. Beginning in 1995 and continuing through the late 1990s, these consecutive wet years provided abundant excess water for the contractors and others to store in the Kern County Groundwater Subbasin.

The next two reasons relate to the Monterey Amendment. Although DWR, on a policy basis, had approved out-of-service area banking prior to the Monterey Amendment (i.e., the Semitropic WSD banking program), the Amendment provided a contractual assurance that contractors

would be able to store SWP water outside their service areas. Of the total amount delivered for banking within Kern County between 1995 and 2000, about 503,000 AF was provided by contractors for storage outside their service areas in banking programs approved after implementation of the Monterey Amendment. The Monterey Amendment also transferred ownership of the KFE property to local interests, and the KWBA developed percolation ponds and wells on the property for groundwater banking by its participating members. Of the total amount delivered for banking within Kern County between 1995 and 2000, about 873,000 AF was for banking at the KWB. As was shown in Section VII, all of the SWP water banked at the KWB during this period could have been banked in available capacity in other existing banking projects in the Kern Fan area. Therefore, much of the water banked at the KWB would have been banked in Kern County, even without the KFE property transfer.

So while groundwater banking increased in Kern County after 1995, it occurred for a number of reasons. Of the total 2.38 million AF delivered for banking in Kern County between 1995 and 2000, more than half was, or otherwise would have been, banked in existing banking programs unrelated to the Monterey Amendment.

Between 1995 and 2005, KWB participants placed about one million AF more water in groundwater storage in Kern County than they withdrew (see Table 9). KCWA estimates that every 100,000 AF of water placed in storage causes a rise of one foot in the groundwater level in the San Joaquin Valley portion of Kern County. Thus, storage of water in the KWB probably raised groundwater levels by about 10 feet between 1995 and 2005.

During the late 1990s and early 2000s, KWB participants appeared to be setting aside the stored water for use in dry periods rather than using it to increase their average annual deliveries of SWP water. This operating practice would result in water remaining in storage for several years and only being drawn down occasionally. Overall, the effect of the additional groundwater banking facilitated by the KWB was to raise groundwater levels in Kern County by several feet relative to the baseline scenario. Thus, the KWB had a modestly beneficial effect on groundwater levels in Kern County between 1995 and 2005 relative to the baseline, and is therefore a ***less-than-significant impact***.

C. Terrestrial Biological Resources

1. Existing Conditions in 1995

The approximately 19,900 acre KFE property is located in Kern County, about 20 miles west of Bakersfield and 10 miles south of Buttonwillow. Interstate 5 and the Kern River both bisect the area. The KFE property had historically been subject to periodic flooding from the Kern River, and is able to absorb water at an extremely high rate, retaining it in underground aquifers. The land was used for cattle grazing in the 1880s, and then crop production in the 1930s. It was also explored for gas and oil resulting in numerous wells and pipelines. The Department purchased the land in 1988 with the intention of creating a groundwater bank. In 1994, four special-status plants and eleven special-status animals were known to occur on the KFE property (see Table 11, Note: for this study, ADEIR Table 9.4-2 was revised to include only that information relevant to the KFE property).

Prior to the Department's purchase of the KFE property, approximately 17,068 acres of the property was under extensive cultivation.[ix] The remaining property contained 1,515 acres of isolated sensitive native plant communities (valley saltbush scrub, Great Valley mesquite scrub and valley sacaton grassland) and 1,317 acres of non-native grassland, which had been leased for oil recovery facilities. No wetland habitat was present in the project area, except for the canals used to convey agricultural water.

After the Department acquired the property, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed.

TABLE 11

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED ON THE KERN FAN ELEMENT PROPERTY

Species Name	Status[(1)] Federal/State/CNPS		Habitat	Kern Fan Element Property
	1994	2003		
Plants				
Hoover's wolly- star (eriastrum) *Eriastrum hooveri*	T/-/4	D/-/4	Alkali sinks, washes. Usually on silty to sandy soils.	X
Recurved larkspur *Delphinium recurvatum*	C2/-/1B	SC/-/1B	On alkaline soils	X
San Joaquin woollythreads *Monolopia (Lembertia) congdonii*	E/-/1B	E/-/1B	Alkaline or loamy plains, sandy soils	X
Slough thistle *Cirsium crassicaule*	C2/-/1B	SC/-/1B	Sloughs, riverbanks, and marshy areas	X
Amphibians				
Western spadefoot *Scaphiopus hammondii*	C2/CSC	SC/CSC	Primarily grassland habitats, requires vernal pools for breeding and egg-laying.	X
Reptiles				
Blunt-nosed leopard lizard *Gambelia sila*	E/E, FP	E/E, FP	Sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief.	X
Western pond turtle *Emys marmorata (includes both subspecies)*	C2/CSC	SC/CSC	Permanent or nearly permanent bodies of water; requires basking sites, and suitable nesting sites	X
Birds				
Burrowing owl *Athene cunicularia*	C2/CSC	SC,BCC/CSC	Subterranean nester, dependant upon burrowing mammals, Burrow sites typically in open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation.	X
California thrasher Toxostoma redivivum	-/-	SC/-	Lowland and coastal chaparral, riparian thickets	X

TABLE 11

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED ON THE KERN FAN ELEMENT PROPERTY

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2003	Habitat	Kern Fan Element Property
Cooper's hawk *Accipiter cooperii*	-/CSC	-/CSC	Nests in riparian growths of deciduous trees, as in canyon bottoms of river floodplains, within open, interrupted or marginal woodland.	X
Double-crested cormorant Phalacrocorax auritus	-/CSC	-/CSC	Fresh, brackish, and salt water, along coastal regions and inland lakes	X
Lawrence's goldfinch *Carduelis lawrencei*		SC/	Oak and riparian woodland, chaparral, pinion/juniper woodland, and weedy areas near water.	X
Loggerhead Shrike *Lanius ludovicianus*	C2/CSC	SC,BCC/CSC	Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting. Typically nests in broken woodlands, savannah, pinyon-juniper, Joshua tree, and riparian woodlands, desert oases, scrub, and wash.	X
Northern Harrier *Circus cyaneus*	-/CSC	-/CSC	Breeds in shrubby vegetation within marshes, or grasslands.	X
Swainson's hawk *Buteo swainsoni*	-/T	SC,BCC/T	Breeds in stands with few trees in Juniper-sage flats, riparian areas and oak savannahs. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	X
White-tailed (black shouldered) kite *Elanus leucurus*	-/*	SC,MNBMC/ FP	Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching. General nesting habitat is rolling foothill/valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland.	X
Mammals				
American badger Taxidea taxus	-/CSC	-/SA (CSC in 2006)	Need friable soils and open, uncultivated ground in drier open stages of most shrub, forest, and herbaceous habitats.	X
Buena Vista Lake shrew *Sorex ornatus relictus*	C1/CSC	E/CSC	Marshlands and riparian areas in the Tulare Basin. Prefers moist soil. Uses stumps, logs and litter for cover.	X
San Joaquin antelope squirrel *Ammospermophilus nelsoni*	C2/T	SC/T	Western San Joaquin Valley on dry, sparsely vegetated loam soils. Need widely scattered shrubs, forbs and grasses in broken terrain with gullies and washes	X

TABLE 11

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES AND THE POTENTIAL TO BE IMPACTED ON THE KERN FAN ELEMENT PROPERTY

Species Name	Status[1] Federal/State/CNPS		Habitat	Kern Fan Element Property
	1994	2003		
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	E/T	Needs loose-textured sandy soils for burrowing, and suitable prey base, in annual grasslands or grassy open stages with scattered shrubby vegetation.	X
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	E/E	E/E	Needs soft friable soils which escape seasonal flooding within saltbrush scrub and sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley	X
Yuma myotis *Myotis yumanensis*	C2/-/-	SC/	Optimal habitats are open forests and woodlands with sources of water over which to feed. Distribution in closely tied to the bodies of water. Maternity colonies in caves, mines, buildings or crevices.	X

Notes 1. Status explanation

Federal

E Listed as endangered under the Federal Endangered Species Act.

T Listed as threatened under the Federal Endangered Species Act.

C1 Category 1 Candidate for which the USFWS has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposed rules not yet issued because this action is precluded at present by other listing activity.

C2 Category 2 Candidate for which information now in the possession of the USFWS indicated that proposing to list and endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules.

SC Federal Species of Concern. The USFWS decided to no longer maintain C2 and C3 lists, and species formerly categorized as such were informally termed "Species of Concern." The Sacramento Fish & Wildlife Office maintains a list of *Species of Concern*. These species receive no legal protection and the use of the term does not mean that they will eventually be proposed for listing. In 2006, the USFWS stopped maintaining a Federal Species of Concern list.

D Delisted – Delisted species are monitored for five years after being delisted.

BCC US Fish and Wildlife Service, Bird of Conservation Concern

MNBMC US Fish and Wildlife Service, Migratory Nongame Bird of Management Concern

\- No listing

State

E Listed as endangered under the California Endangered Species Act.

T Listed as threatened under the California Endangered Species Act.

CSC California Special Concern Species – categorized as such because of declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.

FP Fully Protected – Fully protected species may not be taken or possessed without a permit from the Fish and Game Commission.

* Taxa listed with an asterisk (*) fall into one or more of the following categories – (1) Taxa that are biologically rare, very restricted in distribution , or declining throughout their range; (2) population(s) in California that are peripheral to the major portion of a taxon's range, but which are threatened with extirpation within California; and (3) taxa closely associated with a habitat that is declining in California (e.g. wetlands, riparian, old growth forest).

SA Taxa found on the July 2003 Special Animals List, which have no legal or protection status.

\- No listing.

Other – California Native Plant Society

1B Rare, threatened or endangered in California and elsewhere

4 Plants of limited distribution.

Sources:

USFWS List of Candidate Fauna from California and Nevada as of 31 August 1994 (59 FR 58982)

Endangered and Threatened Wildlife and Plants 50 CFR 17.11 and 17.12, August 20, 1994.

State and Federal Endangered Animals for California and Listing Dates, Department of Fish and Game, Revised January 1994.

California Department of Fish and Game Natural Diversity Data Base Special Animals, December 1992 (The 1994 version could not be located).

2. Effects of Transfer, Development, and Operations

The Monterey Amendment called for ownership of the KFE property to be transferred from the Department to the KCWA, and then to the KWBA, which was completed in 1996 (upon completion of the title search). In 1995, the KCWA received interim permits/authorizations from the USFWS and CDFG to initiate water banking to take advantage of a high availability of water due to a heavy snow pack in the Sierras. As a condition of the interim permit, KCWA was required to set aside permanent habitat mitigation land, which had moderate habitat value, or natural vegetation, until the long term HCP could be implemented on the KFE property.[x] The interim project was carried out in two stages. The first stage resulted in the rehabilitation of disused canals and inundation of 1,518 acres of former agricultural land. Pre-construction surveys were conducted, and revealed poor habitat values throughout the Stage 1 area, and no suitable habitat for listed species.

The second stage resulted in the inundation of 1,516 acres of grassland and fallow agricultural land, which had the potential to support listed species. Biological surveys were conducted in all areas proposed for disturbance by either construction or flooding and 58 potential San Joaquin kit fox dens were found to be unoccupied and destroyed; the animals did not return prior to construction. Approximately 300 potential Tipton kangaroo rat burrows were located during surveys, but were not monitored for the presence of Tipton kangaroo rat. If any of these burrows were inhabited, then a take may have occurred if the animals were unable to escape. Approximately one-quarter to one-third of a known population of San Joaquin woolly threads were inadvertently covered with excavated soils during project construction. The location of this plant was not identified prior to construction, but upon discovering the damage, the area was flagged and avoided. *[Comment: Could you please provide us with a reference for these statements regarding the Tipton Kangaroo rats and San Joaquin woolly threads. Current KWBA staff are unfamiliar with these incidents and would like to verify their accuracy.]* Construction of the recharge basins resulted in the loss of potential San Joaquin kit fox and Tipton kangaroo rat habitat, the potential take of Tipton kangaroo rat, and the destruction of a portion of the San Joaquin woolly thread population. This was not fully mitigated for prior to project construction, but has been mitigated for through post-construction participation in the KWB HCP/NCCP.

Since 1996, the KWBA has been responsible for land management on the KFE property. Lands have been managed in accordance with a HCP/NCCP approved by USFWS and CDFG in 1997.[xi] The KWB HCP/NCCP documents a plan to accomplish both water conservation and environmental objectives, mitigating project specific impact to less than significant at a regional level. The primary water conservation objective is the storage of water in aquifers during times of surplus for later recovery during times of shortage. The primary environmental objective is to set aside large areas of the KFE property for endangered, threatened and other sensitive species and to implement a program to protect and enhance the habitat.

Under the KWB HCP/NCCP, the 19,900-acre KFE property was divided up for different land uses (see Table 1).

- Recharge Basins and Other Banking Facilities – Permanent operation of the banking facilities included the flooding of basins, constructing facilities for recovery of the water from underground aquifers and maintenance of all project facilities.
- Compatible Habitat – This habitat is largely fallowed agricultural land that has become established as non-native annual grassland that has been preserved and managed around the banking facilities. It will provide upland habitat for San Joaquin kit foxes and other upland species.
- Sensitive Habitat – Three areas of sensitive habitat containing remnant native saltbush and valley sink scrub habitat have been identified. They are comprised of historic upland habitat and non-farmed locations of the KFE property and will benefit native upland species. These areas will be protected throughout the life of the permit.
- Department Mitigation Land – A 530-acre conservation easement has been established on the KFE property to mitigate other projects carried out by the Department prior to the transfer of this land to the KCWA. This easement will be managed by KWBA in accordance with the management plan established for the area.
- KWBA Mitigation Land – A 435-acre conservation easement has been established in the Kern Fan Element to mitigate KWBA projects on KWB lands. This easement will be managed by KWBA in accordance with the management plan established for the area.
- Farming – 3,170 acres of the project site may be farmed in a manner appropriate to soil conditions found on site. The land may also be used for water recharge and recovery purposes, including recharge basins, levees and related uses.
- Conservation Bank - 3,267 acres of potential and occupied habitat has been designated for a conservation bank. Pursuant to the HCP, KWBA may use, or sell up to 490 acres of this habitat for commercial development. However, KWBA has agreed not to sell or use the 490 acres as a condition of the Monterey Settlement Agreement. Much of this land was pre-approved mitigation land by CDFG and is adjacent to other land preserved in the area. KWBA can use or sell up to 3,267 conservation credits to landowners, developers and others for mitigation for projects within the Master Permit Credit Area.

Between 1998 and 2003, the KWBA built an additional 4,080 acres of shallow recharge basins on the KFE property. Some of acres were located within an area designated for farming.[xii] Of the original 3,267 acres of available conservation credits, 744 acres have been sold as of December 31, 2005.

Several measures were implemented in accordance with the KWB HCP/NCCP, to reduce impacts on native or migratory wildlife using the KFE property, including:

1) Maintaining water levels constant, to the extent possible to prevent impacts on birds nesting in the recharge basins;
2) Slowly refilling basins and canals that have been idle for more than two years, so that any covered animals will be able to escape before drowning;
3) Constructing shallow canal side slopes to allow animals to escape from the interior and extending internal access roads across new canals, which would provide access for animals to cross the canal when wet;

4) Surveying unused canals that will be used in the near future, prior to the burrowing owl nesting season. Any burrows found will be collapsed, in consultation with the Resource Agencies, to prevent nesting in those locations.
5) Vegetation removal from roadways, turnouts, interbasin structures, road crossings and control structures will be accomplished by burning, motor grading (used minimally), mowing, herbicide or hand. Vegetation removed from canals and basins will be accomplished by hand control, lightweight equipment (weed-eaters), grazing, mowing and burning; and
6) Complying with the "Interim Measures for Use of Rodenticides in Kern County," in order to prevent damage to facilities from rodents and to prevent the poisoning of listed species.

A Vegetation Management Plan was created to describe cost effective vegetation management and restoration practices for the long-term adaptive management and enhancement of the Kern Water Bank. Protection of existing and newly established sensitive habitats, vegetation management of compatible habitat using effective, low-cost adaptive methods and exotic pest plant control are primary goals under this management plan.

Under the HCP, the KWBA has authorization to incidentally take (including harm or harass) 161 covered species that are listed, or may be listed in the future under FESA. Of these species, fourteen special-status plants and animals have recorded occurrences on the KFE property. Since the approval of the HCP/NCCP, only one incidence of take has been reported or is known to have occurred on the KFE property.[xiii] In 1999, during the construction of the KWB Canal, some Tipton kangaroo rats were captured and temporarily relocated to avoid harming them. After construction was complete, they were reintroduced into the area they had originally inhabited.

In addition to the KWB HCP/NCCP, an Initial Study and Addendum was prepared for the KWB, which included mitigation measures to reduce impacts on terrestrial biological resources. These mitigation measures, in addition to measures from the HCP/NCCP have reduced the impact of the KWB to a ***less-than-significant level***, and are incorporated into this document to mitigate for future impacts of the proposed project, as discussed under Impact 9.4-3B.

D. Visual Resources

1. Existing Conditions in 1995

The KFE property consists of about 19,900 acres of land located in Kern County, southwest of Bakersfield. The KFE property lies on both sides of the Kern River but does not include the river itself, or the lands within the river levees. The terrain is flat with no more than a few feet of topographical relief. Prior to 1995, there were no major structures on KFE property except for Interstate 5 (I-5), the Cross Valley Canal, some abandoned tanks and other oil-field equipment, and about 300 acres of percolation ponds.

The KFE property was farmed for many years until the mid-1980s. After the Department purchased the land in 1988, it continued to be farmed by tenants for several years. One of the

tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed. By 1995, introduced annual grasses and forbs had colonized the land.

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xiv] The Kern Water Bank Canal has a uniform cross-section and is confined between earthen levees. It is a prominent feature in the landscape but one that is visually consistent with other waterways in the area including the Cross Valley Canal and the California Aqueduct.

Although these land use changes have altered the appearance of lands within the KFE property, they did not alter the overall visual character of the area. The changes would be seen by a limited number of viewers and would probably be noticed by even fewer. The alteration in visual resources is considered to be a ***less-than-significant impact***.

E. Air Quality

1. Existing Conditions in 1995

Kern and Kings Counties are in the San Joaquin Valley Air Basin (SJVAB). This air basin is in non-attainment of federal and State standards for both PM_{10} and ozone. The SJVAB also has areas where TACs are problematic. In 1995, the SJVAB was designated by the U.S. Environmental Protection Agency (EPA) as being in "serious" non-attainment for the federal one-hour ozone standard. No other federal ozone standard was in place at the time. This led to the preparation of the 1994 Ozone Attainment Plan, which was prepared by the local air agency and was adopted in November of 1994. The SJVAB was also in "serious" non-attainment of the federal PM_{10} standard and developed a plan to bring the basin into attainment of the standard.

In 1995, the State as a whole experienced health impacts from TACs, mostly from diesel particulate matter. At that time, Kern County had several areas where the estimated inhalation cancer risk was greater than 250 per million people.

2. Effects of Transfer, Development, and Operations

By 2003, the air basin's attainment status had been changed to "severe" nonattainment for the federal ozone standard. The SJVAPCD was also readying to petition the EPA to reclassify the Basin to "extreme" for one-hour ozone standard to allow the Basin more time to attain the standard. The Basin remained a "serious" non-attainment area for the federal PM_{10} standard. The Basin also remained a non-attainment area for State ozone and PM_{10} standards. The SJVAPCD threshold of significance in 2003 was 10 tons/year of ROG, 10 tons/year NO_x, and an

excess cancer risk of 10 in one million from TACs. Risk from diesel particulate matter in the Basin had improved since 1995, but areas still existed where Toxic Air Contaminants (TAC) risk was high.

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xv]

Construction of the percolation ponds, canal, and other facilities required the use of heavy-duty construction equipment. This equipment generated diesel particulate matter, which is a TAC, as well as emissions of ozone precursors such as ROG and NO_x. The disturbance of the soil associated with the various earthmoving activities also generated PM_{10}. Because the proposed project would have implemented all of the SJVAPCD's suggested PM_{10} control measures, PM_{10} construction emissions would be below SJVAPCD thresholds. Based on a conservative assumption of 800 acres per year of soil disturbance to construct the ponds, NO_x and ROG emissions would not have exceeded SJVAPCD thresholds. Further, the duration of construction-generated air pollutant emissions was limited to the construction periods only.

Operation of the facilities requires pumping to convey water to percolation ponds and to extract water from underground. With the KWB, there would have been increased pumping to convey water through the system, as compared to pre-project conditions. While electric pump use would have increased, this would not have increased air emissions, as electric pumps are relatively pollution-free.

Therefore, because the KWB did not result in a net increase in criteria air pollutants over SJVAPCD annual thresholds in a non-attainment area, there would have been no conflict with implementation of the adopted air quality plan for the region. This is considered to be a ***less-than-significant impact***. Further, any construction-related emissions would have been temporary. Operational emissions would not likely have exceeded adopted criteria.

F. Geology and Soils

1. Existing Conditions in 1995

The San Joaquin Valley basin is bordered to the south and east by the Sierra Nevada and Tehachapi mountains, which are composed of crystalline igneous and metamorphic rock. Exposed consolidated marine sedimentary rock from the Coast Range are evident in the layer of sediment above bedrock underlying the San Joaquin basin. The KFE property overlies a large, deep, and asymmetrical sedimentary basin located in the southern portion of the San Joaquin Valley.

The marine sedimentary rock is overlain by a thick series of continental rocks and semi-consolidated to unconsolidated sediments. These sediments are several thousand feet thick under

the KFE lands, and encapsulate the primary groundwater basin. The portion of this sediment that is usable for groundwater storage is located above the base of the fresh water in the basin. This area of the groundwater basin is dominated by the alluvial fan and lake material that comprise the KFE lands. Further, groundwater development is limited to the upper portions of the fresh water aquifer system in this basin.

The southern San Joaquin Valley, including the KFE property, is dominated by the alluvial fan deposited by the Kern River, and consists of thick deposits of sand and gravel with extensive but discontinuous silt and clay beds.[xvi] The sand and gravel deposits are remnants of old streambed channels which generally occur in long, winding, and interconnecting stingers and sheets that are prevalent throughout the KFE property, but less evident along its borders. These sand and gravel deposits are highly permeable, but are imbedded with less permeable areas comprised of fine-grained silt and clay deposits. These silt and clay deposits are more extensive along the edges of the alluvial fan and in some areas may intersect with clay beds deposited in lakes. In general, the upper layers of the alluvial fan deposits form an unconfined to semi-confined aquifer system that provides a large amount of groundwater recharge area.

Soils in the southern portion of the San Joaquin Valley, including the KFE lands, range from highly permeable, coarse sandy soils to silty loam with very low permeability.[xvii] In general, the soils present are characterized as deep, well-drained sandy loam that have moderate to rapid permeability with low water retention, and have a slight erosion potential. These soils are interspersed with pockets of clay deposits that are characterized by low-permeability and are often associated with saline-alkali conditions.[xviii]

2. Effects of Transfer and Development and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xix] As previously described, grading was required to construct the percolation ponds. However, construction of the ponds and associated levees occurred on topography that is relatively flat and required only minor grading and compaction of soils. Furthermore, soils on the KFE property can generally be characterized as being slightly erodible. Therefore, although conversion of approximately 7,114 acres of land to percolation ponds changed rates of erosion, this impact is considered ***less than significant***.

G. Land Use and Planning

1. Existing Conditions in 1995

In the 1980s, the Department began exploring the feasibility of developing an SWP groundwater storage facility in Kern County, which it called the KWB. As envisioned, the KWB was to consist of a series of “elements,” which would be geographically separate projects that would be

operationally integrated. In 1988, Tenneco West sold approximately 20,000 acres of land in the Kern Fan area to the Department, which was intended to be used for development of one of these groundwater storage elements – the KFE. In 1993, uncertainties regarding the proposed groundwater storage facility ultimately convinced the Department to halt feasibility studies and design work on the project.[xx] The uncertainties were created by proposed water quality standards for the Delta and issues associated with the protection of threatened and endangered species, both of which would have reduced the amount of water that could be pumped from the Delta. Later, the Department concluded that these constraints on Delta pumping and other uncertainties made development of an SWP groundwater storage facility on the KFE property not feasible at the time.[xxi] In 1994, the potential of the Department's proposed KFE for SWP groundwater storage remained unrealized, and the land on the KFE property remained undeveloped.

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xxii]

An HCP was developed for the KFE property. The HCP allows developed uses on about 4,000 acres of the KFE property (not including recharge ponds).[xxiii] Developed uses include farming, permanent facilities for the KWB and commerce. Approximately 490 acres of land adjacent to Interstate 5 (I-5) is designated for possible commercial use. However, KWBA has agreed not to sell or use the 490 acres as a condition of the Monterey Settlement Agreement.

Implementation of the KWB has altered the physical use of the land; however, overall land use and designations have not changed. The operation of percolation ponds is compatible with the surrounding existing uses. No commercial, retail, office, residential or other uses were developed, and an established community has not been divided. In addition, development of uses on the KFE property was consistent with the HCP. Therefore, the impact of the KWB on land use is considered to be ***less than significant***.

H. Hazards and Hazardous Materials

1. Existing Conditions in 1995

In the 1980s, the Department began exploring the feasibility of developing an SWP groundwater storage facility in Kern County, which it called the KWB. As envisioned, the KWB was to consist of a series of "elements," which would be geographically separate projects that would be operationally integrated. In 1988, Tenneco West sold approximately 20,000 acres of land in the Kern Fan area to the Department, which was intended to be used for development of one of these groundwater storage elements – the KFE. Prior to the Department acquiring the KFE property, the land was historically used for agricultural production. Once the land was acquired by the

Department, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed.

The hazards and hazardous materials setting for the KFE property was described in the Department's 1990 Supplemental EIR for the first stage of the KFE of the KWB project ("1990 Supplemental EIR"). The setting described was generally related to the hazardous materials present in the soils on the KFE property. The 1990 Supplemental EIR described the results of soil sampling done throughout the KFE property to characterize potential contamination. Pesticides, herbicides, and other contaminants were found in soil samples near the pond sites, with isolated pockets of petroleum compounds found near oil pipelines or facilities.[xxiv] Soil samples were used to determine the safest location for the construction of the percolation ponds. In addition, the 1990 Supplemental EIR identified mitigation measures in the form of further testing and monitoring of the soil and groundwater in the area of the percolation ponds to prevent future contamination of groundwater or potential for release of contaminants.[xxv]

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal; a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xxvi] The construction of percolation ponds resulted in ground-disturbing activities that could have exposed construction workers to residual chemicals associated with past and present agricultural practices involving the use of pesticides, fungicides, and similar agricultural products on crops and soils.

Soil samples were used to determine the safest location for the construction of the percolation ponds. In addition, the 1990 Supplemental EIR identified mitigation measures in the form of further testing and monitoring of the soil and groundwater in the area of the percolation ponds to prevent future contamination of groundwater or potential for release of contaminants.[xxvii]

Residues of agricultural chemical products in farmed soils as a result of routine agricultural operations are not typically managed as hazardous waste when used in accordance with adopted laws and regulations. Nonetheless, individuals performing excavation and grading activities would be at a greater risk of exposure to agricultural chemical residues in soil through inhalation of dust from soil movement. Construction of the ponds would also involve the use of heavy equipment that would contain fuels and lubricants. These products contain hazardous compounds, and an accidental release of these materials could injure construction workers, contaminate soil or water, or present a fire/explosion hazard.

Construction contracts included specific language requiring contractors to comply with applicable hazardous materials management laws and regulations adopted at the State level in Titles 19 and 22 of the CCR, which address proper storage and disposal of substances such as

fuels. Title 8 of the CCR also addresses the use of hazardous products in the work environment, which would apply to construction contractors. The potential for inadvertent spills of materials, which could affect nearby surface water bodies or groundwater, was managed through construction site Best Management Practices (BMPs). Therefore, impacts would be ***less than significant***.

I. Noise

1. Existing Conditions in 1995

The KFE property consists of 19,900 acres of land located in Kern County southwest of Bakersfield. The KFE property lies on both sides of the Kern River but does not include the river itself, or the lands within the river levees. In 1995, there were no major structures on the KFE property except for I-5, the Cross Valley Canal, and some abandoned tanks and other oil field equipment.

The KFE property was farmed for many years until the mid-1980s. After the Department acquired the property, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed. Therefore, vehicular traffic was the primary source of noise throughout the area. The KFE property is primarily bisected by rural roads, SRs 99, 119, 166, and 223, and I-5.

2. Effects of Transfer, Development, and Operations

Between 1995 and 2005, as part of the KWB, approximately 7,114 acres of land were converted to shallow percolation ponds, and a six-mile long earthen canal (the Kern Water Bank Canal) and several wells and pump stations were built. Unpaved roads were built to provide access to the new facilities. However, there were no noise-sensitive land uses located in close proximity to the construction sites that were adversely impacted by daytime construction noise and groundborne vibration levels. Routine maintenance of the new facilities results in temporary noise levels. Operation of the KWB requires pumping to convey water to percolation ponds, to extract water from underground, and to convey water in the Kern Water Bank Canal. Electric motors power the pumps. A representative range of noise levels for pumps is estimated to be 68 to 72 dBA (see Table 12) at 50 feet. *[Comment: Note that the reference to Table 9.12-3 in ADEIR is incorrect; the correct reference is Table 9.12-5.]* The installation and operation of pumps associated with the construction of percolation ponds on the KFE property attributable to the KWB would result in an increase in noise emissions from pumps compared to pre-1995 conditions. However, increased noise levels would not affect sensitive receptors because the pumps are located in relatively remote areas far from homes and businesses. Ongoing maintenance of the new facilities is intermittent and not considered a substantial source of increased noise levels at sensitive land uses. Therefore, these land use changes are considered to have a ***less-than-significant impact***.

TABLE 12 NOISE RANGES OF TYPICAL CONSTRUCTION EQUIPMENT	
Construction Equipment	**Noise Levels in dBA Leq at 50 feet[1]**
Front Loader	73–86
Trucks	82–95
Cranes (moveable)	75–88
Cranes (derrick)	86–89
Vibrator	68–82
Saws	72–82
Pneumatic Impact Equipment	83–88
Jackhammers	81–98
Pumps	68–72
Generators	71–83
Compressors	75–87
Concrete Mixers	75–88
Concrete Pumps	81–85
Back Hoe	73–95
Pile Driving (peaks)	95–107
Tractor	77–98
Scraper/Grader	80–93
Paver	85–88

Note:
1. Machinery equipped with noise control devices or other noise-reducing design features does not generate the same level of noise emissions as that shown in this table.

Source: U.S. EPA 1971 as presented in City of Los Angeles 1998.

J. Cultural and Paleontological Resources

1. Existing Conditions in 1995

Archeological Resources

The Southern Valley Yokuts included a large number of distinct small tribes. The groups depended on diverse resources, but freshwater lake and marsh resources were predominant.[xxviii] Their territory was in the southern end of the San Joaquin Valley, around Tulare, Buena Vista and Kern lakes, and the lower ends of the streams that fed those lakes.[xxix] The *Wechihit* Yokuts lived on the lower Kings River, and undoubtedly traded and intermarried with the *Holkoma* and *Wobonuch* Mono; the *Koyeti* Yokuts lived on the lower Tule River, and probably interacted closely with their relatives, the *Yawdanchi*, upstream. On the Kern River, the *Yawelmani* occupied present-day Bakersfield and the stream course for some distance upstream, as indicated by archaeological evidence. The *Tachi* Yokuts occupied land that comprises present-day Kings County. The KFE property falls within *Yawelmani* Yokuts territory, and sites have been recorded in the area.[xxx]

Paleontological Resources

During the Miocene Epoch, most of Kern County was an ocean bay which extended as far north as Redding and as far south as Bakersfield. The waters lapped against rolling hills that were soon to be pushed up to form the Sierra Nevada Mountains. Northeast of Bakersfield, where the modern Kern River leaves the Sierra Nevada, a river flowed into the bay. The river carried

sediments and the remains of plants and animals into the bay. These materials, along with the plentiful remains of marine organisms, sank to the bottom and much of the organic remains were fossilized. Subsequent geologic events pushed up the sediments, and they then eroded to form the rolling hills that include Sharktooth Hill. Exposed in these hills is the bone bed that formed from those fossil-rich sediments. The Sharktooth Hill bone bed encompasses more than 110 square miles, most of it deep underground only exposed east of the Bakersfield area.[xxxi]

This bed is the most fossil-rich Miocene marine bone bed in the world. And, like the great La Brea discoveries in Los Angeles provide for the Pleistocene, the Sharktooth Hill bone bed offers a surprisingly complete view of the marine Miocene period. The bed contains the fossilized remains of all major marine groups of animals.[xxxii]

Kings County is home to Kettleman Hills, which contain three geological rock deposits from the Etchegoin, San Joaquin, and Tulare Formations, with the Etchegoin Formation being the oldest and the Tulare Formation being the youngest.[xxxiii] The Kettleman Hills contain an abundance of invertebrate, vertebrate, and botanical fossils from the Pliocene Epoch (4.5 to 2.0 million years old). The area contains 370 registered fossil localities, while there are a total of approximately 570 registered fossil localities throughout the entire Kings County.[xxxiv] Many of these fossils were preserved and deposited within a complex integrating fresh water, estuarine, and marine conditions directly related to the sea that existed during the Tertiary Period of the Cenozoic Era. The Kettleman Hills continue to produce the well preserved fossils they are famous for today.

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds (see Section V.C.2.a). The KWBA also constructed the Kern Water Bank Canal, a six-mile long earthen canal extending from the Kern River to the California Aqueduct.[xxxv]

As previously noted in Impact 9.13-1A, prehistoric sites have been recorded in the Kern Fan Element, and paleontological deposits have been identified in the southern portion of the county. Some of these deposits are exposed while others are underground. Ground disturbance associated with the construction of groundwater storage facilities could expose paleontological resources. Prior to construction, archeological investigations were completed in the Kern Fan Element and for the Kern Water Bank Habitat Conservation Plan/ Natural Community Conservation Plan (HCP/NCCP). Some of these investigations recorded significant archeological sites at or near the Kern Fan Element project area.[xxxvi] Mitigation measures were also adopted to ensure that if previously unidentified archeological resources were discovered during construction activities, that work would cease and a qualified archaeologist would examine the discovery and make recommendations for appropriate data recovery.

Therefore, the proposed project is considered to have had a ***less than significant impact***.

K. Traffic and Transportation

1. Existing Conditions in 1995

The KFE property consists of 19,900 acres of land located in Kern County southwest of Bakersfield. The KFE property was farmed for many years until the mid-1980s. After the Department purchased the land in 1988, it continued to be farmed by tenants for several years. One of the tenants' leases was terminated in 1989. Then in 1991, at the peak of the drought, all the remaining tenants leases were terminated, and thereafter the lands were fallowed. By 1995, introduced annual grasses and forbs had colonized the land. The area is traversed by I-5, SRs 99, 119, 166, and 223 and paved and unpaved rural roads.

2. Effects of Transfer, Development, and Operations

Prior to 1995, approximately 300 acres of shallow percolation ponds existed on the KFE property. These ponds had been constructed before the Department acquired the property. Between 1995 and 2003, KWBA constructed 4,699 acres of recharge ponds within the Recharge Sector (see Section V.C.2.a) and 2,415 acres of ponds within the Farming Sector, for a total of 7,114 acres of recharge ponds. KWBA also constructed the Kern Water Bank Canal, and a six-mile long earthen canal extending from the Kern River to the California Aqueduct.xxxvii Unpaved roads were constructed to provide access to the new facilities. Traffic volumes on some rural roads temporarily increased during the construction period. In addition, routine maintenance of the new facilities resulted in a permanent increase in vehicular traffic. While there had been vehicular traffic related to agricultural activities on the KFE property through the 1991, in the several years prior to 1995, the land now occupied by the ponds lay fallow and generated little or no traffic. The small increases in vehicular movements attributable to construction and operation of the KWB had little adverse effect on traffic flow on the affected rural roads. Consequently, the KWB is considered to have a less-than-significant impact.

IX. Summary

Compliance reports from 1999 through 2005 were reviewed to determine construction activities, recharge and extraction operations, wildlife use of the site, vegetation trends, and identify any incidences of "take" in light of the Kern Environmental Permits. Since 1999, a number of structures have been added to the site (canals, recharge ponds, levees, etc). These structures were developed based on the HCP/NCCP guidelines. Section VI highlights recharge and extraction operations at the Kern Water Bank that was determined from the Annual Reports and from staff at the KWCA.

Several "no take" projects have been authorized on the KWB property. The qualified biologists who spent many hours at the KWB since 1999 observing, photographing, and trapping, have reported no instances of "take" nor have any reports of "take" from staff or third party operators on the site been received. Due to the construction of more recharge ponds and the growth of riparian trees and other native vegetation, waterfowl and other bird species numbers and biodiversity have generally increased since 1999. Other wildlife species have benefited from the

restoration and preservation activities at the KWB (coyotes, bobcat, etc.), however; numbers of the endangered San Joaquin kit fox and Tipton kangaroo rat continue to be low.

Based on the Annual Reports, and conversations with staff at the KWBA, the Department of Water Resources concludes that the KWB is operating as intended and within the confines of the HCP/NCCP.

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F. DETAILED RESULTS OF CALSIM II MODELING (STUDY NOS. 3 AND 4)

Monterey Plus EIR
Analysis of Hydrology and SWP Deliveries in each Alternative Using CALSIM II and Associated Post-Processing Routines

5/03/2007

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1.0. Introduction

This appendix describes the approach, assumptions and results of CALSIM II modeling and associated post-processing that was performed in support of the Monterey Plus EIR. The modeling assisted analysis of some of the Monterey Amendment's impacts on the State Water Project (SWP) and other areas. The analysis included evaluation of a 1994 Baseline and 2003 and 2020 evaluations of a Baseline, the Proposed Project and multiple No Project Alternatives that reflect different interpretations of the pre-Monterey contracts.

2.0. Overview of Impacts Analyses

The EIR analysis of potential effects of the Monterey Plus scenarios on California's surface water system utilizes the output from the CALSIM II model. This section of the appendix describes the CALSIM II model and associated post-processing spreadsheets that were used, the scenarios analyzed, and the model inputs and assumptions for each scenario.

2.1. Water Supply and Hydrology

Simulation of the hydrologic effects of the proposed project and other scenarios on the surface water system was an important tool for water supply analyses, and the water supply and hydrology output also provided data for other parts of the EIR. The surface water system includes natural water bodies (rivers and streams) and constructed facilities (reservoirs and diversions). Water supply effects include total supplies of the SWP, Central Valley Project (CVP), and other Delta water users; individual water supplies of SWP contractors, and operations of the Banks and Tracy pumping plants in the Delta. Hydrologic effects include changes in stream flow, stream water surface elevations, and reservoir levels.

2.1.1. Simulation Tools

The Department of Water Resources (Department), U.S. Bureau of Reclamation (Reclamation), and many other agencies and stakeholder groups currently use CALSIM II to simulate SWP and CVP operations, other water supply entities that interact with the SWP and CVP, the Delta, and other water bodies. For the Monterey Plus EIR, SWP deliveries from CALSIM II are post-processed using Excel spreadsheets to determine deliveries to each contractor in each scenario.

2.1.1.1. CALSIM II Model

The following is a brief overview of the CALSIM II model's approach and assumptions. For more detailed descriptions of the model, please refer to *Benchmark Study Assumptions*[1] (DWR 2002) and *Long-Term Central Valley Project Operations Criteria and Plan CVP-OCAP*[2] (USBR 2004).

[1] http://modeling.water.ca.gov/hydro/studies/SWPReliability/index2.html
[2] http://www.usbr.gov/mp/cvo/ocap.html

CALSIM II is a planning simulation model developed jointly by the Department and Reclamation to simulate the California water system including the SWP and CVP. The model operates on a monthly time step from water year 1922 through 1994 and utilizes optimization techniques to route water through a network. A linear programming/mixed integer solver determines an optimal set of decisions for each time period given a set of weights and system constraints (DWR 2002).

The modeled geographic area includes the valley floor drainage of the Sacramento and San Joaquin Rivers, the upper Trinity River, and the delivery locations for contractors served by the SWP and CVP. The hydrology in CALSIM II was developed jointly by the Department and Reclamation and includes estimates of water diversion requirements (demands), stream accretions and depletions, rim basin inflows, irrigation efficiency, return flows, non-recoverable losses, and groundwater operations. Sacramento Valley and tributary rim basin hydrologies are developed using a process designed to adjust the historical sequence of monthly stream flows to represent a sequence of flows at a future level of development. Adjustments to historic water supplies are determined by imposing future level land use on historical meteorological and hydrologic conditions. San Joaquin River basin hydrology is developed using fixed annual demands and regression analysis to develop accretions and depletions. The resulting hydrology is used to represent the water supply available from Central Valley streams to the CVP and SWP at a future level of development (DWR 2002).

CALSIM II uses the Department's Artificial Neural Network (ANN) model to simulate the flow-salinity relationships for the Delta. The ANN model correlates DSM2 model-generated salinity at key locations in the Delta with Delta inflows, Delta exports, and Delta Cross Channel operations. The ANN flow-salinity model estimates electrical conductivity at the following four locations for the purpose of modeling Delta water quality standards: Old River at Rock Slough, San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville. In its estimates, the ANN model considers antecedent conditions up to 148 days, and considers a "carriage-water" type of effect associated with Delta exports (DWR 2002). CALSIM II uses logic for determining deliveries to north-of-Delta and south-of-Delta CVP and south-of-Delta SWP contractors that incorporates runoff forecast information and uncertainty and standardized rule curves (i.e. Water Supply Index versus Demand Index Curve) to estimate the water available for delivery and carryover storage. Updates of delivery levels occur monthly from January 1 through May 1 for the SWP and March 1 through May 1 for the CVP as water supply parameters become more certain. The south-of Delta SWP delivery is determined based upon water supply parameters and operational constraints. The CVP system wide delivery and south-of-Delta delivery are determined similarly upon water supply parameters and operational constraints with specific consideration for export constraints (DWR 2002).

CALSIM II dynamically models CVPIA 3406(b)(2) water and the Environmental Water Account (EWA). CVPIA 3406(b)(2) accounting procedures are based on system conditions under operations associated with regulatory requirements under SWRCB Decisions 1485 and 1641. Similarly, the operating guidelines for selection of actions and allocation of assets under the EWA are based on system conditions under operations associated with a Regulatory Baseline as defined by the CALFED Record of Decision (ROD), which includes SWRCB Decision 1641 and CVPIA 3406(b)(2) among other elements (USBR 2004).

2.1.1.2. Post-Processing Spreadsheet for CALSIM II Output

For each scenario, SWP deliveries to North Bay Aqueduct and South-of-Delta contractors from the CALSIM II studies were post-processed by taking total annual scheduled deliveries and total monthly unscheduled deliveries from the model study and allocating them to individual contractors according to each scenario's assumptions regarding allocation rules and transfers. Post-processing spreadsheets performed this allocation using the following steps.

To Allocate Scheduled Deliveries:

1. Take annual time series of scheduled deliveries from the CALSIM II model output for the period 1922-1994.
2. Determine annual quantities of Table A deliveries made to all agricultural contractors and to all M&I contractors using each scenario's allocation rules before Table A transfers from agricultural to M&I contractors are accounted for.
3. Determine total quantity of agricultural Table A delivery that was delivered to M&I contractors as a result of Table A transfers in each year.
4. For No Project B scenarios only, determine annual quantities of XA Amount deliveries made to all agricultural contractors and to all M&I contractors using each scenario's allocation rules.
5. Using the annual quantities of Table A and XA Amount deliveries determined in Steps 2 and 4 and the transferred quantities determine in Step 3, determine annual quantities of scheduled deliveries made to each individual SWP contractor.
6. Determine monthly deliveries made to each contractor by applying the agricultural and M&I monthly delivery patterns from CALSIM II to the annual quantities.
7. Adjust San Luis Reservoir storage within each year to account for changes in the total project monthly delivery pattern that occur because of changes in the proportion of water delivered to agricultural and M&I contractors relative to the CALSIM II study.

To Allocate Unscheduled Deliveries:

1. Take monthly time series of unscheduled deliveries from the CALSIM II model output for the period 1922-1994.
2. Determine monthly deliveries to each individual SWP contractor using each scenario's allocation rules.

2.2.1. Scenarios

Four basic alternatives were analyzed using CALSIM II and associated post-processing spreadsheets for the Monterey Plus EIR. The basic assumptions used in each alternative are shown in Table 1.

- Baseline: The Baseline represents the conditions at each level of development that are assumed to occur without implementation of the Project. In CEQA, the Baseline is used as a point of comparison from which the effects of the Project, No Project, and Alternatives can be assessed. As such, the Baseline developed for this analysis does not include the Monterey Amendment or the Settlement Agreement. The Baseline does not include invocation of Article 18(b) of the SWP contracts. Additionally, no Table A amount transfers from agricultural to M&I contractors occur in the Baseline. However, the 2003 and 2020 Baseline

Table 1 – Assumptions for Monterey Plus EIR Alternatives

Issue	Baseline	Proposed Project	No Project Alternative A	No Project Alternative B-A (Apportioned XA allocation rules)	No Project Alternative B-S (Surplus XA allocation rules)
Allocation of Table A Water	Uses 1994 contract provisions including Article 18	Uses Monterey Plus provisions	Uses 1994 contract provisions including Article 18	Uses 1994 contract provisions including Article 18	Uses 1994 contract provisions including Article 18
Allocation of Interruptible Water	Uses 1994 contract provisions including Article 21	Uses Monterey Plus provisions	Uses 1994 contract provisions including Article 21	Uses 1994 contract provisions including Article 21	Uses 1994 contract provisions including Article 21
Table A changes	No transfers from TLBWD and KCWA to M&I contractors are included	Includes (1) 22.27 TAF of transfers from TLBWD to M&I contractors in 2003-2007, (2) 114 TAF of transfers from KCWA to M&I contractors in 1998-2003, and (3) 16 TAF of transfers from KCWA to M&I contractors by 2020	Includes (1) 22.27 TAF of transfers from TLBWD to M&I contractors in 2003-2007, (2) 73 TAF of transfers from KCWA to M&I contractors in 1998-2003, and (3) 16 TAF of transfers from KCWA to M&I contractors by 2020	No transfers from TLBWD and KCWA to M&I contractors are included	No transfers from TLBWD and KCWA to M&I contractors are included
SWP conservation storage in Kern Fan Element	No SWP conservation storage in KFE	No SWP conservation storage in KFE	Analyzed with and without 350 TAF SWP storage in KFE in 2003 and 500 TAF storage in 2020	Analyzed with and without 350 TAF SWP storage in KFE in 2003 and 500 TAF storage in 2020	Analyzed with and without 350 TAF SWP storage in KFE in 2003 and 500 TAF storage in 2020
Status of KCWA 40.67 TAF Table A and DRWD 4.33 TAF Table A amounts	KCWA and DRWD retain Table A amounts	Table A amounts are retired in 1996-97	KCWA and DRWD retain Table A amounts	KCWA and DRWD retain Table A amounts	KCWA and DRWD retain Table A amounts
Invocation of Article 18(b)	DWR retains Article 18(b) but does not invoke Article 18(b)	Elimination of Article 18(b)	DWR retains Article 18(b) but does not invoke Article 18(b)	DWR invokes Article 18(b)	DWR invokes Article 18(b)
Allocation rules for XA water	Not applicable	Not applicable	Not applicable	Allocates XA water in proportion to Table A amounts	XA deliveries for ag and gw replenishment uses are given priority

Note: All entries in this table are the same for all levels of development at which each alternative is analyzed.

scenarios include inputs such as increased Table A amounts and water demands to capture immutable and non-discretionary changes that occurred from 1995 to 2003 and that will occur in the future.

- Proposed Project: The Proposed Project is the implementation of the Monterey Amendment and the Settlement Agreement. Up to 153 TAF of Table A transfers from agricultural to M&I contractors are included.

- No Project Alternative A: Neither the Monterey Amendment nor the Settlement Agreement would be implemented. DWR would not invoke Article 18(b) of the SWP contracts. Up to 112 TAF of Table A transfers from agricultural to M&I contractors are assumed to occur.

- No Project Alternative B: Neither the Monterey Amendment nor the Settlement Agreement would be implemented. DWR would invoke Article 18(b) of the SWP contracts and announce new reduced Table A amounts. Based on prior modeling analysis, Table A amounts were assumed to be reduced proportionally among all contractors so that they totaled 1.9 million acre-feet[3]. No Table A transfers from agricultural to M&I contractors are assumed to occur.

  Demands for scheduled water above the reduced Table A amounts have been designated as "XA Amounts". Two alternative ways of allocating XA Amount water are included as different permutations of No Project Alternative B:

  - No Project Alternative B-A: XA Amount deliveries are made using "apportioned allocation" rules, in which deliveries to agricultural and M&I contractors are made in proportion to each contractor's Table A amounts.
  - No Project Alternative B-S: XA Amount deliveries are made using pre-Monterey's Article 21 "surplus water" rules, in which deliveries for agricultural or groundwater replenishment uses are given priority over those for M&I uses.

In addition, No Project Alternatives A, B-A, and B-S have been analyzed with and without a SWP groundwater storage bank in the Kern Fan Element (KFE).

Using these alternatives, scenarios for the 1994, 2003, and 2020 levels of development were analyzed using CALSIM II and the post-processing spreadsheets. For 1994, only a single baseline scenario was simulated. For the 2003 and 2020 levels of development, the EIR analyzed the following scenarios:

- Baseline
- Proposed Project
- No Project A without KFE storage
- No Project A with KFE storage
- No Project B-A without KFE storage
- No Project B-A with KFE storage

[3] The minimum project yield through the worst drought of record, found through iterative modeling studies

- No Project B-S without KFE storage
- No Project B-S with KFE storage

2.6.1.1. State Water Project Table A Amounts

Table 2 shows the Table A amounts assigned to each contractor in each scenario. Table A amounts for each contractor at each level of development are based on the schedule contained in Table B-4 of Appendix B of the Department of Water Resources' Bulletin 132-95[4]. These Table A amounts were modified based on historical Table A transfers and relinquishments.

Historical transfers totaling 100,000 acre-feet originating from the Metropolitan Water District of Southern California (MWDSC) are incorporated into all scenarios at the 2020 level of development. Historical Table A transfers of 22,273 acre-feet originating from Tulare Lake Basin WSD are included in all of the Proposed Project and No Project A Alternatives, but not in the Baseline or No Project B Alternatives.

Transfers from Kern County Water Agency (KCWA) are incorporated into the Proposed Project Alternative, totaling 114,000 acre-feet in 2003 and 130,000 acre-feet in 2020. No Project Alternative A includes 73,000 acre-feet of transfers originating from KCWA in 2003, increasing to 89,000 acre-feet in 2020. No transfers originating from KCWA are included in the Baseline or No Project B Alternatives.

Table 3 shows Table A transfers incorporated into each alternative.

In addition, Dudley Ridge Water District and KCWA have Table A relinquishments in the Proposed Project Alternatives, which are shown in Table 4. These relinquishments are not included in the Baseline and No Project Alternatives.

2.6.1.2. State Water Project Contractors' Water Requests and Demands

2.6.1.2.1. Scheduled Water

For the purposes of this analysis, each SWP contractor's Table A request is defined as the amount that the contractor submits to DWR at the beginning of the contract year. This analysis assumes that each contractor's request will be its full Table A Amount (prior to invocation of Article 18(b) in the case of No Project Alternative B) in each year and that this will be the amount that will be used to determine allocations for the contractor as part of the SWP allocation process.

Demand is defined in this analysis as the amount of water that the contractor would actually like to receive and will physically accept delivery of if the water is available. The demand for each contractor can be less than the request for any contractor in any given year. Demand is an essential CALSIM II input that strongly affects CALSIM II output. Each contractor's demand is related to the contractor's need for water, but the contractor's demand cannot exceed its Table A Amount. In the real world, a contractor's demand varies due to the availability of local water supplies, the contractor service area's demand for water, water costs of SWP water relative to other available water, water quality considerations, and other factors.

[4] http://wwwswpao.water.ca.gov/publications/bulletin/95/chapters_frameset95.html

Table 2 - Table A Amounts in Each Scenario (acre-feet)

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2020 Baseline	2003 No Project A	2020 No Project A	2003 No Project B	2020 No Project B	2003 Proposed Project	2020 Proposed Project
County of Butte	1,200	3,500	27,500	3,500	27,500	1,594	12,388	3,500	27,500
Plumas County FC&WCD	1,200	1,690	2,700	1,690	2,700	770	1,216	1,690	2,700
City of Yuba City	9,600	9,600	9,600	9,600	9,600	4,372	4,325	9,600	9,600
Napa County FC&WCD	9,135	17,450	24,900	21,475	28,925	7,947	11,217	21,475	28,925
Solano County WA	28,080	41,000	42,000	46,756	47,756	18,672	18,920	46,756	47,756
Alameda Co. FC&WCD, Zone 7	40,000	46,000	46,000	80,619	80,619	20,950	20,722	80,619	80,619
Alameda County WD	42,000	42,000	42,000	42,000	42,000	19,128	18,920	42,000	42,000
Santa Clara Valley WD	100,000	100,000	100,000	100,000	100,000	45,543	45,048	100,000	100,000
Oak Flat WD	5,700	5,700	5,700	5,700	5,700	2,596	2,568	5,700	5,700
County of Kings	4,000	4,000	4,000	9,000	9,000	1,822	1,802	9,000	9,000
Dudley Ridge WD	57,700	57,700	57,700	61,673	61,673	26,273	25,933	57,343	57,343
Empire West Side ID	3,000	3,000	3,000	3,000	3,000	1,366	1,351	3,000	3,000
Kern County Water Agency (M&I)	134,600	134,600	134,600	134,600	134,600	61,300	60,635	134,600	134,600
Kern County Water Agency (Agric.)	1,018,800	1,018,800	1,018,800	945,800	929,800	463,987	458,953	864,130	848,130
Tulare Lake Basin WSD	118,500	118,500	118,500	96,227	96,227	53,568	53,382	96,227	96,227
San Luis Obispo Co. FC&WCD	25,000	25,000	25,000	25,000	25,000	11,386	11,262	25,000	25,000
Santa Barbara Co. FC&WCD	45,486	45,486	45,486	45,486	45,486	20,715	20,491	45,486	45,486
Antelope Valley-East Kern WA	138,400	138,400	138,400	141,400	141,400	63,031	62,347	141,400	141,400
Castaic Lake WA (31A)	12,700	12,700	12,700	12,700	12,700	5,784	5,721	12,700	12,700
Castaic Lake WA	41,500	41,500	41,500	41,500	41,500	18,900	18,695	82,500	82,500
Coachella Valley WD	23,100	23,100	111,200	33,000	133,100	10,520	50,094	33,000	133,100
Crestline-Lake Arrowhead WA	5,800	5,800	5,800	5,800	5,800	2,641	2,613	5,800	5,800
Desert WA	38,100	38,100	50,000	38,100	54,000	17,352	22,524	38,100	54,000
Littlerock Creek ID	2,300	2,300	2,300	2,300	2,300	1,047	1,036	2,300	2,300
Mojave WA	50,800	50,800	50,800	75,800	75,800	23,136	22,885	75,800	75,800
Metropolitan WDSC	2,011,500	2,011,500	1,911,500	2,011,500	1,911,500	916,088	861,080	2,011,500	1,911,500
Palmdale WD	17,300	17,300	17,300	21,300	21,300	7,879	7,793	21,300	21,300
San Bernardino Valley MWD	102,600	102,600	102,600	102,600	102,600	46,727	46,220	102,600	102,600
San Gabriel Valley MWD	28,800	28,800	28,800	28,800	28,800	13,116	12,974	28,800	28,800
San Gorgonio Pass WA	17,300	5,000	17,300	5,000	17,300	2,277	7,793	5,000	17,300
Ventura County FCD	20,000	20,000	20,000	20,000	20,000	9,109	9,010	20,000	20,000
Total Agriculture	1,220,400	1,220,400	1,220,400	1,134,100	1,118,100	555,801	549,771	1,048,100	1,032,100
Total M&I	2,933,801	2,951,526	2,997,286	3,037,826	3,099,586	1,344,199	1,350,229	3,078,826	3,140,586
Total	4,154,201	4,171,926	4,217,686	4,171,926	4,217,686	1,900,000	1,900,000	4,126,926	4,172,686

Table 3 - Table A Transfers

Transferor	Transferee	Year	Baseline Amount (AF)	Proposed Project Amount (AF)	No Project Alternative A Amount (AF)	No Project Alternative B Amount (AF)	Applicable Levels of Development
Kern County WA	Mojave Water Agency	1998	0	25,000[1]	25,000	0	2003, 2020
Kern County WA	Alameda Co. FC&WCD, Zone 7	2000	0	7,000[1]	7,000	0	2003, 2020
Kern County WA	Alameda Co. FC&WCD, Zone 7	2000	0	15,000[1]	15,000	0	2003, 2020
Kern County WA	Castaic Lake WA	2000	0	41,000[1]	0	0	2003, 2020
Kern County WA	Palmdale WD	2000	0	4,000[1]	4,000	0	2003, 2020
Kern County WA	Alameda Co. FC&WCD, Zone 7	2001	0	10,000[1]	10,000	0	2003, 2020
Kern County WA	Alameda Co. FC&WCD, Zone 7	2001	0	2,219[1]	2,219	0	2003, 2020
Kern County WA	Napa Co. FC&WCD	2001	0	4,025[1]	4,025	0	2003, 2020
Kern County WA	Solano County WA	2001	0	5,756[1]	5,756	0	2003, 2020
Kern County WA	Coachella Valley WD	2006	0	12,000[1]	12,000	0	2020
Kern County WA	Desert WA	2006	0	4,000[1]	4,000	0	2020
Tulare Lake Basin WSD	Antelope Valley-East Kern WA	2002	0	3,000	3,000	0	2003, 2020
Tulare Lake Basin WSD	Dudley Ridge WD	2002	0	3,973	3,973	0	2003, 2020
Tulare Lake Basin WSD	Alameda Co. FC&WCD, Zone 7	2003	0	400	400	0	2003, 2020
Tulare Lake Basin WSD	County of Kings	2003	0	5,000	5,000	0	2003, 2020
Tulare Lake Basin WSD	Coachella Valley WD	2004	0	9,900	9,900	0	2003, 2020
MWDSC	Coachella Valley WD	2005	88,100	88,100	88,100	88,100	2020
MWDSC	Desert WA	2005	11,900	11,900	11,900	11,900	2020

Notes:
(1) This Table A transfer is a component of the Monterey Amendment Article 53 KCWA commitment of 130 TAF of Table A transfers

Table 4 - Table A Relinquishments in the Proposed Project Alternative

Contractor	Year	Amount (AF)	Applicable Levels of Development
Dudley Ridge WD	1996	4,333	2003, 2020
Kern County WA	1996	36,340	2003, 2020
Kern County WA	1997	4,333	2003, 2020

Although the SWP has many categories of deliveries, including Table A, Article 12(d), Article 14(b), Turnback Pool, Carryover, and Article 21 deliveries, CALSIM II categorizes all SWP deliveries as either Table A or Article 21 deliveries. In order to develop an estimate of SWP demand for each contractor at the 1994, 2003, and 2020 levels of development, SWP delivery data has been combined into categories that CALSIM II uses to represent SWP demand. Therefore, historical SWP water delivery categories (Table A, Article 12(d), Article 14(b), Turnback Pool, and Carryover) have been classified as CALSIM II Table A demand for simulation purposes. This categorization is shown in Table 5.

Table 5 - Categorization of State Water Project Demand in CALSIM II

	SWP Demand Categories	**CALSIM II Demand Categories**
Scheduled	Table A Article 12(d) Article 14(b) Turnback Pool Carryover	Table A
Unscheduled	Article 21	Article 21

For each level of development, CALSIM II incorporates the historical 73-year period of hydrology, which includes a range of hydrologic year types. For the 2020 level of development, the Department assumed that all SWP M&I contractors would have a scheduled demand equal to their full Table A entitlement in each year of the simulation. In the 1994 and 2003 levels of development, each M&I contractor has historically had a water demand that varies under different local hydrologic and water supply conditions. However, to simplify the analysis the Department decided to use a variable annual demand for only MWDSC; after consultation with the Department, MWDSC staff developed an annual time series of scheduled MWDSC water demands for the Monterey Plus EIR for each level of development.

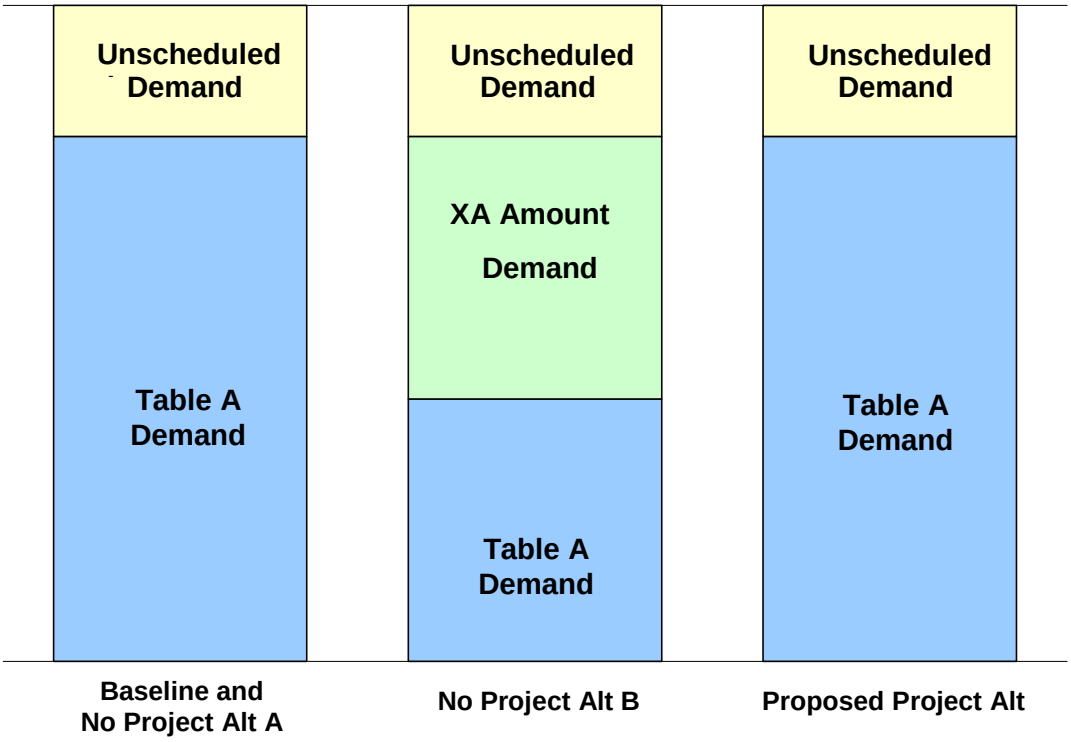
As recommended by the Monterey Plus EIR Modeling Subcommittee, the Department determined representative scheduled demands for the other M&I contractors for the 1994 and 2003 levels of development using historical Table A delivery and allocation data. For these contractors, historical deliveries from 1993 and 1996-97 were used to estimate demands at the 1994 level of development while deliveries during 2002 and 2003 were used to estimate 2003 level of development demands. These years were used because they were considered to be the most representative of average demand for the 1994 and 2003 levels of development. The demand estimate for each contractor in these two levels of development equaled the average historical deliveries to the contractor during the applicable years. The only exceptions are that the Department excluded 1997 deliveries for County of Kings and Tulare Lake Basin WSD because 1997 was a partial flood year which depressed those contractors' deliveries of SWP water and the Department only included 2003 deliveries to San Gorgonio Pass to approximate the 2003 level of development demand because San Gorgonio did not take any deliveries prior to 2003.

The Department assumed that agricultural contractors would demand their full Table A amount in each year except for years when the agricultural contractors' service areas had abundant

precipitation and local water supplies. Consequently both the 1994 and 2003 level of development included full scheduled water demands for all agricultural contractors except when the Kern River Index indicated above normal and wet years. For the 2020 level of development, the Department reduced agricultural demand only when the Kern River Index indicated wet years at the 2020 level of development. These reductions in agricultural demands are of the same quantity and occur in the same water years as the reductions assumed in the U.S. Bureau of Reclamation's Operations Criteria and Plan (OCAP) CALSIM II studies.

Figure 1 depicts how total demand was split between Table A and XA Amount demand under each alternative. All Baseline, No Project Alternative A and Proposed Project scenarios classified all scheduled demand as Table A demand. All No Project Alternative B scenarios, classified all scheduled water demand up to the contractor's reduced Table A amount as Table A demand, with any additional scheduled demand classified as XA Amount demand. The sum of the Table A and XA Amount demand for the No Project Alternative B scenarios equaled the Table A demand for the Baseline scenarios. Total SWP scheduled demand remained the same in all three scenarios.

Figure 1 - Contractor Demand by Category in each Alternative



In the Baseline and No Project Alternatives, each contractor's actual scheduled demand was capped by its Table A amount (prior to invocation of Article 18(b) in the case of No Project Alternative B) plus or minus any Table A transfers the contractor had participated in. For some contractors, the scheduled water demand calculated from historical delivery data at the 1994 or 2003 levels of development was higher than the contractor's Table A amount for that scenario.

Table 6 shows the contractors for whom this was the case at each level of development. For the 1994 level of development, this occurred with Solano County Water Agency, who's Table A increased between 1994 and 1997 as a result of maturation of its original Table A contractual Table A amounts, and Coachella Valley Water District and Desert Water Agency, which had received Turnback Pool deliveries in 1996-97 that are included in the 1994 demand estimates but would not be possible in the Baseline and No Project Alternatives. For the 2003 level of development, this occurred in the Baseline and No Project Alternative B scenarios for Alameda County Flood Control and Water Conservation District, Zone 7 and in all of the Baseline and No Project Alternative scenarios for Castaic Lake Water Agency. Both of the contractors had received increased historical deliveries as a result of Table A amount transfers from KCWA.

Table 6 - Contractors With Capped Demands

Contractor	Level of Development	Scheduled Demand Calculated from Historical Deliveries (acre-feet)	Table A Amount in the Baseline or No Project Alternative (acre-feet)
Solano County WA	1994	31,600	28,080
Coachella Valley WD	1994	51,200	23,100
Desert WA	1994	64,600	38,100
Alameda County FC & WCD, Zone 7	2003	66,500	46,000
Castaic Lake WA	2003	68,600	41,500

In the No Project Alternative A scenarios, Table A transfers from agricultural contractors to M&I contractors were included. In the No Project alternative the Department allocates water for the transferred Table A amounts according to pre-Monterey Article 18(a) provisions that first assign deficiencies first to agricultural contractors. The post-processing classifies Table A amounts that was transferred from agricultural to M&I contractors as agricultural demand for water allocation purposes.

Table A and XA Amount demands are shown for each 1994 and 2003 alternative in Table 7[5]. Demands are shown for the 2020 alternatives in Table 8.

2.6.1.2.2. Unscheduled Water

Table 9 shows monthly unscheduled demands for each contractor at each level of development. The unscheduled demand for each contractor is the same in each scenario and at each level of development. These are the same unscheduled demands that Reclamation used for its OCAP studies, except that the EIR increases monthly MWDSC demand from 50 TAF/month to 100 TAF/month as requested by MWDSC.

[5] Plumas County FC&WCD is not represented in CALSIM II and is therefore not included in this or subsequent tables.

Table 7 - Table A and XA Demands in Each 1994 and 2003 LOD Alternative (acre-feet/year)

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 Proposed Project	2003 No Project A	2003 No Project B	
	Table A	Table A	Table A	Table A	Table A	XA Amount
Butte	200	500	500	500	500	0
Yuba City	900	1,200	1,200	1,200	1,200	0
Napa	4,800	6,800	6,800	6,800	6,800	0
Solano	28,080	37,700	37,700	37,700	18,672	19,028
Zone 7	26,700	46,000	66,500	66,500	20,950	25,050
Alameda	18,000	35,200	35,200	35,200	19,128	16,072
Santa Clara	82,500	84,700	84,700	84,700	45,543	39,157
Oak Flat	4,600-5,700	4,600-5,700	4,420-5,700	4,517-5,700	2,596	2,004-3,104
Kings	3,230-4,000	3,230-4,000	6,979-9,000	7,132-9,000	1,822	1,408-2,178
Dudley Ridge	46,570-57,000	46,570-57,000	46,464-57,343	48,872-61,673	26,273	20,293-30,727
Empire W.S.	2,420-3,000	2,420-3,000	2,326-3,000	2,377-3,000	1,366	1,054-1,834
KCWA (M&I)	134,600	134,600	134,600	134,600	61,300	73,300
KCWA (Agric.)	822,290-1,018,800	822,290-1,018,800	670,049-864,130	749,485-945,800	463,987	358,203-554,813
Tulare	95,640-118,500	95,640-118,500	74,615-96,227	76,254-96,227	53,568	42,072-64,932
SLO	0	4,400	4,400	4,400	4,400	0
Santa Barbara	0	26,300	26,300	26,300	20,715	5,585
AVEK	53,700	64,900	64,900	64,900	63,031	1,869
Castaic (Agric.)	10,250-12,700	10,250-12,700	9,848-12,700	10,064-12,700	5,784	4,466-6,916
Castaic (M&I)	15,100	41,500	68,600	41,500	18,900	22,600
Coachella	23,100	19,300	19,300	19,300	10,520	8,780
Crestline	500	1,900	1,900	1,900	1,900	0
Desert	38,100	31,200	31,200	31,200	17,352	13,848
Littlerock	600	0	0	0	0	0
Mojave	9,800	13,200	13,200	13,200	13,200	0
MWDSC	783,000-1,433,000	706,000-2,011,500	706,000-2,011,500	706,000-2,011,500	706,000-916,088	0-1,095,412
Palmdale	10,400	14,900	14,900	14,900	7,879	7,021
San Bernardino	6,700	69,800	69,800	69,800	46,727	23,073
San Gabriel	15,500	18,100	18,100	18,100	13,116	4,984
San Gorgonio	0	100	100	100	100	0
Ventura	600	5,000	5,000	5,000	5,000	0
Total Agriculture	985,000-1,220,400	985,000-1,220,400	812,700-1,048,100	898,700-1,134,100	555,369	429,631-665,031
Total M&I	1,271,180-1,903,180	1,363,300-2,668,800	1,410,900-2,716,400	1,383,800-2,689,300	1,104,027-1,314,115	259,273-1,354,685
Total	2,238,180-3,123,580	2,348,300-3,889,200	2,223,600-3,763,500	2,281,500-3,823,400	1,659,396-1,869,484	688,904-2,019,716

Table 8 - Table A and XA Demands in Each 2020 LOD Alternative (acre-feet/year)

SWP CONTRACTOR	2020 Baseline	2020 Proposed Project	2020 No Project A	2020 No Project B	
	Table A	Table A	Table A	Table A	XA Amount
Butte	27,500	27,500	27,500	12,388	15,112
Yuba City	9,600	9,600	9,600	4,325	5,275
Napa	24,900	28,925	28,925	11,217	13,683
Solano	42,000	47,756	47,756	18,920	23,080
Zone 7	46,000	80,619	80,619	20,722	25,278
Alameda	42,000	42,000	42,000	18,920	23,080
Santa Clara	100,000	100,000	100,000	45,048	54,952
Oak Flat	4,601-5,700	4,400-5,700	4,500-5,700	2,568	2,033-3,132
Kings	3,228-4,000	6,947-9,000	7,105-9,000	1,802	1,427-2,198
Dudley Ridge	46,570-57,700	44,264-57,343	48,689-61,673	25,933	20,577-31,707
Empire W.S.	2,421-3,000	2,316-3,000	2,316-3,000	1,351	1,070-1,649
KCWA (M&I)	134,600	134,600	134,600	60,635	73,695
KCWA (Agric.)	822,286-1,018,800	654,890-848,130	654,690-929,800	458,953	363,333-559,847
Tulare	95,643-118,500	74,280-96,227	74,280-96,227	53,382	42,260-65,118
SLO	25,000	25,000	25,000	11,262	13,738
Santa Barbara	45,486	45,486	45,486	20,491	24,995
AVEK	138,400	141,400	141,400	62,347	76,053
Castaic (Agric.)	10,250-12,700	9,803-12,700	9,803-12,700	5,721	4,529-6,979
Castaic (M&I)	41,500	82,500	41,500	18,695	22,805
Coachella	111,200	133,100	133,100	50,094	61,106
Crestline	5,800	5,800	5,800	2,613	3,187
Desert	50,000	54,000	54,000	22,524	27,746
Littlerock	2,300	2,300	2,300	1,036	1,246
Mojave	50,800	75,800	75,800	22,885	27,915
MWDSC	1,911,500	1,911,500	1,911,500	861,080	1,050,420
Palmdale	17,300	21,300	21,300	7,793	9,507
San Bernardino	102,600	102,600	102,600	46,220	56,380
San Gabriel	28,800	28,800	28,800	12,974	15,826
San Gorgonio	17,300	17,300	17,300	7,793	9,507
Ventura	20,000	20,000	20,000	9,010	10,990
Total Agriculture	985,000-1,220,400	796,700-1,032,100	882,700-1,118,100	549,771	435,229-670,629
Total M&I	2,994,586	3,137,886	3,096,886	1,349,013	1,645,573
Total	3,979,586-4,214,986	3,934,586-4,169,986	3,979,596-4,214,986	1,898,784	1,663,384-2,316,202

Table 9 - Monthly Unscheduled Demands (acre-feet/month)

Contractor	1994	2003	2020
Napa County FC&WCD	1,000	1,000	1,000
Solano County WA	1,000	1,000	1,000
Alameda Co. FC&WCD, Zone 7	1,000	1,000	1,000
Alameda County WD	1,000	1,000	1,000
Santa Clara Valley WD	4,000	4,000	4,000
Dudley Ridge WD	1,000	1,000	1,000
Empire West Side ID	1,000	1,000	1,000
Kern County WA	50,000	50,000	50,000
Tulare Lake Basin WSD	15,000	15,000	15,000
Antelope Valley-East Kern WA	1,000	1,000	1,000
Castaic Lake WA	1,000	1,000	1,000
Coachella Valley WD	2,000	2,000	2,000
Desert WA	5,000	5,000	5,000
MWDSC (Dec-Mar only)	100,000	100,000	100,000
Total	84-184,000	84-184,000	84-184,000

2.6.2. State Water Project Allocation Rules

As part of the analysis, annual CALSIM II deliveries to SWP contractors on the North Bay Aqueduct and south of Banks Pumping Plant were post-processed to estimate deliveries to each contractor. The County of Butte and City of Yuba were not included in the post-processing because their deliveries are more influenced by local water supply conditions and are not affected by Delta regulatory requirements and export restrictions. Therefore, the Butte and Yuba deliveries were not modified from the CALSIM II results.

The remainder of this section discusses how deliveries were determined for each North Bay Aqueduct and South of Delta contractor in each scenario. Table 10 shows the allocation rules that were used to allocate Table A, XA Amount, and unscheduled deliveries to these contractors.

2.6.2.1. Proposed Project Alternative

In the Proposed Project Alternative, Table A and unscheduled allocations are made in proportion to the requesting contractors' Table A amounts as limited by their demands for delivery.

2.6.2.2. Baseline and No Project Alternatives

For the Baseline and No Project Alternatives, Table A allocations are made to agricultural Table A (AG), which includes Table A that was transferred from agricultural to M&I contractors, and to M&I Table A (M&I) using the following procedure:

- If the total supply available is greater than the sum of AG's and M&I's demands, both AG and M&I receive their full demand and allocation for both is assumed to be 100% with no cuts.
- If the total supply available is less than the sum of AG's and M&I's demands, AG's allocation is reduced until the total AG and M&I delivery equals the available supply or until the maximum AG-specific cut (termed AG deficiency) for the year is reached, whichever comes first. In each year, the AG deficiency is determined as a percentage of AG's Table A amount. This percentage equals the minimum of 50% or (100% minus the sum of the

Table 10 - SWP Allocation Rules for Monterey Plus EIR Alternatives

Delivery Type	Baseline	Proposed Project	No Project Alternative A	No Project Alternative B-A (Apportioned XA allocation rules)	No Project Alternative B-S (Surplus XA allocation rules)
Table A	If scheduled SWP supply is less than demand, cuts in deliveries are made first to agricultural contractors up to the maximum allowed under Article 18(a). Additional cuts are then made in proportion to each contractor's Table A amount.	Deliveries are made to each contractor according to its proportion of Table A amount relative to all other contractors' Table A amounts.	If scheduled SWP supply is less than demand, cuts in deliveries are made first to agricultural Table A up to the maximum allowed under Article 18(a). Additional cuts are then made in proportion to each contractor's Table A amount.	If scheduled SWP supply is less than demand, cuts in deliveries are made first to agricultural Table A up to the maximum allowed under Article 18(a). Additional cuts are then made in proportion to each contractor's Table A amount.	If scheduled SWP supply is less than demand, cuts in deliveries are made first to agricultural Table A up to the maximum allowed under Article 18(a). Additional cuts are then made in proportion to each contractor's Table A amount.
XA Amount	Not applicable.	Not applicable.	Not applicable.	Deliveries are made to each contractor according to its proportion of Table A amount relative to all other contractors' Table A amounts.	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.
Unscheduled	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.	Deliveries are made to each contractor according to its proportion of Table A amount relative to all other requesting contractors' Table A amounts.	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.	Deliveries for agricultural and groundwater replenishment uses are given priority over those for M&I uses.

Note: All entries in this table are the same for all levels of development at which each alternative is analyzed.

previous 6 years' AG deficiencies). The reduction in AG's allocation determined in this step is the AG deficiency for the year for use in subsequent years' calculations.

- If the AG-specific cuts do not reduce the total AG and M&I delivery to the same amount as the available supply, additional cuts are made equally to AG and M&I in proportion to their Table A amounts until the total SWP Table A delivery equals the available Table A supply for the year.

In No Project Alternative B-A, XA Amount allocations are made in proportion to each contractor's Table A amounts. For XA Amount deliveries in No Project Alternative B-S and for unscheduled deliveries in all of the Baseline and No Project Alternatives, the Department developed the following scheduled surplus allocation procedure that separates agricultural (AG), groundwater recharge (GWR) and M&I components of the demands:

1. Divide contractors into two groups depending on whether a contractor is north of Dos Amigos Pumping Plant or south of Dos Amigos Pumping Plant;
2. For north of Dos Amigos Pumping Plant contractors, allocate each year's Scheduled Surplus water supply in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A water use divided by total SWP AG and GWR Table A amount, or
    b. Each contractor's AG and GWR Scheduled Surplus demand,
3. For contractors south of Dos Amigos Pumping Plant, aggregate contractors into separate geographic zones, and allocate the remaining Scheduled Surplus water to the geographic zones - 69% of water to the San Joaquin Valley area, 29% to Southern California area, and 2% to the Central Coast area.
4. For each geographic zone, allocate water to each contractor in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A amount relative to the zone's total AG and GWR Table A amount, or
    b. Each contractor's remaining AG and GWR Scheduled Surplus demand,
5. For each geographic zone, if there is remaining water and remaining AG and GWR Scheduled Surplus demand, perform a second water allocations of the zone's remaining Scheduled Surplus water to the zone's contractors in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A amount relative to zone's total AG and GWR Table A amount, or
    b. Each contractor's remaining AG and GWR Scheduled Surplus demand,
6. For each zone, repeat AG and GWR Scheduled Surplus allocations until the allocations have completely allocated the zone's Scheduled Surplus water supply or the zone's Scheduled Surplus allocations satisfy the contractors' demands;
7. If a zone has met all demand and has water remaining, make the water available to other south-of-Dos-Amigos zones that have not satisfied all contractors' demands for Scheduled Surplus water. Allocate water to each south-of-Dos-Amigos contractor in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A amount relative to the remaining contractors' total AG and GWR Table A amount, or
    b. Each contractor's remaining AG and GWR Scheduled Surplus demand,

8. For south-of-Dos-Amigos area, repeat AG and GWR Scheduled Surplus allocations until the allocations have completely allocated the south-of-Dos-Amigos area's Scheduled Surplus water supply or the south-of-Dos-Amigos area's Scheduled Surplus allocations satisfy the contractors' demands;
9. If the south-of-Dos-Amigos area has met all demand and has remaining unallocated water, make the water available to the north-of-Dos-Amigos contractors that have not satisfied their demands for Scheduled Surplus water for AG use and GWR. Allocate water to each north-of-Dos-Amigos contractor in proportion to the minimum of either:
    a. Each contractor's AG and GWR Table A amount relative to the remaining contractors' total AG and GWR Table A amount, or
    b. Each contractor's remaining AG and GWR Scheduled Surplus demand,
10. For the north-of-Dos-Amigos area, repeat AG and GWR Scheduled Surplus allocations until the allocations have completely allocated the north-of-Dos-Amigos area's Scheduled Surplus water supply or the north-of-Dos-Amigos area's Scheduled Surplus allocations satisfy the contractors' demands;
11. If the north-of-Dos-Amigos area has met all demand and has water remaining, make the water available to all contractors that have not satisfied their demands for Scheduled Surplus water for M&I use. Allocate water to each contractor in proportion to the minimum of either:
    a. Each contractor's M&I Table A water use relative to the remaining contractors' total M&I Table A water use, or
    b. Each contractor's M&I Scheduled Surplus demand,
12. Repeat Scheduled Surplus M&I allocations until the allocations have completely allocated the Scheduled Surplus water supply or the Scheduled Surplus allocations satisfy the contractors' M&I demands.

2.6.3. Kern Fan Element Storage Assumptions

Scenarios were developed for the 2003 and 2020 No Project Alternatives A, B-A, and B-S that incorporate a hypothetical SWP groundwater banking facility in the Kern Fan Element (KFE). The Department developed basic assumptions regarding the facilities and operations of the groundwater banking program using the *Kern Water Bank First Stage Kern Fan Element Feasibility Report* (DWR 1990). This analysis assumes that SWP operations north of Banks Pumping Plant and the operation of San Luis Reservoir would be the same with and without the presence of the KFE.

Table 11 shows the basic operating parameters that were used to model the KFE. The KFE has an initial storage of 83 TAF, which equals the KFE water supply indicated in the 1995 KFE Exchange Agreement between KCWA and DWR. Maximum groundwater storage capacity is 350 TAF at the 2003 level of development and 500 TAF at the 2020 level of development. The maximum recharge is 10.5 TAF per month in 2003 and 15 TAF per month in 2020, with a maximum extraction of 6.2 TAF per month in 2003 and 8.9 TAF per month in 2020. A one-time loss rate of 10% is applied to all recharge amounts to represent all the losses that occur in the KFE's operations.

The analysis assumes that the SWP would extract previously stored water from the KFE to augment Table A deliveries in years when the total Table A allocation is less than 60% without

use of the KFE in No Project A. In No Project B, the SWP will extract if allocations are less than 100% without use of the KFE. If the amount of SWP water stored in the KFE at the beginning of the month is greater than 200 TAF, an amount equal to the extraction limit is extracted. However, if the SWP water in storage is less than 200 TAF, a hedging rule has been included that reduces the extraction amount for the month in order to slow down the depletion of remaining storage.

Table 11 - KFE Operating Parameters

Parameter	No Project A		No Project B	
	2003	2020	2003	2020
Storage Capacity (TAF)	350	500	350	500
Initial Storage (TAF)	83	83	83	83
Recharge Limit (TAF/month)	10.5	15	10.5	15
Recharge Loss (%)	10%	10%	10%	10%
Extraction Limit (TAF/month)	6.2	8.9	6.2	8.9
Extraction Threshold (% Table A Allocation)	60%	60%	100%	100%

Recharge into the KFE only occurs in years in which no water is extracted. The analysis assumes that the SWP would recharge the KFE with SWP water that would otherwise be delivered as unscheduled water up to the monthly recharge limit in any month that unscheduled water is available, unless the amount of SWP water already in storage equals the KFE storage capacity.

Once operations of the KFE were determined, the monthly time series of Table A and unscheduled water deliveries in No Project Alternatives A, B-A, and B-S were modified to reflect the operations of the KFE. Table A deliveries were increased by the extraction amount while unscheduled deliveries were reduced by the recharge amount. The revised time series of deliveries were then analyzed in the post-processing spreadsheets for each alternative.

2.6.4. Other CALSIM II Assumptions

Table 12 shows other assumptions that were used for the CALSIM II studies. Assumptions included in this table refer to hydrology, demands, facilities, regulations, and operating criteria at each level of development. The CALSIM II studies used in this analysis for 2003 and 2020 are based on the OCAP_2001D10A_TodayEWA_012104 and OCAP_2020D09D_FutureEWA_012104 studies[6] . The 1994 CALSIM II study was modified from the 2003 study as shown in Table 2 in order to reflect 1994 conditions.

With the exception of SWP Table A amounts and demands, the assumptions for the Baseline, Proposed Project and No Project Alternative model studies were the same at each level of development.

[6] http://www.usbr.gov/mp/cvo/ocap.html

Table 12 – Other CALSIM II Assumptions

CALSIM II INPUT			ASSUMPTIONS FOR LEVEL-OF-DEVELOPMENT YEAR
Hydrol-ogy	Period of Simulation		73 years (1922-1994)
	Initial Conditions (reservoir storage)		1922
	Land Use Level of Development		Assume that 1994 is equal to 2001 level (2001 Level from DWR Bulletin 160-98) and that 2003 level is equal to 2001. 2020 Level from DWR Bulletin 160-98
Demands	North of Delta (except American R.)	CVP	1994 and 2003 based on 2001 land use, limited by full CVP contract. 2020 based on 2020 land use.
		SWP—Feather River Service Area	1994 and 2003 based on 2001 land use, 2020 based on 2020 land use. All years limited by full Settlement Contract
		SWP—FVB Cities (Fairfield, Vacaville, and Benicia)	No demand in 1994; contract-specified in 2003 and 2020.
		Non-Project	Based on land use
		CVP Refuges	Firm Level 2
	American River Basin	Water rights	2001 for 1994 and 2003, 2020 for 2020
		CVP	2001 for 1994 and 2003, 2020 for 2020
	San Joaquin River Basin	Friant Unit	Regression of historical
		Lower Basin	Fixed annual demands
		Stanislaus River Basin	1997 New Melones Interim Operations Plan
	South of Delta	CVP	Full Contract
		Contra Costa Water District	124 TAF/YR in 1994 & 2003, 158 TAF/YR in 2020
		SWP (w/ North Bay Aqueduct)	Varies
		SWP Article 21 Demand	Varies
Facilities	CVP		Existing CVP
	SWP	Existing & new facilities	Existing SWP facilities with Coastal Branch Phase II in operation and without the East Branch Enlargement for 1994 & 2003; 2020 adds East Branch Enlargement
		South Bay Aqueduct	Existing Capacity (300 cfs)
		SWP Kern Fan Element	Kern Fan Element facilities not included
		Banks Pumping Plant	1994 Capacity for 1994 & 2003; 2020 adds 8,500 cfs limits

CALSIM II INPUT			ASSUMPTIONS FOR LEVEL-OF-DEVELOPMENT YEAR
Regula-tions	Trinity River	Minimum Flow below Lewiston Dam	1994 limit is 340 TAF/Yr, 2003 limit is Interim (369-453 TAF/Yr), and 2020 limit is 369-815 TAF/Yr (Trinity EIS Preferred Alternative)
		Trinity Reservoir End-of-September Minimum Storage	No 1994 limit; 600 TAF as able in 2003 & 2020 (Trinity EIS Preferred Alternative)
	Clear Creek	Minimum Flow below Whiskeytown Dam	Downstream water rights, 1963 USBR Proposal to USFWS and NPS, and USFWS discretionary use of CVPIA 3406(b)(2)
	Upper Sacra-mento River	Shasta Lake End-of-September Minimum Storage	SWRCB WR 1993 Winter-run Biological Opinion (1900 TAF)
		Minimum Flow below Keswick Dam	Flows for SWRCB WR 90-5 and 1993 Winter-run Biological Opinion temperature control, and USFWS discretionary use of CVPIA 3406(b)(2)
	Feather River	Minimum Flow below Thermalito Diversion Dam	1983 DWR, DFG Agreement (600 CFS)
		Minimum Flow below Thermalito Afterbay outlet	1983 DWR, DFG Agreement (1000 – 1700 cfs)
	American River	Minimum Flow below Nimbus Dam	SWRCB D-893 and USFWS discretionary use of CVPIA 3406(b)(2)
		Minimum Flow at H Street Bridge	SWRCB D-893
	Lower Sacra-mento River	Minimum Flow near Rio Vista	SWRCB D-1641
	Mokelumne River	Minimum Flow below Camanche Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (100 – 325 cfs)
		Minimum Flow below Woodbridge Diver. Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (25 – 300 cfs)
	Stanislaus River	Minimum Flow below Goodwin Dam	1987 USBR, DFG agreement, and USFWS discretionary use of CVPIA 3406(b)(2)
		Minimum Dissolved Oxygen	SWRCB D-1422
	Merced River	Minimum Flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180 – 220 CFS, Nov – Mar), and Cowell Agreement
		Minimum Flow at Shaffer Bridge	FERC 2179 (25 – 100 CFS)
	Tuolumne River	Minimum Flow at La Grange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94 – 301 TAF/YR)
	San Joaquin River	Maximum Salinity near Vernalis	SWRCB D-1641
		Minimum Flow near Vernalis	SWRCB D-1641, and Vernalis Adaptive Management Program per San Joaquin River Agreement
	Sacramento River-San Joaquin River Delta	Delta Outflow Index (Flow and Salinity)	SWRCB D-1641
		Delta Cross Channel Gate Operation	SWRCB D-1641
		Delta Exports	SWRCB D-1641, USFWS discretionary use of CVPIA 3406(b)(2) for 1994, 2003, & 2020; 2003 & 2020 add CALFED Fisheries Agencies discretionary use of EWA

CALSIM II INPUT			ASSUMPTIONS FOR LEVEL-OF-DEVELOPMENT YEAR
Opera-tions Criteria	Upper Sacra-mento River	Flow Objective for Navigation (Wilkins Slough)	Discretionary 3,250 – 5,000 CFS based on Shasta storage condition
	American River	Folsom Dam Flood Control	Variable 400/670 flood control diagram (without outlet modifications)
		Flow below Nimbus Dam	Discretionary operations criteria corresponding to SWRCB D-893 required minimum flow
		Sacramento Water Forum Mitigation Water	No limits in 1994 & 2003; 2020 uses Sacramento Water Forum standard (up to 47 TAF/YR in dry years)
	Stanislaus R.	Flow below Goodwin Dam	1997 New Melones Interim Operations Plan
	San Joaquin River	Flow near Vernalis	San Joaquin River Agreement in support of the Vernalis Adaptive Management Program
	CVP Water Allocation	CVP Settlement and Exchange	100% (75% in Shasta Critical years)
		CVP Refuges	100% (75% in Shasta Critical years)
		CVP Agriculture	100% - 0% based on supply (SOD allocations are reduced due to D1641 and 3406(b)(2) related export restrictions)
		CVP Municipal & Industrial	100% - 50% based on supply (SOD allocations are reduced due to D1641 and 3406(b)(2) related export restrictions)
	SWP Water Allocation	Feather River Service Area	Specified by Settlement Contract
		Fairfield, Vacaville, and Benicia	No allocation in 1994, specified by Settlement Contract in 2003 & 2020
		South of Delta	Based on SWP supply; varies with EIR alternative
	Delta Pumping	Banks Pumping Plant	1994 & 2003 use 6,680 cfs, can increase up to 8,500 cfs Dec. 15-Mar 15 (min. 300cfs); 2020 uses 8,500 cfs year round (500 cfs reserved for EWA Jul, Aug, Sep)
		Tracy Pumping Plant	1994 & 2003 use 4,200 cfs + deliveries upstream of DMC constriction; 2020 adds CVP-SWP Intertie
	CVP/SWP Coordinated Operations	Sharing of Responsibility for In-Basin-Use	1986 Coordinated Operations Agreement (FRWP EBMUD and 2/3 of North Bay Aqueduct diversions are considered as Delta Export, 1/3 of the North Bay Aqueduct diversion is considered as In-Basin-Use)
		Sharing of Surplus Flows	1986 Coordinated Operations Agreement
		Sharing of Restricted Export Capacity	Equal sharing of export capacity under SWRCB D-1641; use of CVPIA 3406(b)(2) only restricts CVP exports; EWA use restricts CVP and/or SWP as directed by CALFED Fisheries Agencies
		Dedicated CVP Conveyance at Banks	No 1994 or 2003 conveyance; SWP to convey 100,000 af/year of Level 2 refuge water through Banks P.P. (Jul & Aug) in 2020 studies
		North of Delta Accounting Adjustments	No adjustments in 1994 or 2003; in 2020, CVP to provide SWP a maximum of 75,000 AF to meet in-basin requirements through adjustments in COA accounting
		Sharing of Export Capacity for Lesser Priority and Wheeling Related Pumping	Cross Valley Canal wheeling (max of 128 TAF/Yr), CALFED ROD defined Joint-Point-of-Diversion

CALSIM II INPUT		ASSUMPTIONS FOR LEVEL-OF-DEVELOPMENT YEAR
CVPIA 3406(b) 2)	Allocation	Per May 2003 Dept of Interior Decision: 800 taf/yr, 700 taf/yr in 40-30-30 dry years, and 600 taf/year in 40-30-30 critical years
	Actions	1995 WQCP, Fish flow objectives (Oct-Jan), VAMP (Apr 15- May 15) CVP export restriction, 3000 CFS CVP export limit in May and June (D1485 Striped Bass cont.), Post (May 16-31) VAMP CVP export restriction, Ramping of CVP export (Jun), Upstream Releases (Feb-Sep)
	Accounting Adjustments	Per May 2003 Interior Decision, no limit on responsibility for non-discretionary D1641 requirements with 500 TAF target, no Reset with the Storage metric and no Offset with the Release and Export metrics
CALFED Environ-mental Water Account	Actions	1994 has none; 2003 and 2020 have export cuts of 50 taf Dec-Feb, VAMP (Apr 15- May 15) export restriction, post (May 16-31) VAMP export restriction, and ramping of export (Jun)
	Assets	1994 has none; 2003 and 2020 have fixed water purchases of 250 TAF/yr, 230 TAF/yr in 40-30-30 dry years, 210 TAF/yr in 40-30-30 critical years. The purchases range from 0 TAF in Wet Years to approximately 153 TAF in Critical Years NOD, and 57 TAF in Critical Years to 250 TAF in Wet Years SOD. Variable assets include the following: used of 50% JPOD export capacity, acquisition of 50% of any CVPIA 3406(b)(2) releases pumped by SWP, flexing of Delta Export/Inflow Ratio (post-processed from CALSIM II results), dedicated 500 CFS pumping capacity at Banks in July to September
	Debt Restrictions	1994 has none; for 2003 and 2020 delivery debt is paid back in full upon assessment; storage debt paid is back over time based on asset/action priorities; SOD and NOD debt carryover is allowed; SOD debt carryover is explicitly managed or spilled; NOD debt carryover must be spilled; and SOD and NOD asset carryover is allowed.

2.6.5. CALSIM II Simulation of SWP Deliveries and Other Hydrology Outputs

The EIR uses post-processing spreadsheet analyses of CALSIM II studies to evaluate the impacts of the scenarios described above; the post-processing spreadsheets apply each scenario's assumed allocation rules and transfers for the scenario. The following CALSIM II simulation studies were performed:

- 1994 Baseline
- 2003 Baseline
- 2003 Proposed Project Alternative
- 2003 No Project Alternative A
- 2020 Baseline
- 2020 Proposed Project Alternative

SWP deliveries from these studies were post-processed by taking total SWP annual South of Delta Table A and Article 21 deliveries from the model study and re-allocating them to individual contractors according to each scenario's assumptions regarding allocation rules and transfers. In addition, deliveries for the 2003 No Project Alternative B scenarios were post-processed using the 2003 Baseline CALSIM II study and deliveries for the 2020 No Project Alternative A and B scenarios were post-processed using the 2020 Baseline CALSIM II study. These alternatives were able to be post-processed from the Baselines because they have the same total annual SWP scheduled and unscheduled demands. A separate model run was performed for 2003 No Project A because the annual SWP scheduled demand differed from the Baseline. During the post-processing, total annual SWP deliveries were unchanged but the monthly pattern of deliveries was modified within each year depending on the proportion of agricultural and M&I deliveries. The San Luis Reservoir storage pattern was also modified to account for this difference. With this approach, CALSIM II results for the Sacramento Valley, San Joaquin Valley, and the Delta were unchanged.

3.0. Results of CALSIM II Simulation Studies

3.1. SWP Deliveries

3.1.1. Total Deliveries

Figures 2 through 4c show total annual scheduled SWP deliveries in each year for each 1994, 2003, and 2020 scenario. In addition, Figures 5 through 7 show frequency plots of total annual scheduled SWP deliveries.

Figures 8 through 13 show the same information for unscheduled deliveries.

At each level of development, all of the scenarios have similar scheduled and unscheduled deliveries in each year. However, the 2020 scenarios tend to have the higher peak scheduled delivery amounts and more years in which higher amounts of deliveries are made than the 2003 scenarios, which in turn tend to have higher scheduled delivery amounts than the 1994 scenario. This reflects the difference in demand levels at the different levels of development and the inclusion of the 8,500 cfs Banks pumping assumption in 2020.

Conversely, the 1994 scenario has the highest unscheduled deliveries, with the 2003 scenarios also having higher unscheduled deliveries than the 2020 scenarios. This occurs because the higher levels of scheduled deliveries at the later level of development results in fewer excess flows being available to be used to make unscheduled deliveries.

Figure 2 - Total Annual Scheduled SWP Deliveries at the 1994 Level of Development

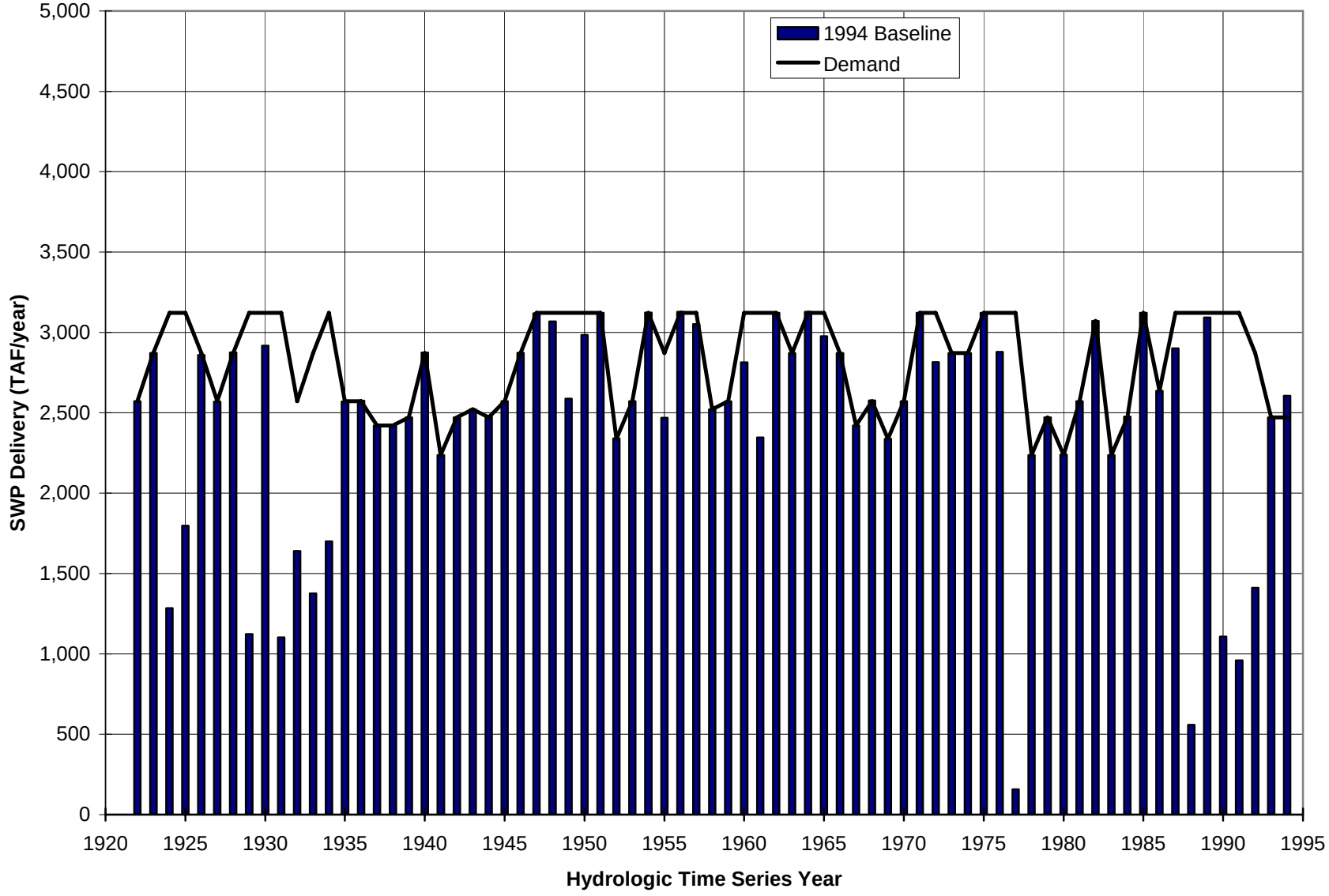


Figure 3a - Total Annual Scheduled SWP Deliveries at the 2003 Level of Development

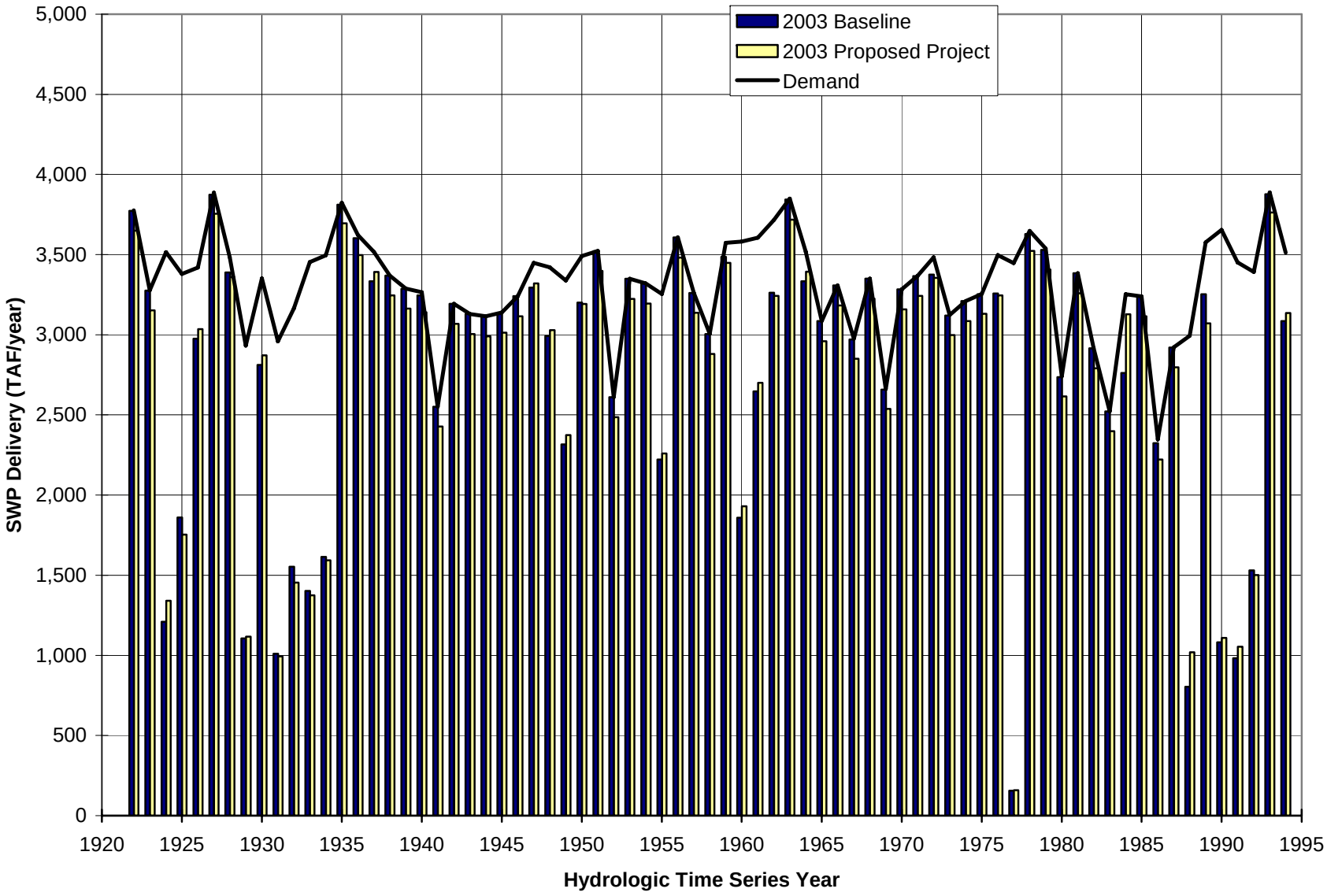


Figure 3b - Total Annual Scheduled SWP Deliveries at the 2003 Level of Development (cont'd)

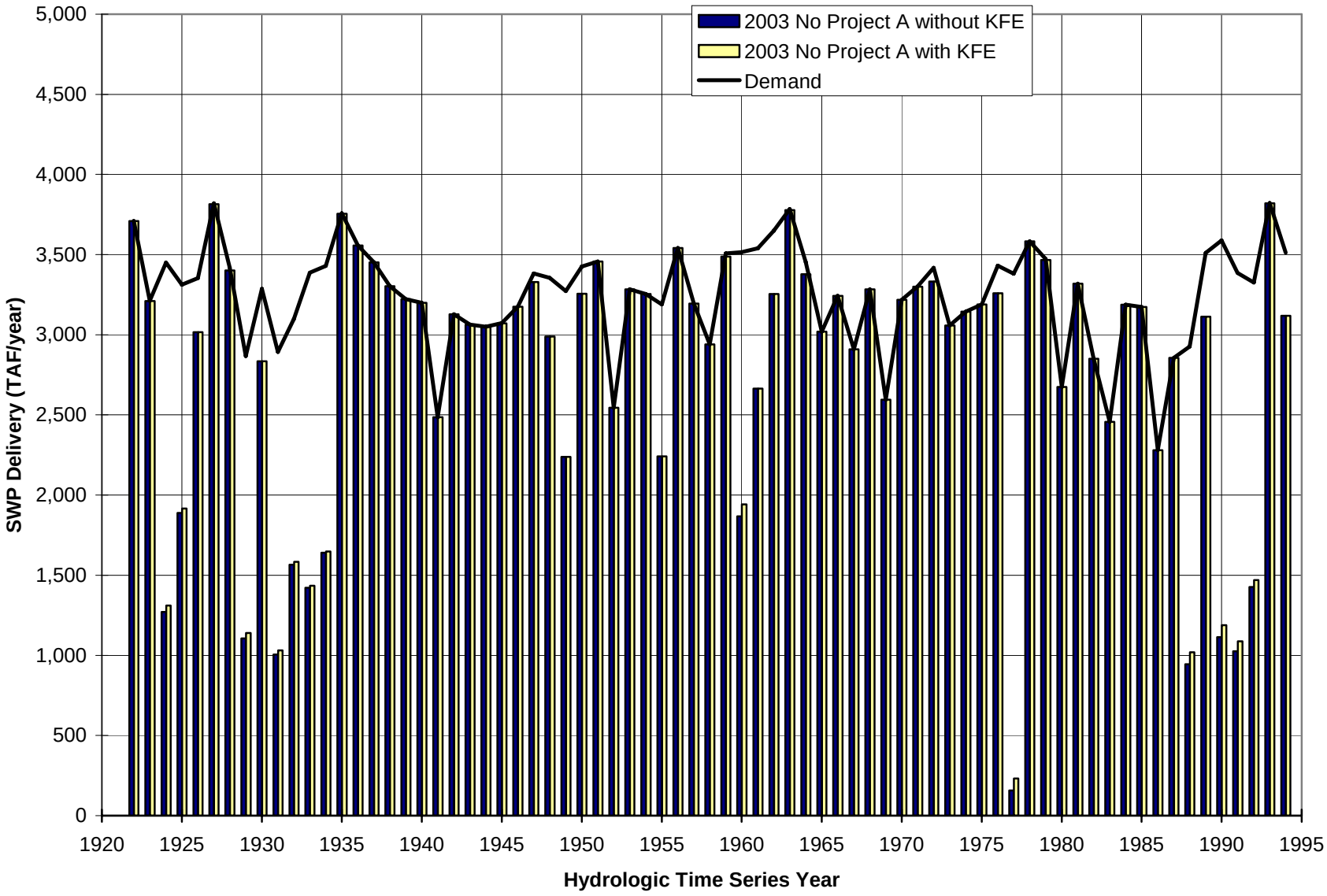


Figure 3c - Total Annual Scheduled SWP Deliveries at the 2003 Level of Development (cont'd)

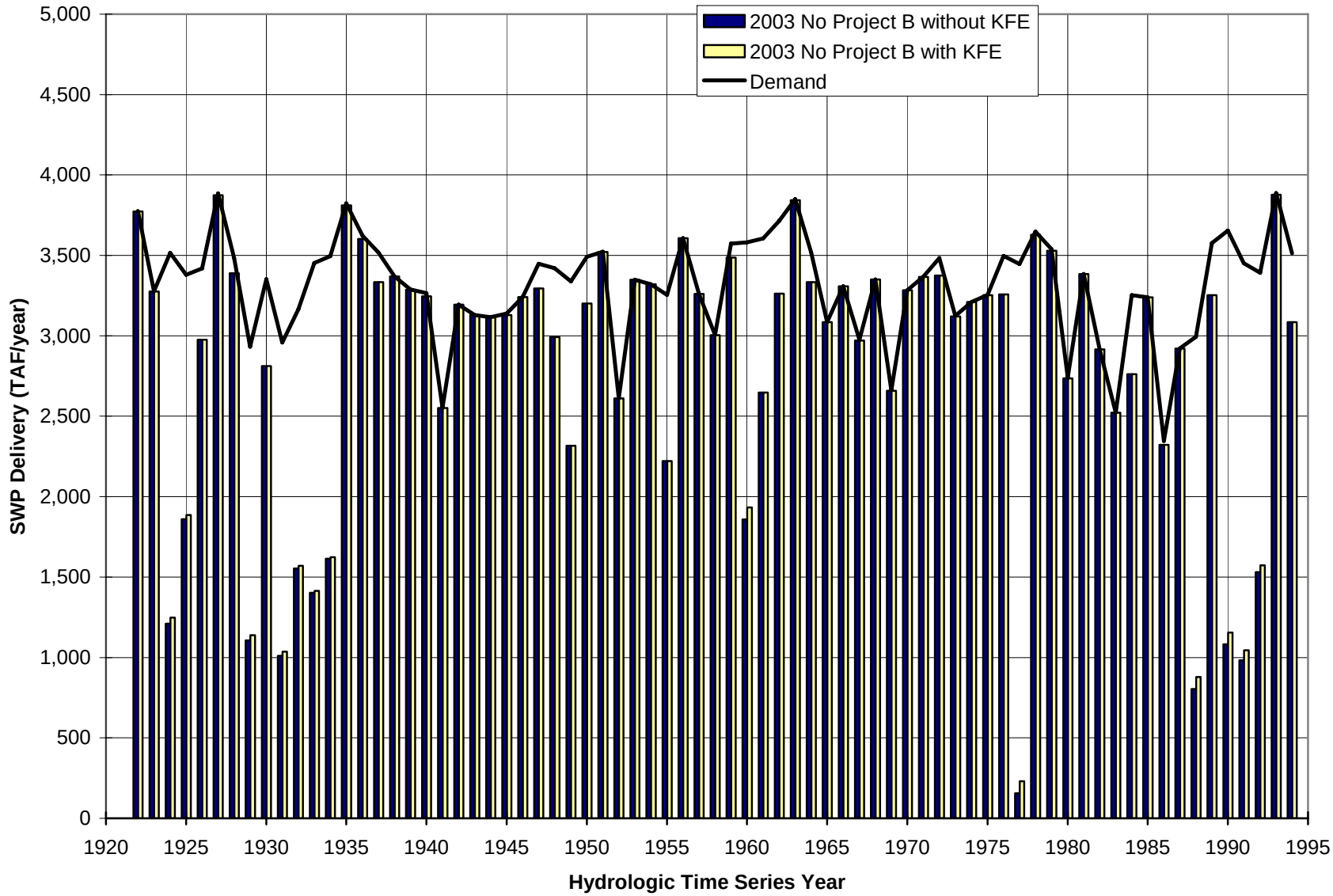


Figure 4a - Total Annual Scheduled SWP Deliveries at the 2020 Level of Development

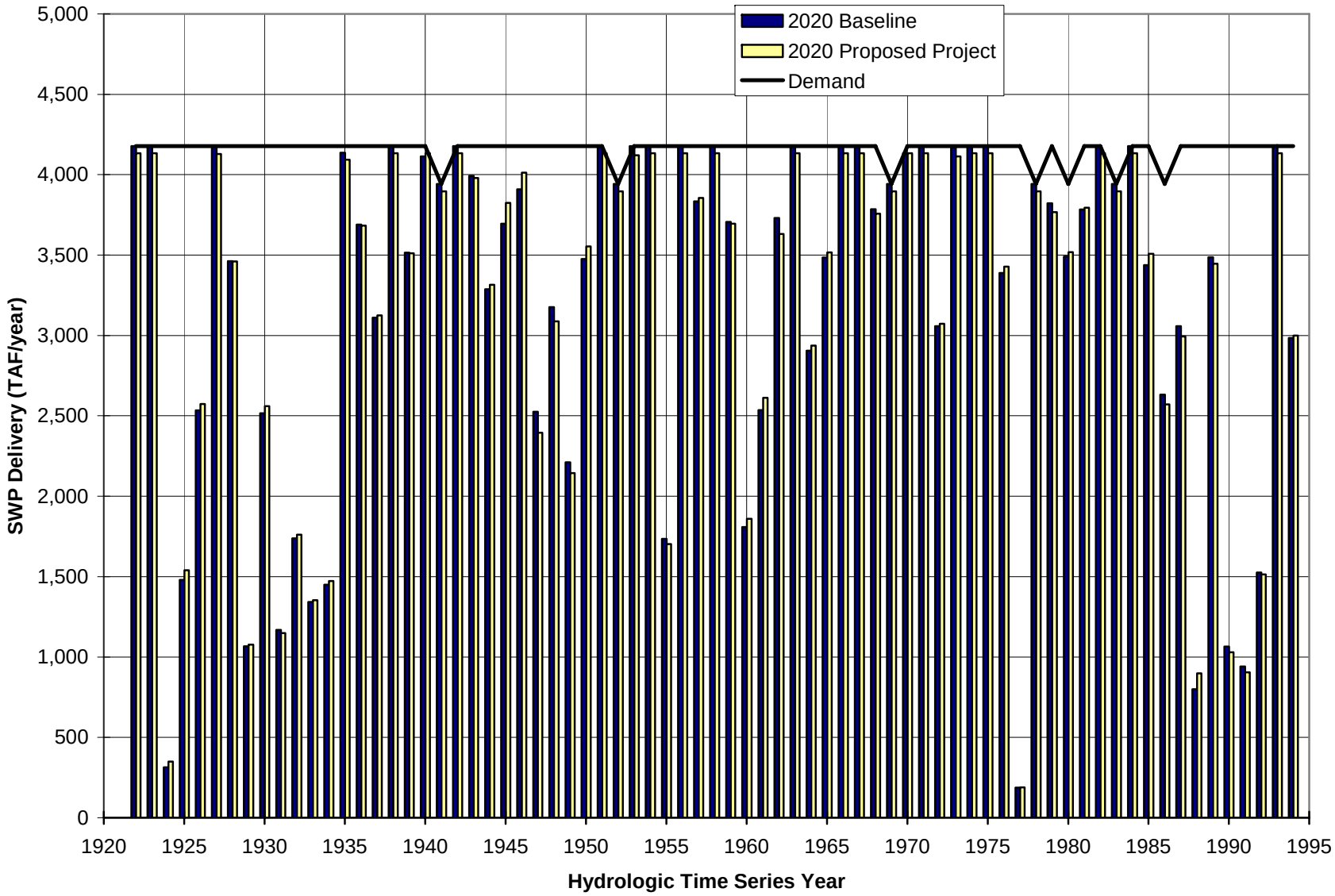


Figure 4b - Total Annual Scheduled SWP Deliveries at the 2020 Level of Development (cont'd)

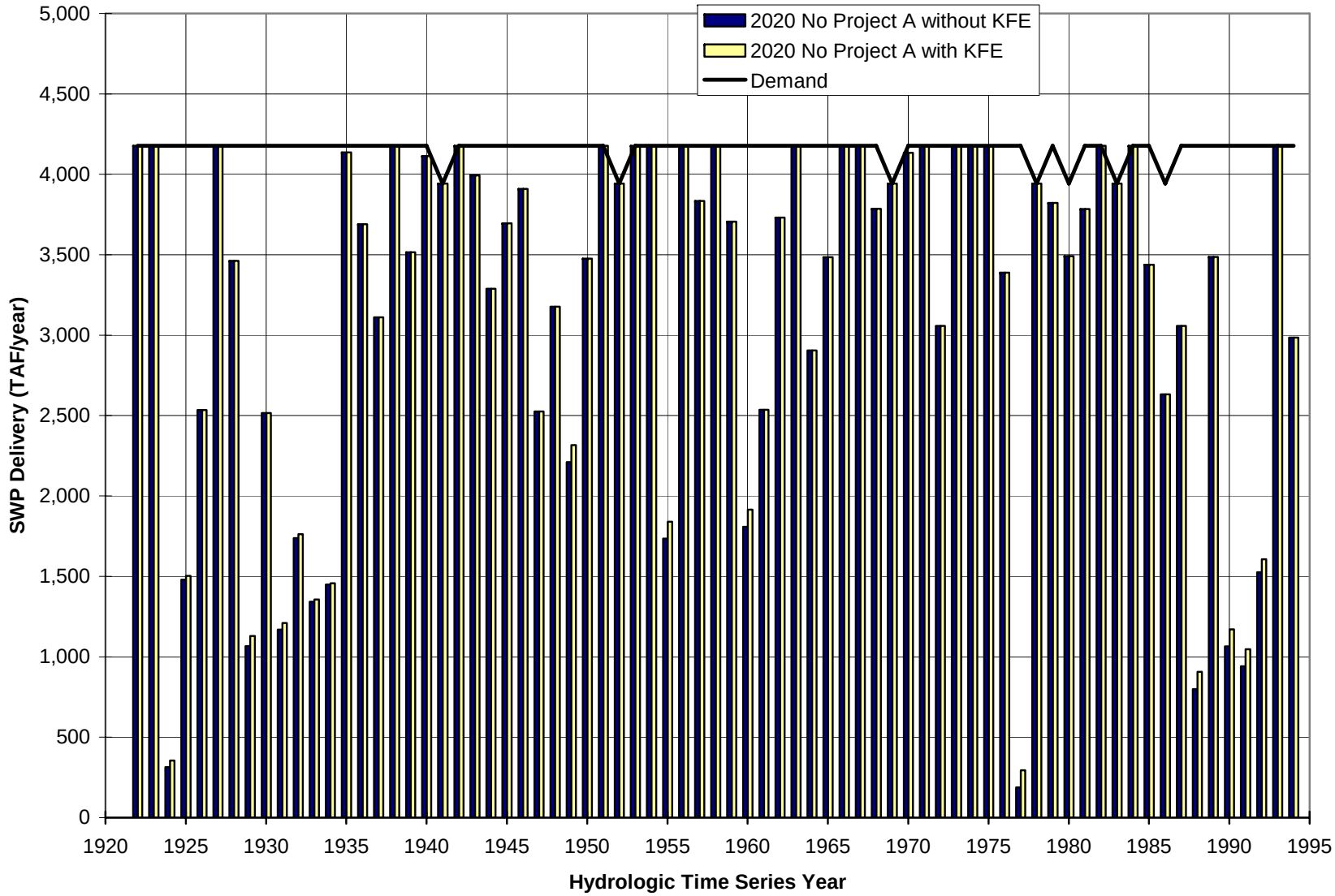


Figure 4c - Total Annual Scheduled SWP Deliveries at the 2020 Level of Development (cont'd)

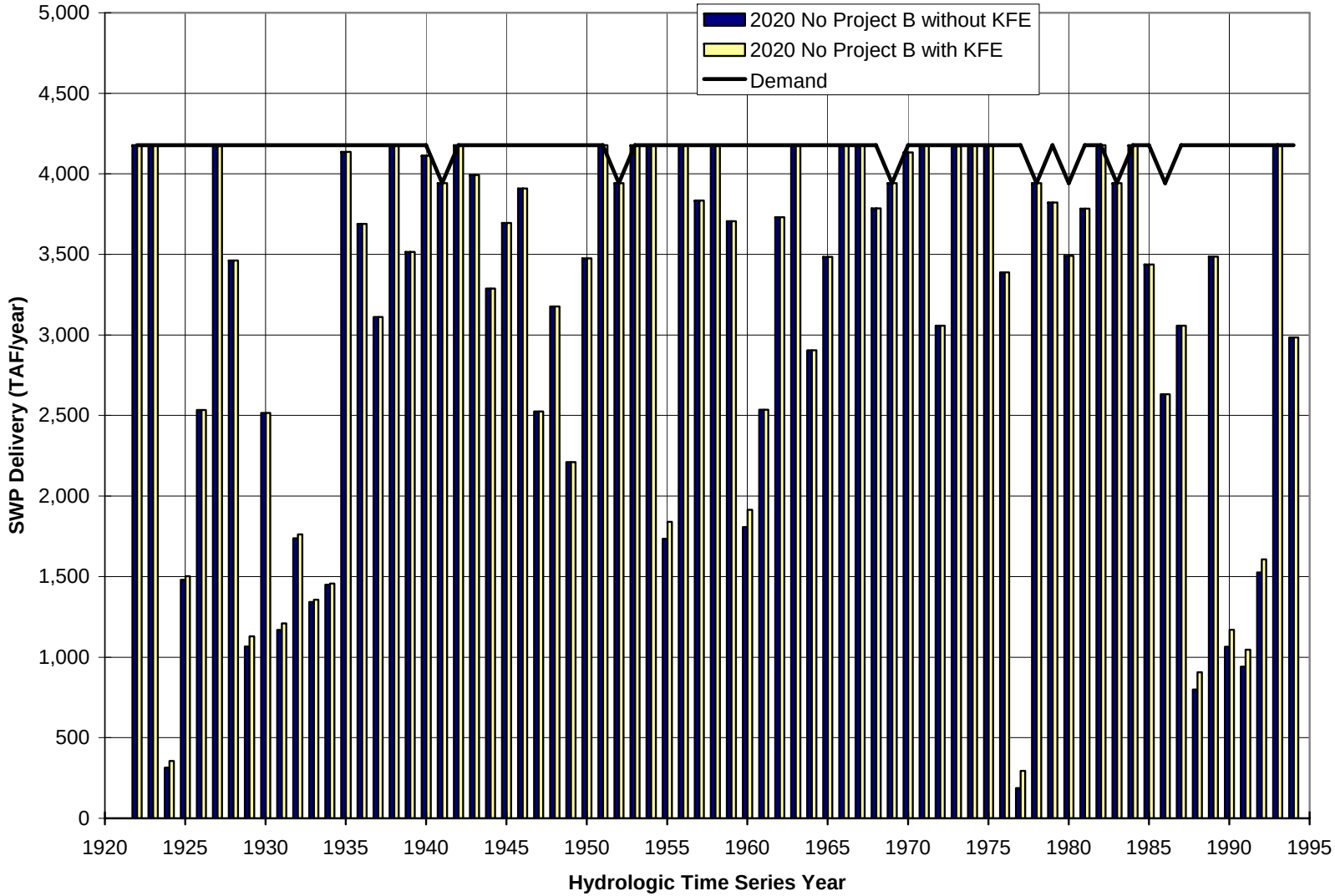


Figure 5 - Frequency of Annual Scheduled SWP Deliveries at the 1994 Level of Development

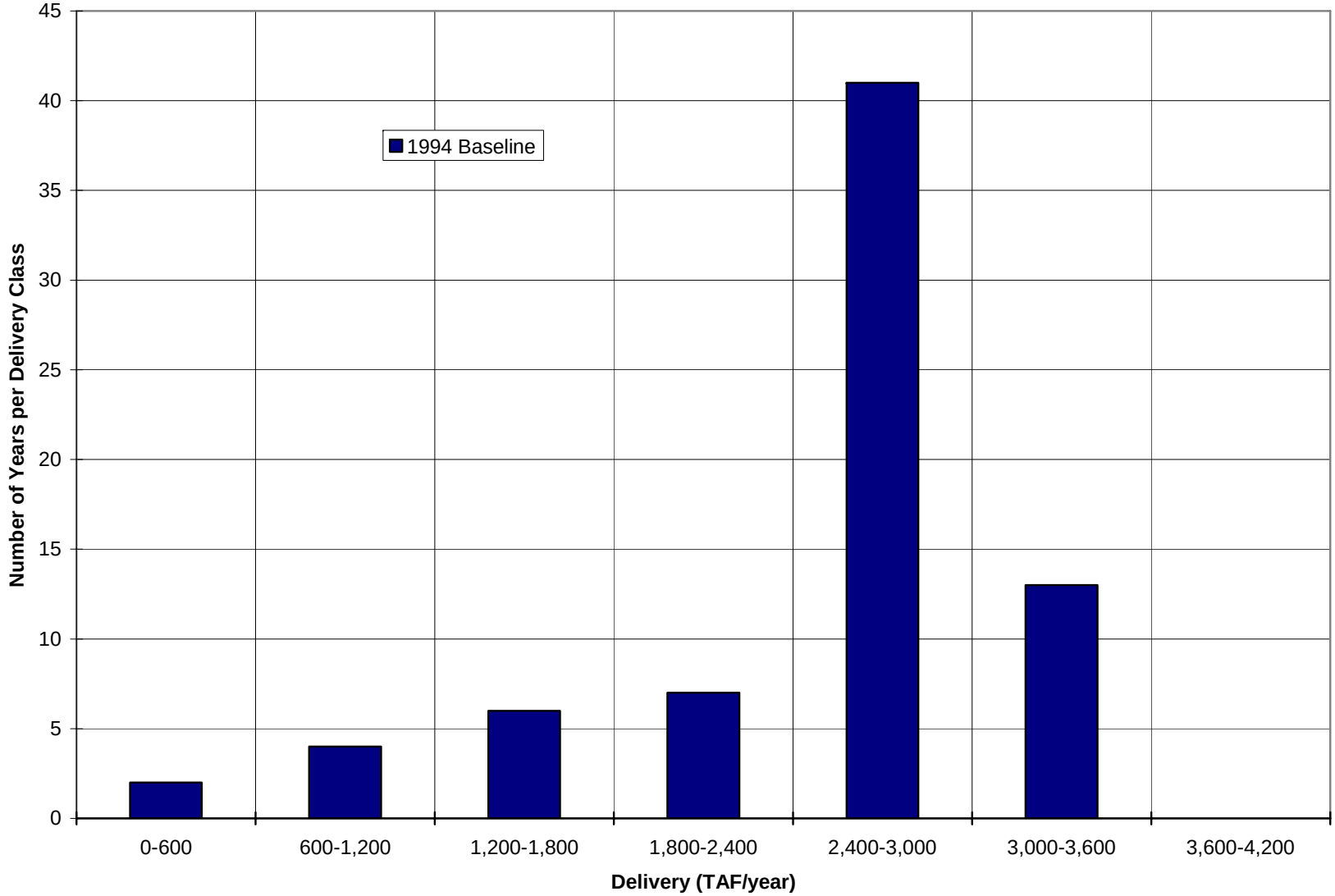


Figure 6 - Frequency of Annual Scheduled SWP Deliveries at the 2003 Level of Development

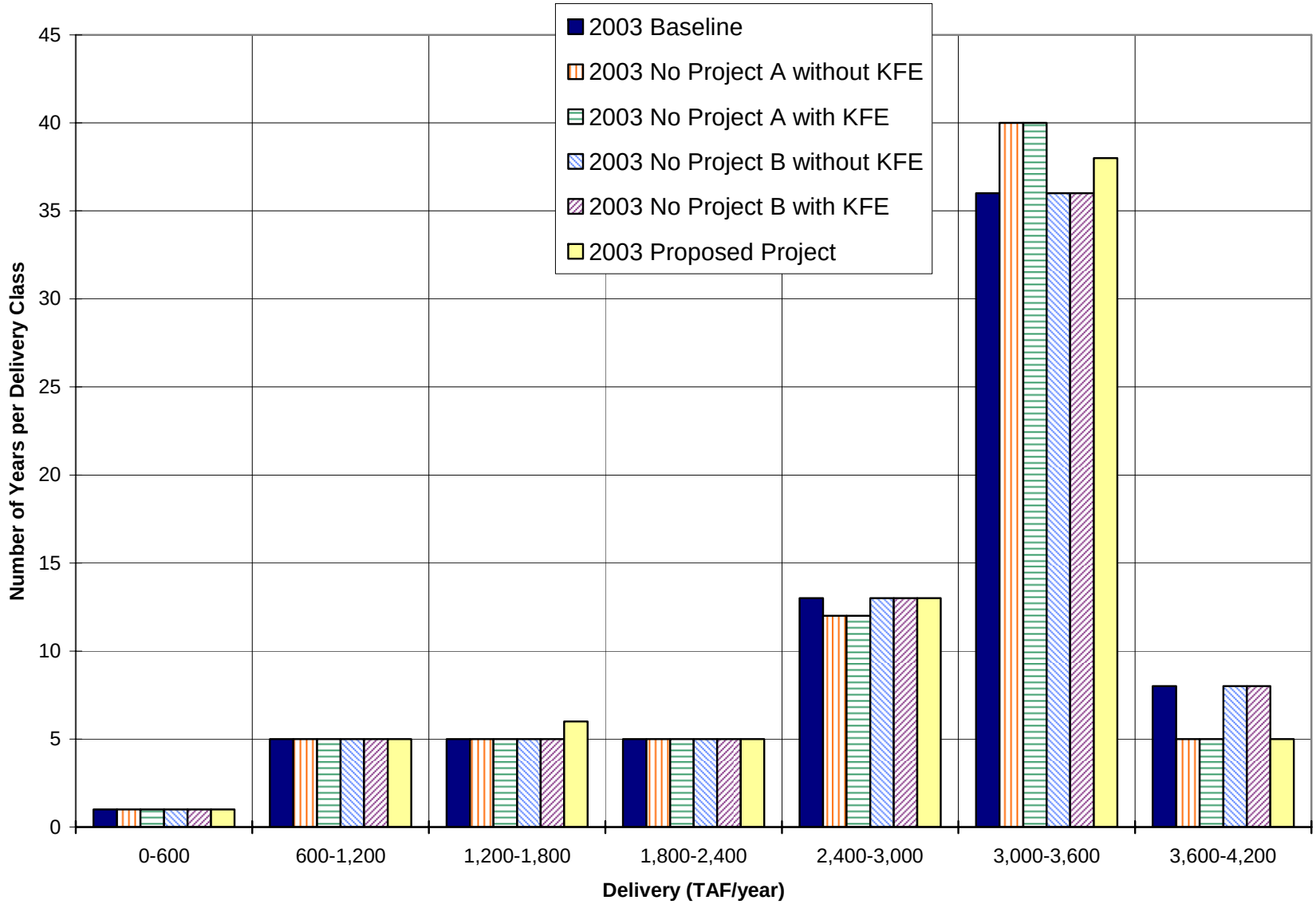


Figure 7 - Frequency of Annual Scheduled SWP Deliveries at the 2020 Level of Development

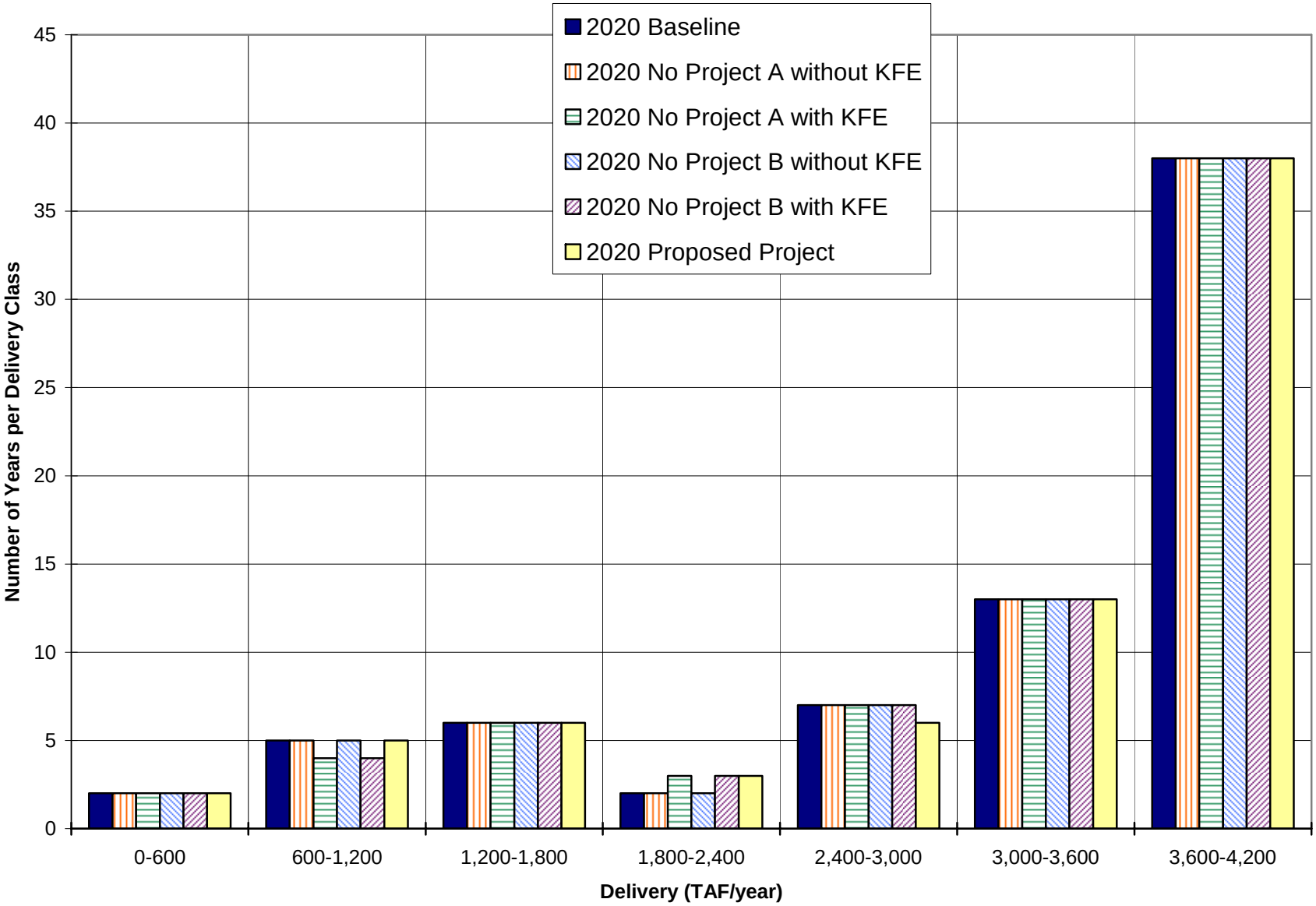


Figure 8 - Total Annual Unscheduled SWP Deliveries at the 1994 Level of Development

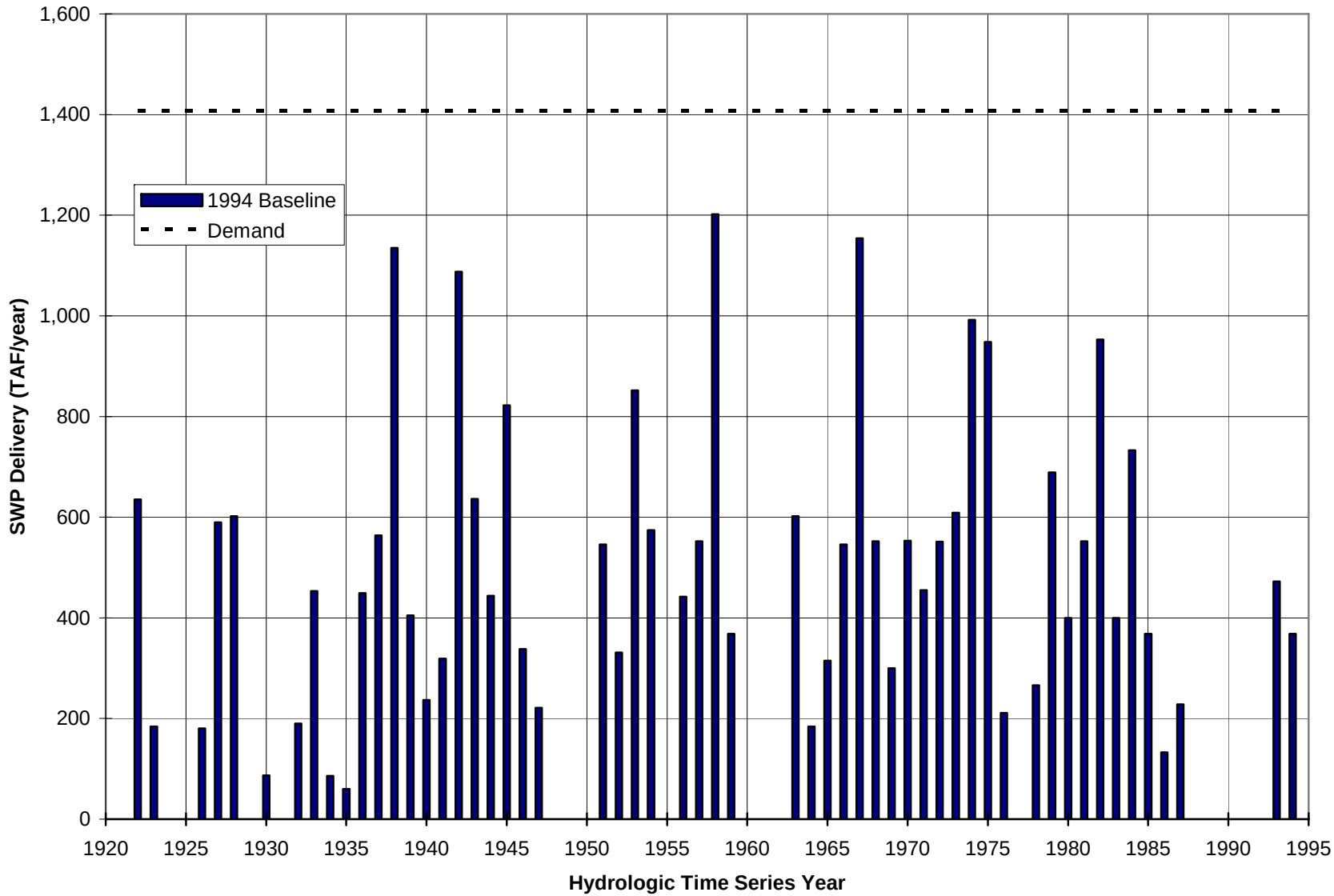


Figure 9a - Total Annual Unscheduled SWP Deliveries at the 2003 Level of Development

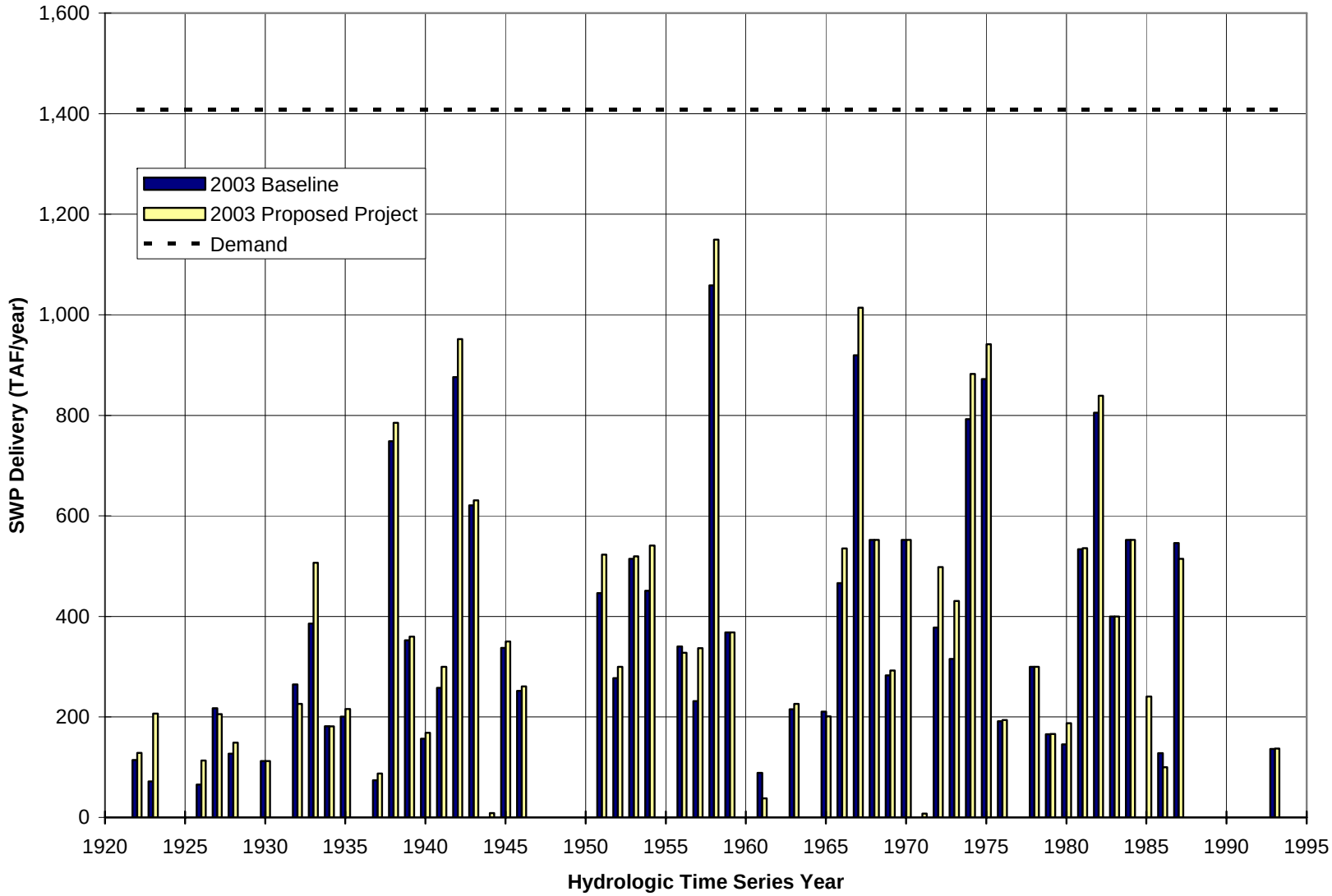


Figure 9b - Total Annual Unscheduled SWP Deliveries at the 2003 Level of Development (cont'd)

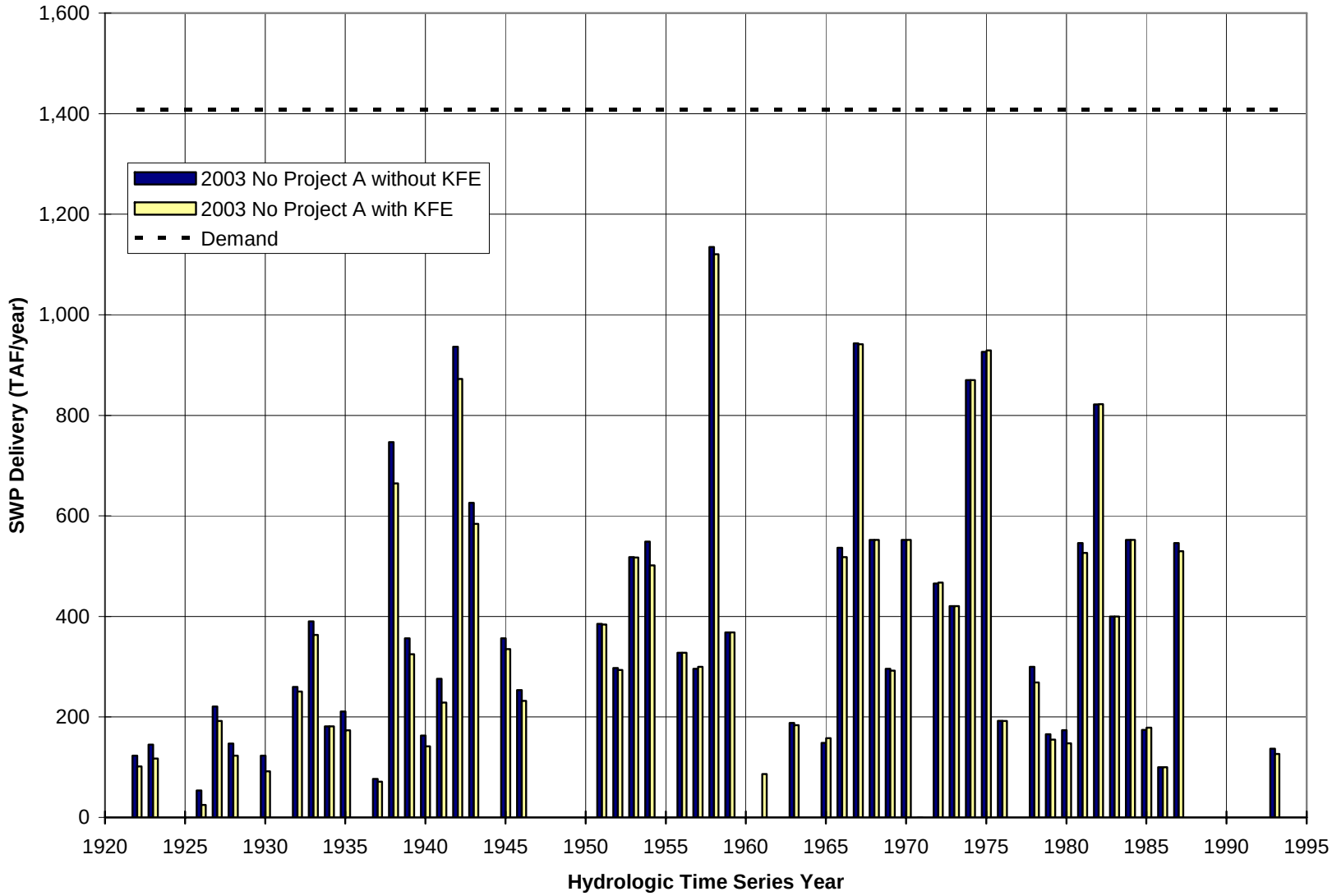


Figure 9c - Total Annual Unscheduled SWP Deliveries at the 2003 Level of Development (cont'd)

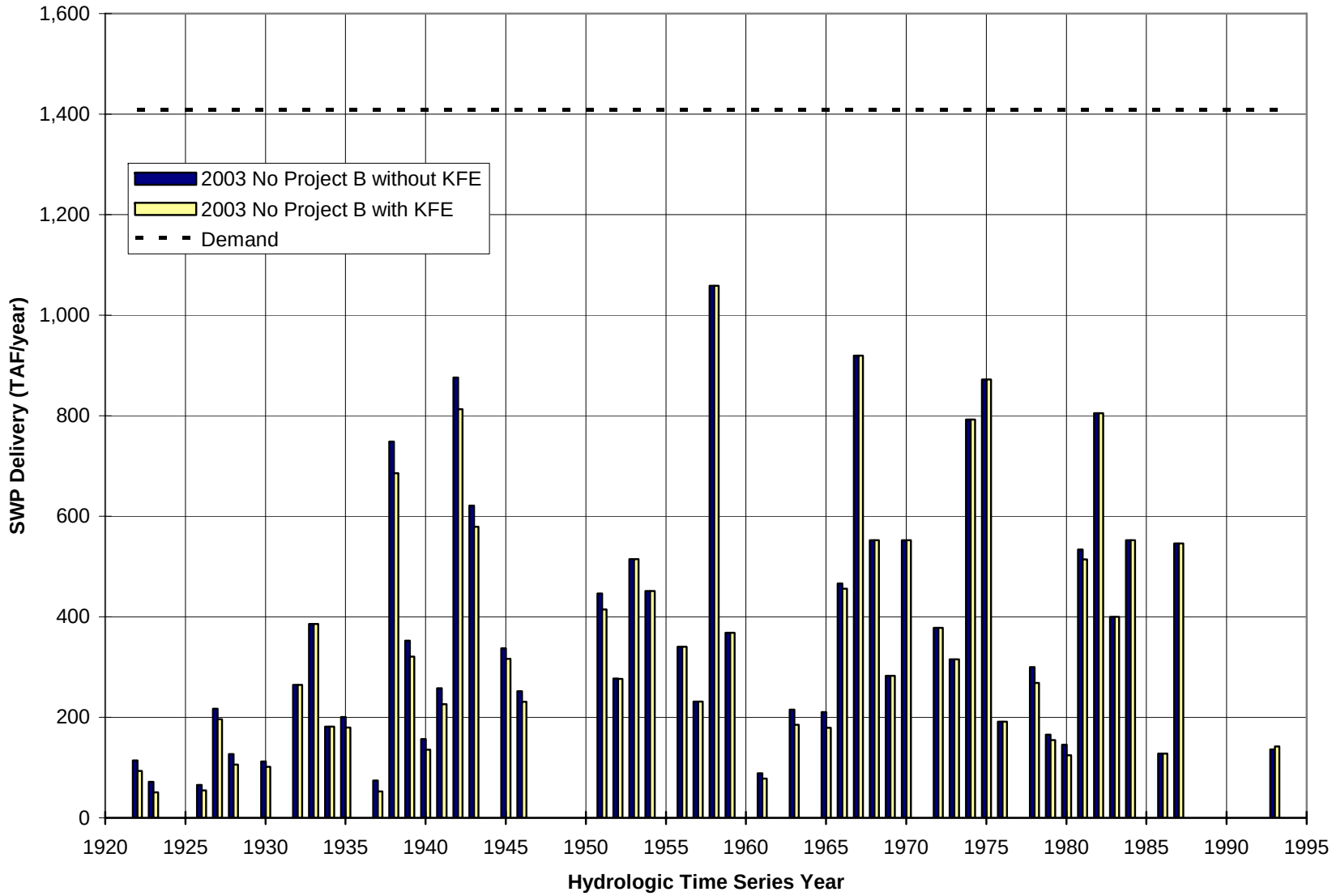


Figure 10a - Total Annual Unscheduled SWP Deliveries at the 2020 Level of Development

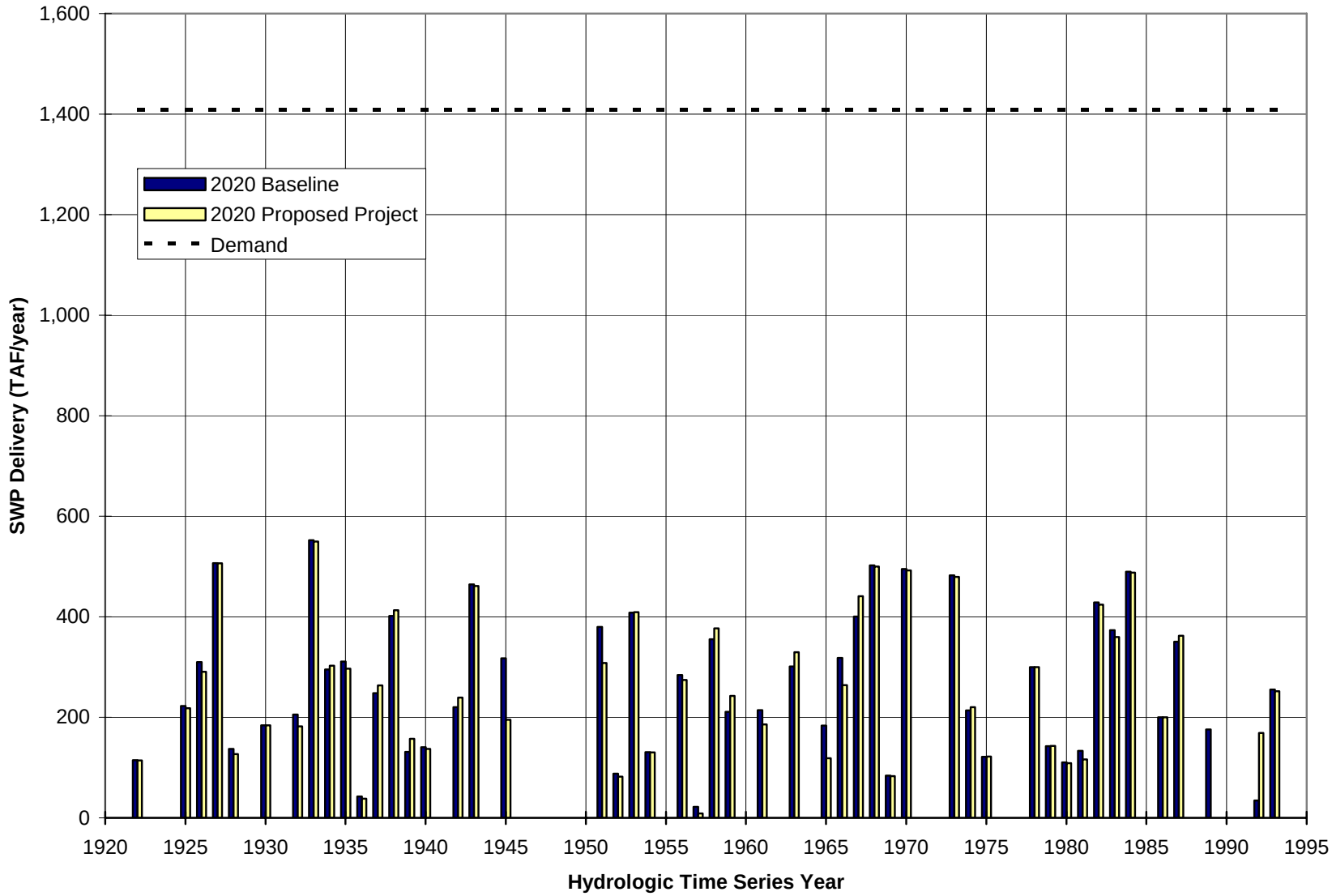


Figure 10b - Total Annual Unscheduled SWP Deliveries at the 2020 Level of Development (cont'd)

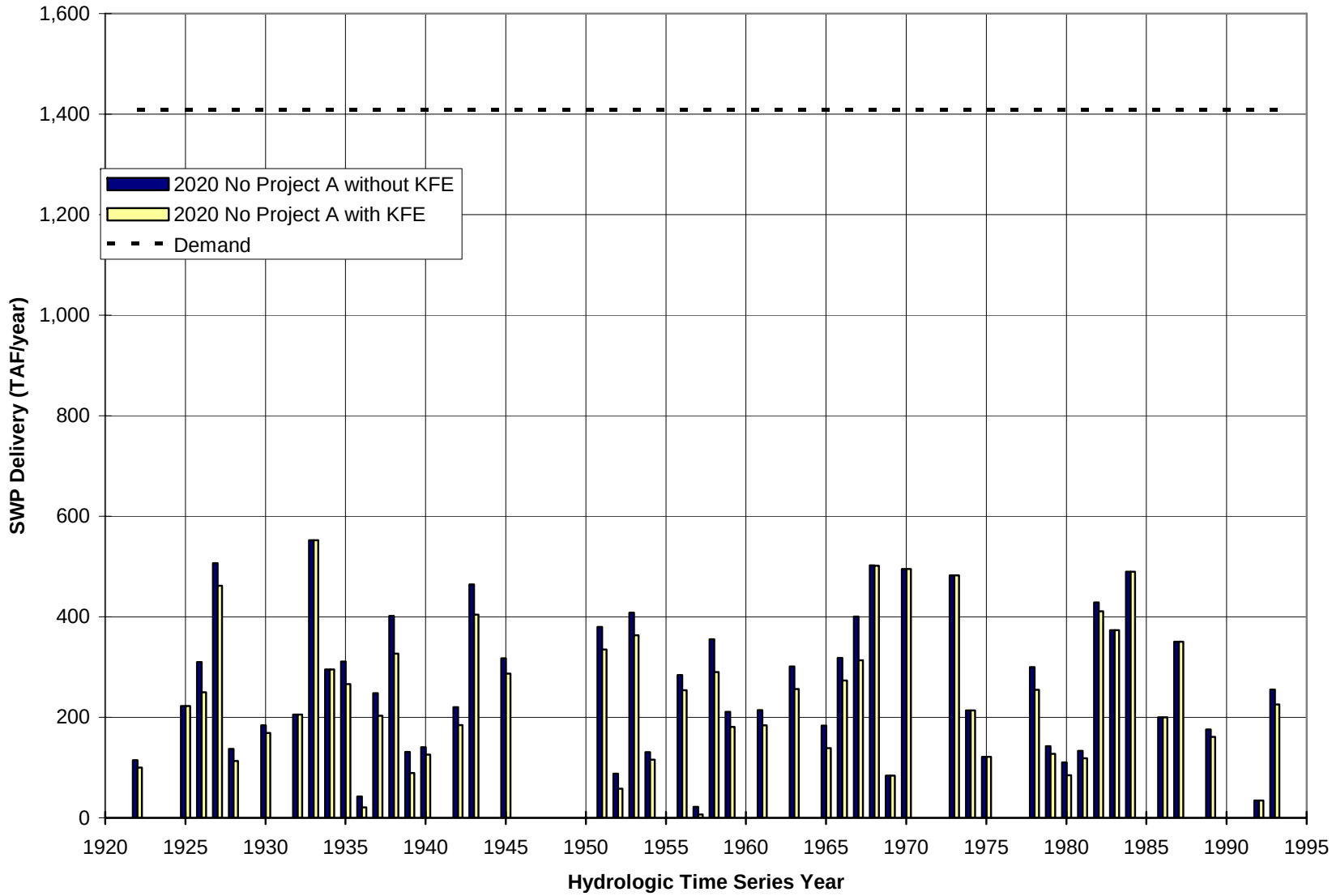


Figure 10c - Total Annual Unscheduled SWP Deliveries at the 2020 Level of Development (cont'd)

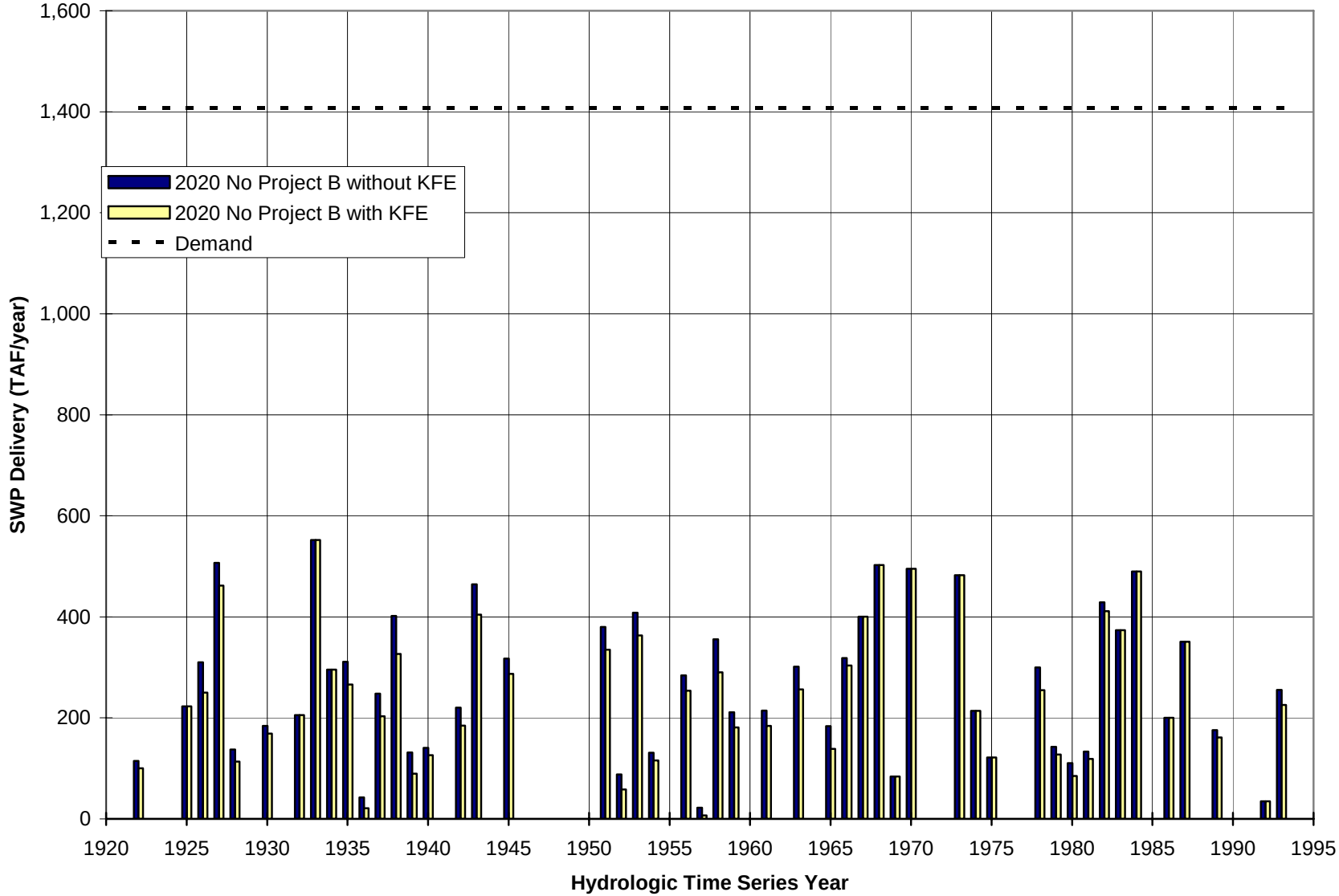


Figure 11 - Frequency of Annual Unscheduled SWP Deliveries at the 1994 Level of Development

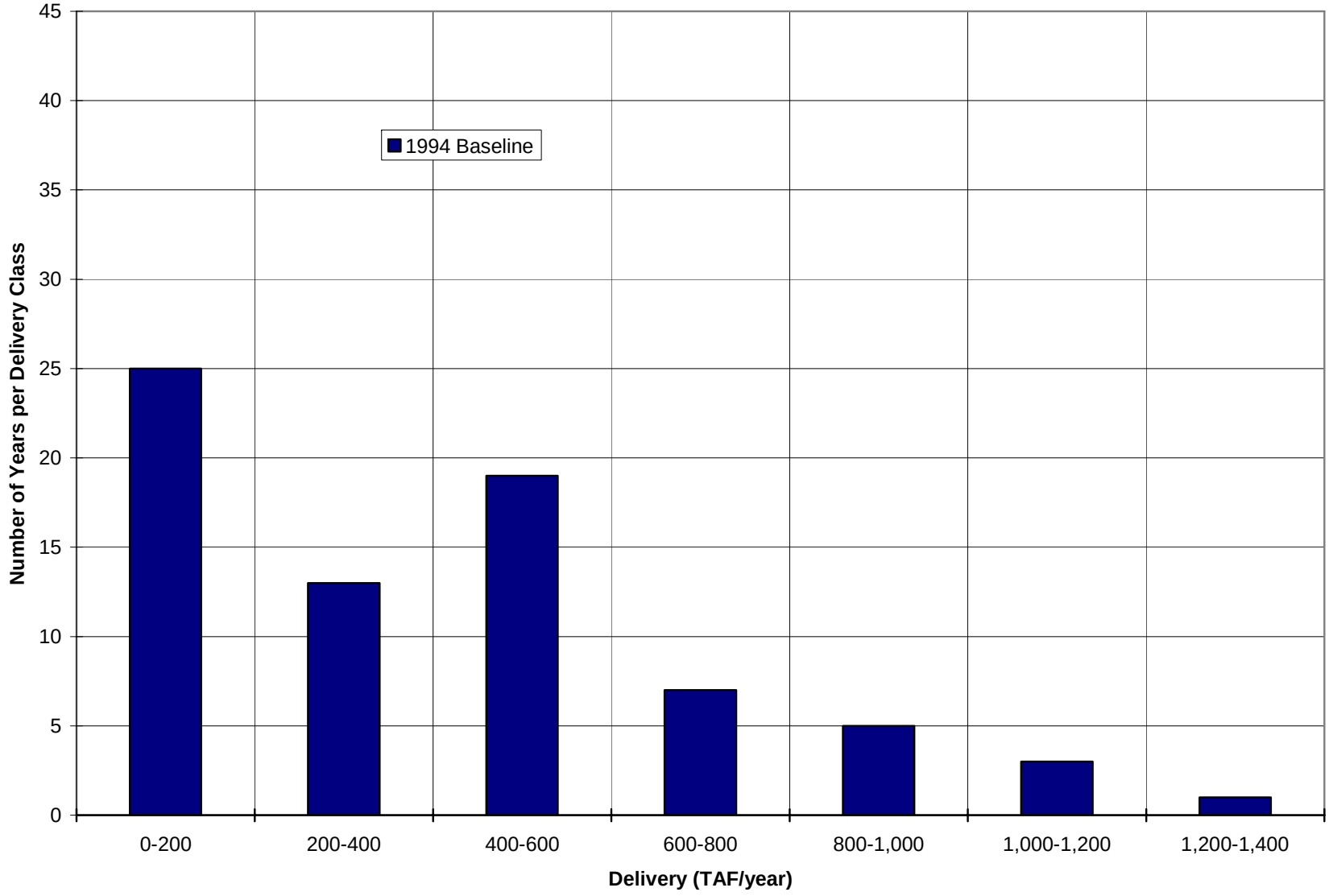


Figure 12 - Frequency of Annual Unscheduled SWP Deliveries at the 2003 Level of Development

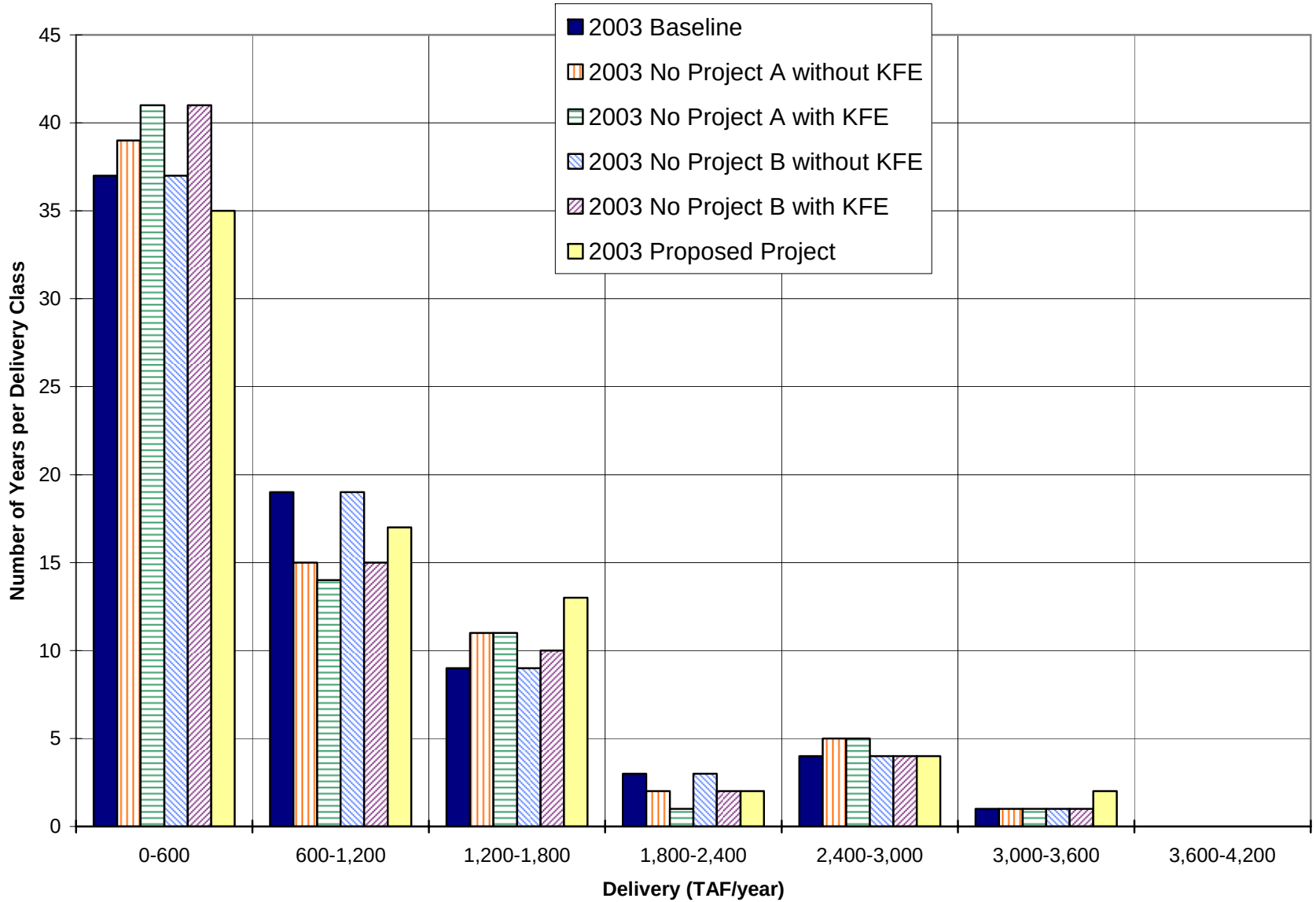
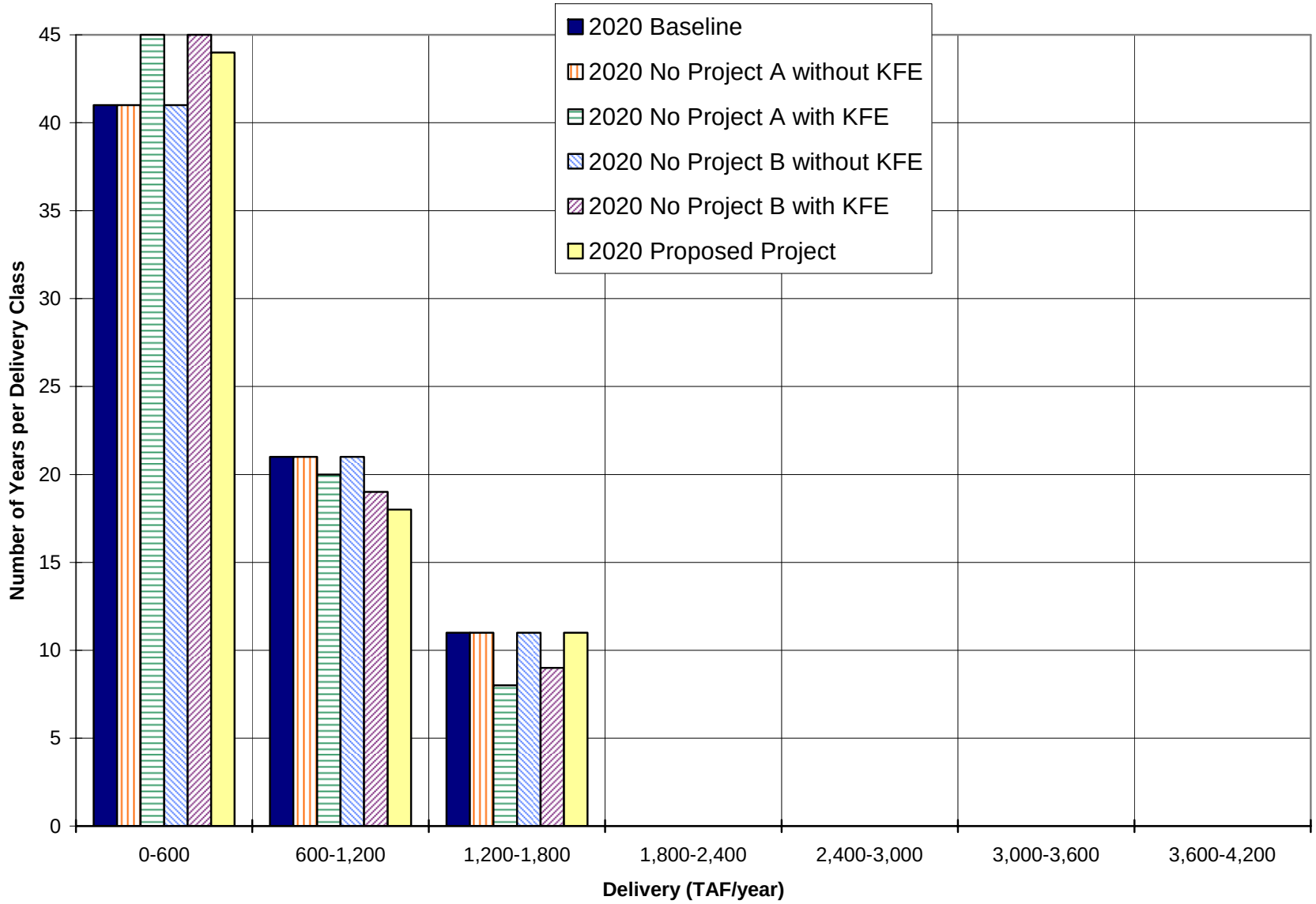


Figure 13 - Frequency of Annual Unscheduled SWP Deliveries at the 2020 Level of Development



3.1.2. SWP Deliveries to Individual Contractors

Tables 13a through 13f show average annual scheduled SWP deliveries at the 1994 and 2003 levels of development to each agricultural and M&I contractor for all years and in years categorized as wet, above normal, below normal, dry, and critical according to the Sacramento River Index. Figures 14a through 14f depict the amounts that are delivered to agricultural and M&I contractors at the 1994 and 2003 levels of development graphically. Tables 14a through 14f and Figures 15a through 15f depict the same information for the 2020 level of development. In order to fully apply the agricultural deficiency requirements in the Baseline and No Project alternatives, the data presented in these tables and figures (and in all subsequent tables and figures in this section) reflects modeled data from 1928 –1994 (i.e. the first six years are excluded from the average).

Total average annual scheduled SWP deliveries are about 2.5 million acre-feet per year in 1994, about 2.8 million acre-feet per year in each of the 2003 scenarios, and about 3.2 million acre-feet in each of the 2020 scenarios. The largest differences in total deliveries between different levels of development occur in wet and above normal years, while in dry and critical years total deliveries are similar in all scenarios. In both 2003 and 2020, agricultural contractors receive the most deliveries in No Project Alternative B-S, while M&I contractors receive the most deliveries in No Project Alternative A. These differences are much greater in 2020 than in 2003. For example, agricultural contractors receive about 60 TAF/year less deliveries in No Project Alternative A than in No Project Alternative B-S in 2003, compared to a difference of about 250 TAF/year in 2020.

Tables 15a through 15f and 16a through 16f and Figures 16a through 16f and 17a through 17f show the same information for unscheduled deliveries.

Total average annual unscheduled SWP deliveries are about 400 TAF per year in 1994, about 270-290 TAF per year in each of the 2003 scenarios, and about 160-180 TAF per year in each of the 2020 scenarios. In both 2003 and 2020, agricultural contractors receive more unscheduled water deliveries in the Baseline and No Project scenarios than in the Proposed Project scenario while M&I contractors received more in the Proposed Project scenario.

Table 13a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.7	6.4	6.5	6.5	6.4	6.4	7.2	7.2	6.4
Solano	26.6	34.2	34.2	34.4	33.3	33.4	30.4	30.5	34.3
Zone 7	25.8	40.8	57.3	57.5	38.3	38.3	36.8	36.8	59.3
Alameda	17.7	31.9	31.9	32.0	30.8	30.9	29.9	29.9	31.3
Santa Clara	78.8	76.6	76.7	76.9	74.0	74.2	71.7	71.8	75.3
Oak Flat	4.5	4.3	4.5	4.5	4.6	4.6	5.2	5.3	4.7
Kings	3.2	3.0	7.1	7.2	3.2	3.3	3.7	3.7	7.3
Dudley Ridge	45.5	43.9	48.2	48.3	46.8	46.9	53.8	53.9	46.8
Empire W.S.	2.4	2.3	2.3	2.3	2.4	2.4	2.8	2.8	2.4
KCWA (M&I)	0.0	119.4	119.5	119.8	111.9	112.2	108.1	108.4	117.8
KCWA (Agric.)	930.0	774.7	736.8	738.0	826.8	828.5	834.2	836.1	705.7
Tulare	93.4	90.1	74.6	74.7	96.2	96.4	110.4	110.6	78.6
SLO	0.0	4.3	4.3	4.3	4.2	4.3	4.2	4.3	4.2
Santa Barbara	0.0	25.2	25.2	25.3	25.1	25.2	24.5	24.6	24.9
AVEK	52.7	61.8	61.8	62.1	61.5	61.8	61.4	61.6	61.3
Castaic (Agric.)	10.0	9.7	9.9	9.9	10.3	10.3	11.8	11.9	10.4
Castaic (M&I)	14.8	36.8	36.8	36.9	34.5	34.6	33.1	33.2	61.1
Coachella	21.8	17.5	17.5	17.6	16.9	17.0	16.6	16.7	17.8
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8
Desert	35.9	28.3	28.3	28.4	27.5	27.5	27.0	27.1	27.8
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.7	13.0	13.0	13.1	13.0	13.1	13.0	13.1	13.0
MWDSC	1,062.9	1,310.0	1,311.4	1,315.5	1,268.2	1,271.9	1,250.8	1,254.4	1,284.6
Palmdale	10.1	13.5	13.5	13.5	13.0	13.0	12.5	12.5	13.5
San Bernardino	6.7	64.4	64.5	64.7	63.3	63.5	63.1	63.3	63.5
San Gabriel	15.1	16.8	16.8	16.9	16.6	16.6	16.5	16.6	16.6
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Total Agriculture	1,088.9	928.0	883.5	884.9	990.4	992.4	1,021.9	1,024.3	855.9
Total M&I	1,385.0	1,907.7	1,926.1	1,932.2	1,845.3	1,850.7	1,813.8	1,818.9	1,919.7
Total	2,473.9	2,835.7	2,809.7	2,817.2	2,835.7	2,843.2	2,835.7	2,843.2	2,775.7

Table 13b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.8	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	28.1	37.7	37.7	37.7	37.6	37.6	35.8	35.8	37.7
Zone 7	26.7	46.0	66.5	66.5	45.2	45.2	44.1	44.1	66.5
Alameda	18.0	35.2	35.2	35.2	34.9	34.9	34.3	34.3	35.2
Santa Clara	82.5	84.7	84.7	84.7	84.1	84.1	82.5	82.5	84.7
Oak Flat	5.3	5.2	5.4	5.4	5.3	5.3	5.9	5.9	5.3
Kings	3.7	3.7	8.8	8.8	3.7	3.7	4.2	4.2	8.4
Dudley Ridge	54.0	53.1	58.3	58.3	53.7	53.7	60.5	60.5	53.4
Empire W.S.	2.8	2.8	2.8	2.8	2.8	2.8	3.1	3.1	2.8
KCWA (M&I)	0.0	134.6	134.6	134.6	132.3	132.3	129.7	129.7	134.6
KCWA (Agric.)	1,087.5	936.9	885.8	885.8	948.4	948.4	935.5	935.5	805.0
Tulare	110.8	109.0	89.3	89.3	110.3	110.3	124.3	124.3	89.6
SLO	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	0.0	26.3	26.3	26.3	26.3	26.3	26.0	26.0	26.3
AVEK	53.7	64.9	64.9	64.9	64.9	64.9	64.4	64.4	64.9
Castaic (Agric.)	11.9	11.7	12.0	12.0	11.8	11.8	13.3	13.3	11.8
Castaic (M&I)	15.1	41.5	41.5	41.5	40.8	40.8	39.8	39.8	68.6
Coachella	23.1	19.3	19.3	19.3	19.2	19.2	18.9	18.9	19.3
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	38.1	31.2	31.2	31.2	31.0	31.0	30.6	30.6	31.2
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.8	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,035.5	1,272.5	1,272.5	1,272.5	1,264.0	1,264.0	1,263.3	1,263.3	1,272.5
Palmdale	10.4	14.9	14.9	14.9	14.8	14.8	14.5	14.5	14.9
San Bernardino	6.7	69.8	69.8	69.8	69.8	69.8	69.3	69.3	69.8
San Gabriel	15.5	18.1	18.1	18.1	18.1	18.1	18.0	18.0	18.1
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,276.1	1,122.3	1,062.3	1,062.3	1,136.0	1,136.0	1,146.9	1,146.9	976.3
Total M&I	1,369.7	1,928.1	1,948.5	1,948.5	1,914.2	1,914.2	1,903.4	1,903.4	1,975.7
Total	2,645.8	3,050.4	3,010.8	3,010.8	3,050.3	3,050.3	3,050.4	3,050.3	2,952.0

Table 13c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.8	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	28.1	37.7	37.7	37.7	37.7	37.7	36.6	36.6	37.7
Zone 7	26.7	46.0	66.5	66.5	45.4	45.4	44.5	44.5	66.5
Alameda	18.0	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Santa Clara	82.5	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7
Oak Flat	5.4	5.4	5.4	5.4	5.4	5.4	6.1	6.1	5.4
Kings	3.8	3.8	8.8	8.8	3.8	3.8	4.3	4.3	8.6
Dudley Ridge	54.8	54.4	59.1	59.1	54.9	54.9	62.1	62.1	54.5
Empire W.S.	2.9	2.8	2.9	2.9	2.9	2.9	3.2	3.2	2.9
KCWA (M&I)	0.0	134.6	134.6	134.6	132.9	132.9	131.1	131.1	134.6
KCWA (Agric.)	1,103.0	960.8	900.4	900.4	969.5	969.5	951.1	951.1	821.0
Tulare	112.6	111.8	91.0	91.0	112.8	112.8	127.6	127.6	91.4
SLO	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	0.0	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3
AVEK	53.7	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	12.1	12.0	12.1	12.1	12.1	12.1	13.7	13.7	12.1
Castaic (M&I)	15.1	41.5	41.5	41.5	41.0	41.0	40.1	40.1	68.6
Coachella	23.1	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	38.1	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.8	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,133.0	1,537.7	1,537.7	1,537.7	1,530.2	1,530.2	1,527.2	1,527.2	1,537.6
Palmdale	10.4	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
San Bernardino	6.7	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	15.5	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,294.7	1,150.9	1,079.7	1,079.7	1,161.3	1,161.3	1,168.1	1,168.1	995.7
Total M&I	1,467.2	2,193.3	2,213.8	2,213.8	2,182.9	2,182.9	2,176.1	2,176.1	2,240.8
Total	2,761.8	3,344.2	3,293.5	3,293.5	3,344.2	3,344.2	3,344.2	3,344.2	3,236.5

Table 13d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.8	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	28.1	37.7	37.7	37.7	37.7	37.7	34.1	34.1	37.7
Zone 7	26.7	46.0	65.1	65.1	42.6	42.6	41.1	41.1	66.5
Alameda	18.0	35.2	35.2	35.2	34.7	34.7	33.7	33.7	35.2
Santa Clara	82.5	84.7	84.7	84.7	83.2	83.2	80.8	80.8	84.7
Oak Flat	5.5	5.1	5.3	5.3	5.5	5.5	6.4	6.4	5.4
Kings	3.9	3.6	8.4	8.4	3.8	3.8	4.5	4.5	8.6
Dudley Ridge	55.7	51.7	57.2	57.2	55.2	55.2	64.9	64.9	54.5
Empire W.S.	2.9	2.7	2.8	2.8	2.9	2.9	3.4	3.4	2.9
KCWA (M&I)	0.0	134.6	134.6	134.6	124.7	124.7	120.9	120.9	134.6
KCWA (Agric.)	1,117.8	912.7	876.5	876.5	975.0	975.0	989.6	989.6	821.8
Tulare	114.4	106.2	89.1	89.1	113.4	113.4	133.4	133.4	91.5
SLO	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	0.0	26.3	26.3	26.3	26.3	26.3	26.2	26.2	26.3
AVEK	53.7	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	12.3	11.4	11.8	11.8	12.2	12.2	14.3	14.3	12.1
Castaic (M&I)	15.1	41.5	41.5	41.5	38.5	38.5	37.0	37.0	68.6
Coachella	23.1	19.3	19.3	19.3	19.0	19.0	18.9	18.9	19.3
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	38.1	31.2	31.2	31.2	30.9	30.9	30.5	30.5	31.2
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.8	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,083.0	1,606.5	1,606.5	1,606.5	1,551.1	1,551.1	1,516.6	1,516.6	1,592.1
Palmdale	10.4	14.9	14.9	14.9	14.6	14.6	14.1	14.1	14.9
San Bernardino	6.7	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	15.5	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,312.4	1,093.3	1,051.0	1,051.0	1,167.9	1,167.9	1,216.5	1,216.5	996.7
Total M&I	1,417.2	2,262.1	2,281.2	2,281.2	2,187.5	2,187.5	2,138.9	2,138.9	2,295.3
Total	2,729.6	3,355.4	3,332.2	3,332.2	3,355.4	3,355.4	3,355.4	3,355.4	3,292.1

Table 13e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.8	6.8	6.8	6.8	6.6	6.6	7.5	7.5	6.7
Solano	28.1	36.5	36.7	36.8	32.5	32.6	27.4	27.4	35.7
Zone 7	26.7	41.8	55.7	55.8	35.7	35.7	32.8	32.9	60.2
Alameda	18.0	33.7	33.9	34.0	29.9	29.9	27.8	27.8	31.8
Santa Clara	82.5	80.9	81.3	81.6	71.6	71.7	66.5	66.5	76.3
Oak Flat	4.6	3.8	3.9	3.9	4.6	4.6	5.1	5.2	4.5
Kings	3.2	2.7	6.1	6.1	3.2	3.2	3.8	3.8	7.1
Dudley Ridge	46.2	38.4	41.7	41.8	46.6	46.8	54.5	54.7	45.4
Empire W.S.	2.4	2.0	2.0	2.0	2.4	2.4	2.8	2.8	2.4
KCWA (M&I)	0.0	122.4	122.3	122.7	104.3	104.5	96.5	96.5	116.5
KCWA (Agric.)	949.8	678.3	640.0	641.6	823.6	826.3	863.1	867.0	684.3
Tulare	94.8	78.9	65.1	65.3	95.8	96.1	111.8	112.3	76.2
SLO	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	0.0	26.3	26.3	26.3	26.1	26.1	23.9	23.9	26.0
AVEK	53.7	64.9	64.9	64.9	63.9	64.0	63.8	63.9	64.0
Castaic (Agric.)	10.2	8.5	8.6	8.6	10.3	10.3	12.0	12.0	10.1
Castaic (M&I)	15.1	37.7	37.7	37.8	32.2	32.2	29.6	29.6	62.0
Coachella	23.1	18.5	18.6	18.6	16.4	16.4	15.8	15.8	18.6
Crestline	0.5	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	38.1	30.0	30.1	30.2	26.8	26.8	25.7	25.7	28.3
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.8	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,243.7	1,365.1	1,367.6	1,370.8	1,252.4	1,254.9	1,215.7	1,217.2	1,286.5
Palmdale	10.4	14.2	14.3	14.3	12.5	12.5	11.5	11.5	14.0
San Bernardino	6.7	68.9	69.1	69.1	63.8	63.9	63.6	63.7	66.0
San Gabriel	15.5	18.0	18.0	18.0	16.9	17.0	16.9	16.9	17.3
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,111.1	812.5	767.4	769.3	986.6	989.8	1,053.1	1,057.8	830.0
Total M&I	1,577.9	1,990.2	2,007.8	2,012.5	1,816.1	1,819.5	1,749.6	1,751.5	1,934.5
Total	2,689.0	2,802.7	2,775.2	2,781.8	2,802.7	2,809.3	2,802.7	2,809.3	2,764.5

Table 13f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	4.0	4.5	4.7	4.9	4.5	4.6	5.5	5.6	4.4
Solano	19.1	18.0	17.9	18.4	17.8	18.3	15.1	15.6	19.3
Zone 7	21.2	19.7	26.1	26.7	17.9	18.4	17.0	17.5	30.5
Alameda	15.9	16.8	16.9	17.3	16.3	16.8	15.5	16.0	16.0
Santa Clara	60.1	40.1	40.3	41.5	38.9	40.0	37.0	38.1	38.3
Oak Flat	0.9	1.6	1.7	1.8	1.8	1.8	2.0	2.1	2.1
Kings	0.7	1.1	2.7	2.8	1.2	1.3	1.4	1.5	3.3
Dudley Ridge	9.4	16.3	18.9	19.2	18.0	18.4	20.5	20.9	21.3
Empire W.S.	0.5	0.8	0.9	0.9	0.9	1.0	1.1	1.1	1.1
KCWA (M&I)	0.0	57.7	58.0	59.5	52.4	53.8	49.8	51.2	55.3
KCWA (Agric.)	254.6	287.2	290.1	295.2	317.9	324.9	333.7	340.7	321.0
Tulare	19.4	33.4	29.5	30.1	37.0	37.8	42.2	43.0	35.7
SLO	0.0	3.5	3.5	3.6	3.5	3.6	3.5	3.6	3.3
Santa Barbara	0.0	19.5	19.6	20.3	19.3	19.9	18.8	19.4	18.4
AVEK	47.7	46.0	46.3	47.9	45.5	46.9	45.6	47.0	44.2
Castaic (Agric.)	2.1	3.6	3.9	4.0	4.0	4.1	4.5	4.6	4.7
Castaic (M&I)	13.5	17.8	17.9	18.4	16.1	16.6	15.3	15.7	31.4
Coachella	15.1	9.2	9.3	9.5	9.0	9.2	8.8	9.1	11.1
Crestline	0.5	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6
Desert	24.8	15.1	15.2	15.6	14.8	15.2	14.5	14.9	14.4
Littlerock	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	9.2	12.2	12.2	12.4	12.1	12.3	12.1	12.3	12.3
MWDSC	801.4	771.2	776.4	797.6	747.3	766.9	732.6	752.3	733.9
Palmdale	8.7	7.0	7.0	7.2	6.7	6.9	6.4	6.6	7.6
San Bernardino	6.7	38.0	38.3	39.4	37.7	38.7	37.7	38.8	36.2
San Gabriel	13.3	10.4	10.5	10.8	10.3	10.6	10.3	10.6	9.9
San Gorgonio	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	0.6	4.6	4.6	4.7	4.6	4.7	4.6	4.7	4.6
Total Agriculture	287.6	344.1	347.8	354.0	380.8	389.2	405.4	413.8	389.3
Total M&I	1,062.3	1,113.3	1,126.5	1,157.6	1,076.5	1,105.2	1,052.0	1,080.7	1,092.6
Total	1,349.9	1,457.3	1,474.3	1,511.6	1,457.3	1,494.4	1,457.4	1,494.5	1,481.9

Figure 14a - Average Annual Scheduled SWP Deliveries in the 1994 and 2003 Scenarios

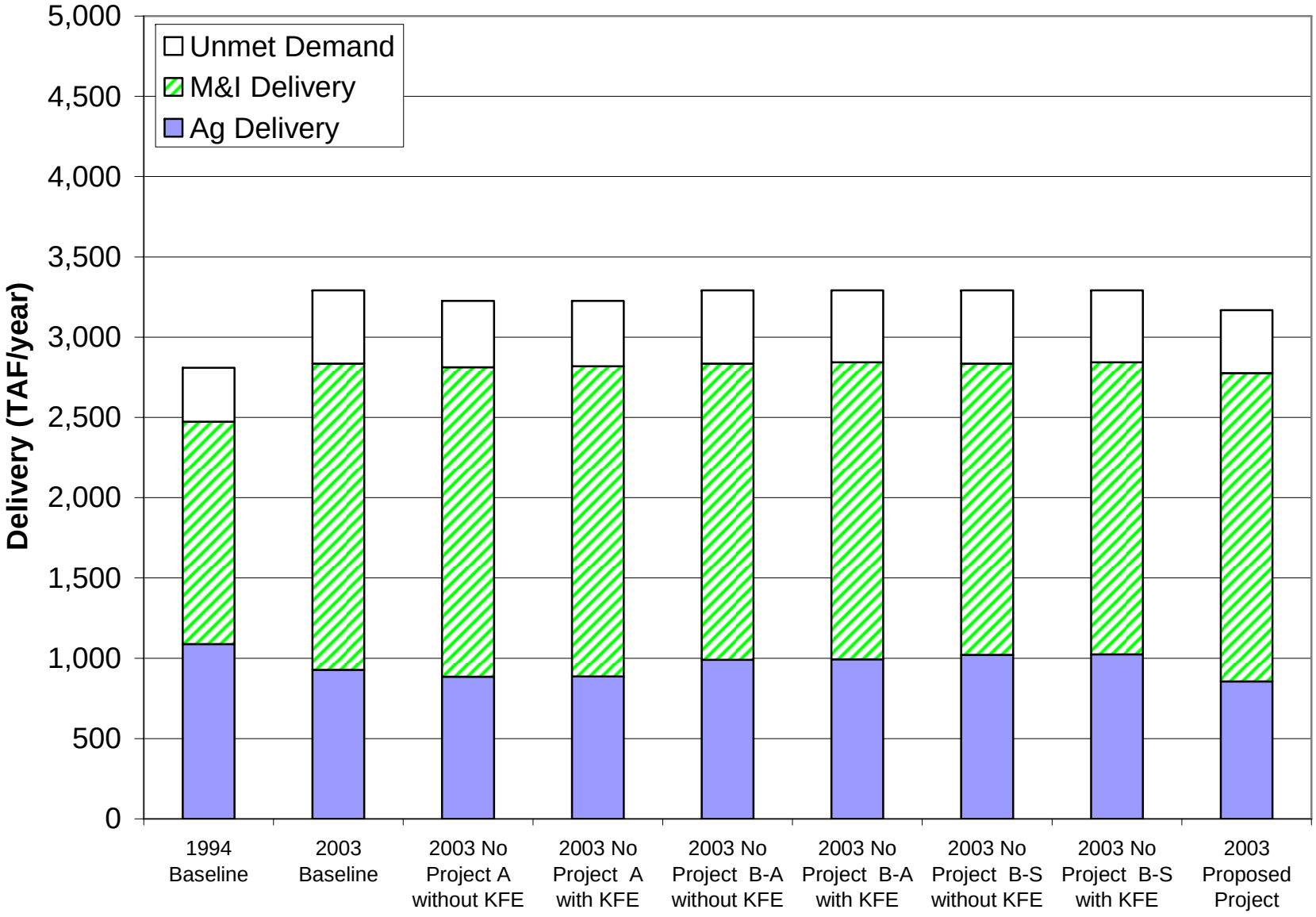


Figure 14b - Average Annual Scheduled SWP Deliveries in Wet Years in the 1994 and 2003 Scenarios

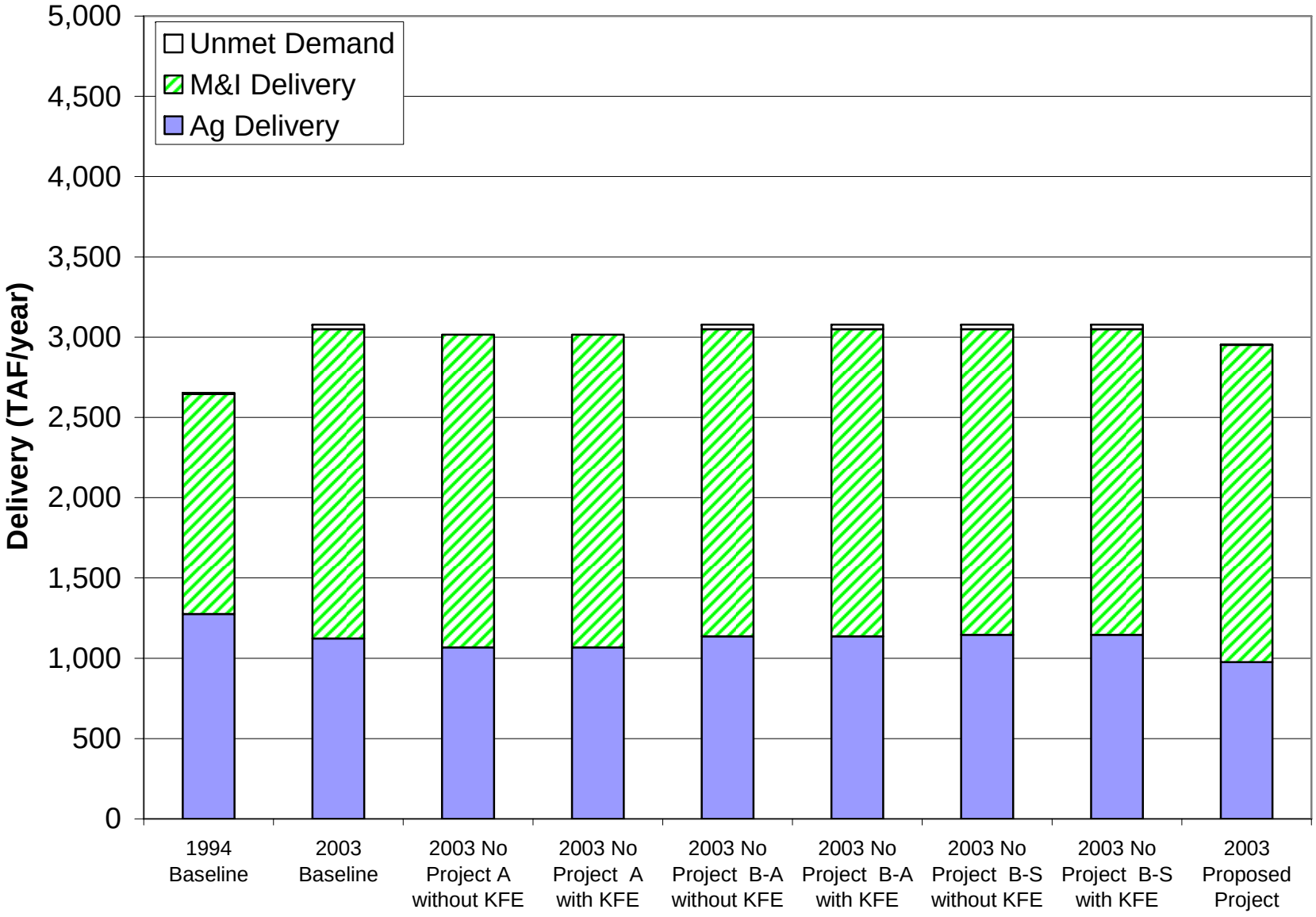


Figure 14c - Average Annual Scheduled SWP Deliveries in Above Normal Years in the 1994 and 2003 Scenarios

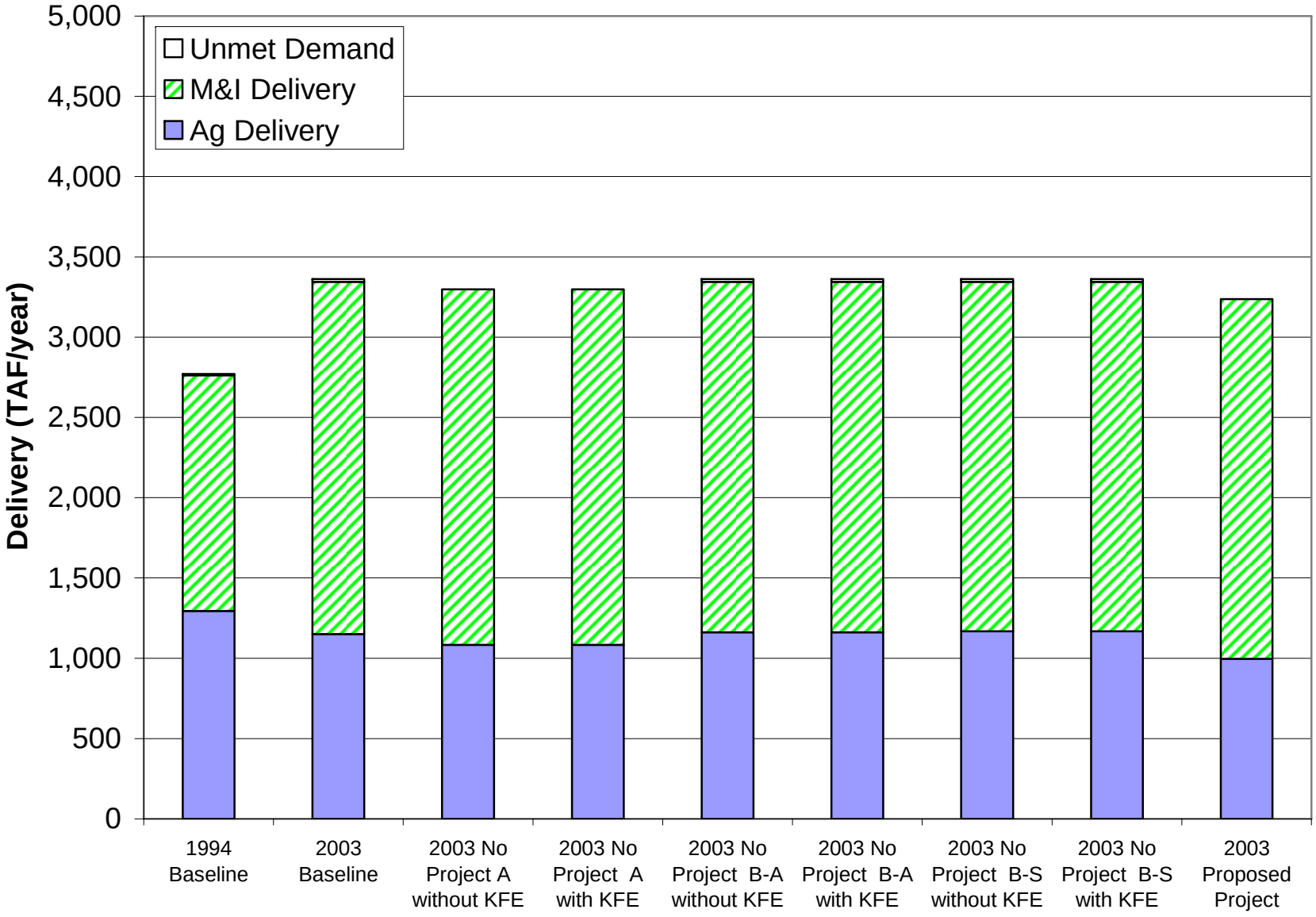


Figure 14d - Average Annual Scheduled SWP Deliveries in Below Normal Years in the 1994 and 2003 Scenarios

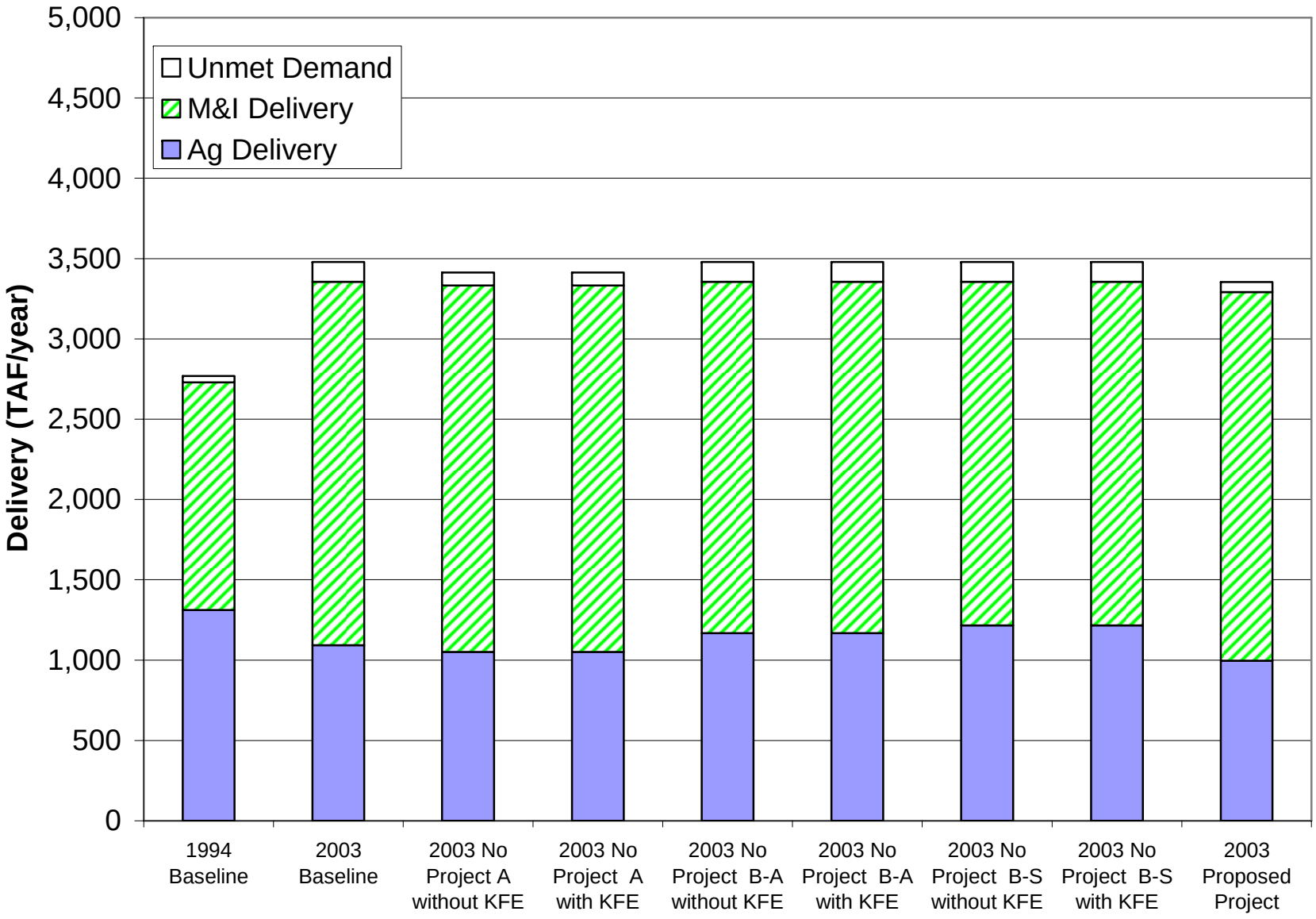


Figure 14e - Average Annual Scheduled SWP Deliveries in Dry Years in the 1994 and 2003 Scenarios

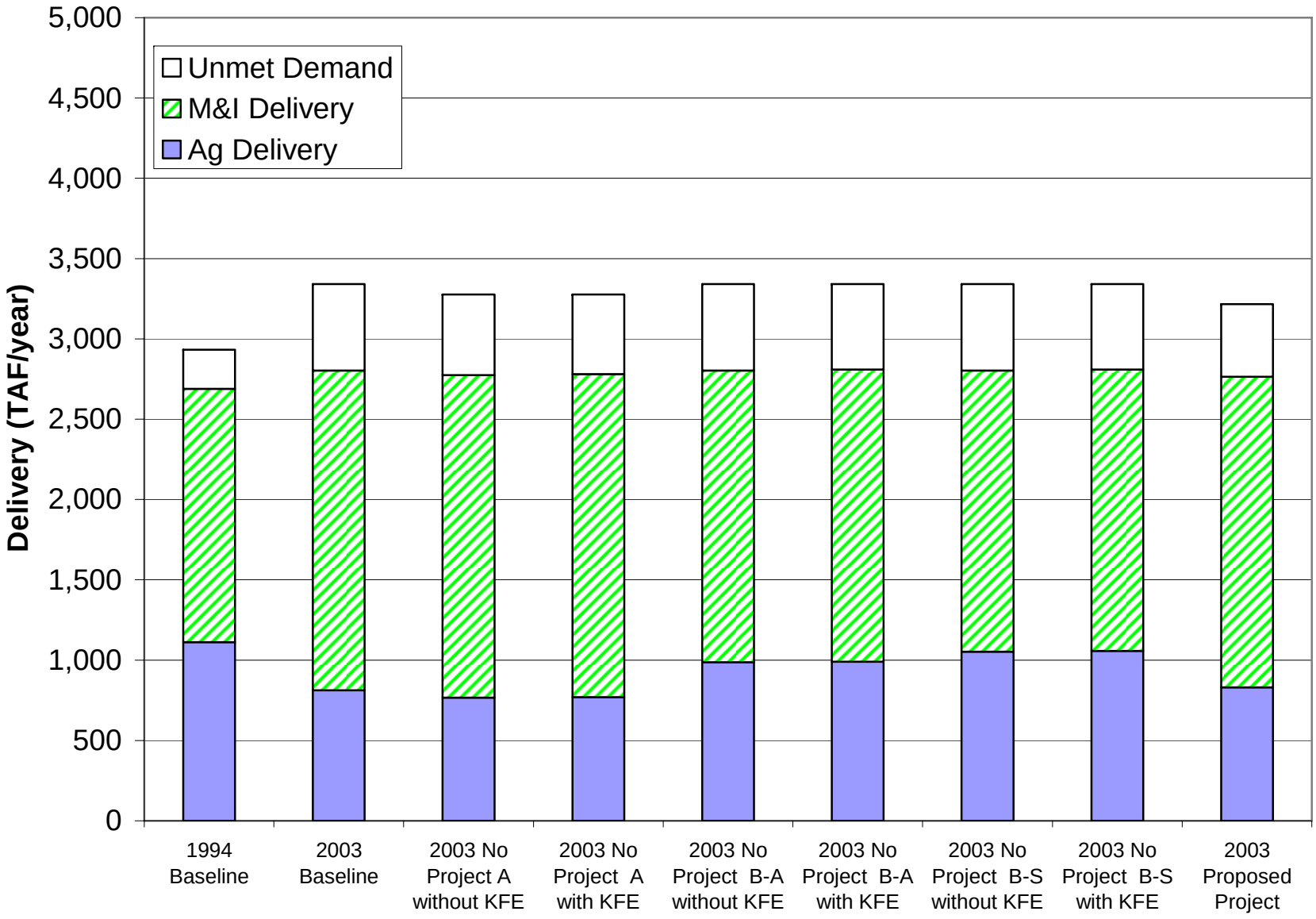


Figure 14f - Average Annual Scheduled SWP Deliveries in Critical Years in the 1994 and 2003 Scenarios

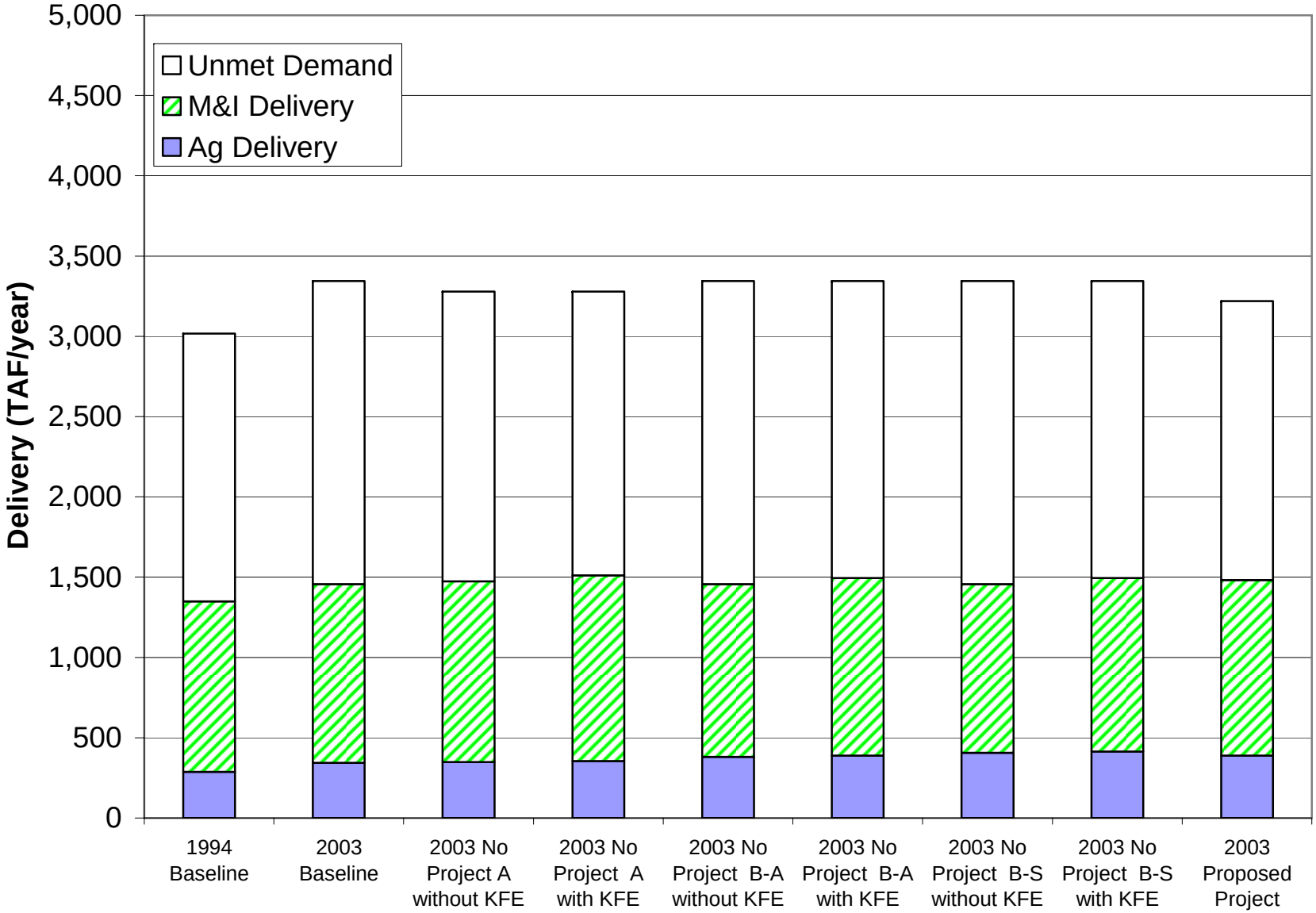


Table 14a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	20.3	23.1	23.2	19.6	19.7	18.0	18.0	22.8
Solano	34.3	38.2	38.4	33.1	33.2	30.0	30.1	37.6
Zone 7	37.6	61.2	61.5	36.2	36.4	32.9	33.1	63.5
Alameda	34.3	34.3	34.5	33.1	33.2	30.3	30.4	33.1
Santa Clara	81.7	81.7	82.1	78.8	79.0	72.2	72.4	78.7
Oak Flat	3.9	3.9	3.9	4.3	4.3	4.7	4.7	4.4
Kings	2.7	6.1	6.2	3.0	3.0	3.3	3.3	6.9
Dudley Ridge	39.3	42.0	42.2	43.4	43.7	47.8	48.0	44.1
Empire W.S.	2.0	2.0	2.1	2.3	2.3	2.5	2.5	2.3
KCWA (M&I)	110.0	110.0	110.5	106.0	106.4	96.2	96.5	106.0
KCWA (Agric.)	694.1	633.5	636.6	767.0	771.4	843.7	848.2	652.0
Tulare	80.7	65.6	65.9	89.2	89.7	98.1	98.7	74.0
SLO	20.4	20.4	20.5	19.7	19.8	17.9	17.9	19.7
Santa Barbara	37.2	37.2	37.3	35.8	35.9	32.5	32.6	35.8
AVEK	113.1	115.1	115.6	109.0	109.4	108.3	108.7	111.3
Castaic (Agric.)	8.7	8.7	8.7	9.6	9.6	10.5	10.6	9.8
Castaic (M&I)	33.9	33.9	34.1	32.7	32.8	29.7	29.8	65.0
Coachella	90.9	105.8	106.3	87.6	87.9	87.0	87.3	104.8
Crestline	4.7	4.7	4.8	4.6	4.6	4.1	4.2	4.6
Desert	40.9	43.6	43.8	39.4	39.5	39.1	39.3	42.5
Littlerock	1.9	1.9	1.9	1.8	1.8	1.7	1.7	1.8
Mojave	41.5	58.5	58.8	40.0	40.1	43.2	43.3	59.7
MWDSC	1,562.0	1,562.0	1,568.8	1,505.6	1,510.6	1,443.8	1,448.7	1,505.1
Palmdale	14.1	16.9	16.9	13.6	13.7	12.4	12.4	16.8
San Bernardino	83.8	83.8	84.2	80.8	81.1	87.3	87.5	80.8
San Gabriel	23.5	23.5	23.6	22.7	22.8	24.5	24.6	22.7
San Gorgonio	14.1	14.1	14.2	13.6	13.7	12.4	12.4	13.6
Ventura	16.3	16.3	16.4	15.8	15.8	14.3	14.3	15.7
Total Agriculture	831.4	761.7	765.5	918.8	924.0	1,010.6	1,016.0	793.5
Total M&I	2,416.8	2,486.5	2,497.3	2,329.5	2,337.2	2,237.6	2,245.2	2,441.6
Total	3,248.2	3,248.2	3,262.8	3,248.2	3,261.2	3,248.2	3,261.2	3,235.0

Table 14b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	24.3	28.0	28.0	24.2	24.2	23.7	23.7	28.1
Solano	41.1	46.3	46.3	40.8	40.8	39.9	39.9	46.4
Zone 7	45.0	76.6	76.6	44.7	44.7	43.7	43.7	78.3
Alameda	41.1	41.1	41.1	40.8	40.8	40.0	40.0	40.8
Santa Clara	97.7	97.7	97.7	97.1	97.1	95.2	95.2	97.2
Oak Flat	5.2	5.2	5.2	5.3	5.3	5.4	5.4	5.3
Kings	3.7	8.2	8.2	3.7	3.7	3.8	3.8	8.3
Dudley Ridge	52.8	56.4	56.4	53.6	53.6	54.9	54.9	53.1
Empire W.S.	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.8
KCWA (M&I)	131.6	131.6	131.6	130.8	130.8	127.9	127.9	130.8
KCWA (Agric.)	932.2	850.7	850.7	946.9	946.9	969.7	969.7	785.4
Tulare	108.4	88.0	88.0	110.1	110.1	112.8	112.8	89.1
SLO	24.4	24.4	24.4	24.3	24.3	23.7	23.7	24.3
Santa Barbara	44.5	44.5	44.5	44.2	44.2	43.2	43.2	44.2
AVEK	135.3	138.0	138.0	134.5	134.5	134.2	134.2	137.4
Castaic (Agric.)	11.6	11.6	11.6	11.8	11.8	12.1	12.1	11.8
Castaic (M&I)	40.6	40.6	40.6	40.3	40.3	39.4	39.4	80.2
Coachella	108.7	128.7	128.7	108.0	108.0	107.8	107.8	129.3
Crestline	5.7	5.7	5.7	5.6	5.6	5.5	5.5	5.6
Desert	48.9	52.5	52.5	48.6	48.6	48.5	48.5	52.5
Littlerock	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Mojave	49.7	72.5	72.5	49.4	49.4	50.3	50.3	73.7
MWDSC	1,868.4	1,868.4	1,868.4	1,857.0	1,857.0	1,838.7	1,838.7	1,857.3
Palmdale	16.9	20.6	20.6	16.8	16.8	16.4	16.4	20.7
San Bernardino	100.3	100.3	100.3	99.7	99.7	101.5	101.5	99.7
San Gabriel	28.2	28.2	28.2	28.0	28.0	28.5	28.5	28.0
San Gorgonio	16.9	16.9	16.9	16.8	16.8	16.4	16.4	16.8
Ventura	19.5	19.5	19.5	19.4	19.4	19.0	19.0	19.4
Total Agriculture	1,116.6	1,023.0	1,023.0	1,134.2	1,134.2	1,161.5	1,161.5	955.8
Total M&I	2,890.8	2,984.4	2,984.4	2,873.2	2,873.2	2,845.9	2,845.9	3,012.9
Total	4,007.4	4,007.4	4,007.4	4,007.4	4,007.4	4,007.4	4,007.4	3,968.7

Table 14c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	24.1	27.7	27.7	23.8	23.8	22.9	22.9	27.8
Solano	40.7	45.8	45.8	40.2	40.2	38.4	38.4	45.9
Zone 7	44.6	75.3	75.3	44.0	44.0	42.1	42.1	77.4
Alameda	40.7	40.7	40.7	40.2	40.2	38.6	38.6	40.3
Santa Clara	97.0	97.0	97.0	95.7	95.7	91.8	91.8	96.0
Oak Flat	5.1	5.1	5.1	5.2	5.2	5.5	5.5	5.3
Kings	3.5	8.0	8.0	3.7	3.7	3.8	3.8	8.3
Dudley Ridge	51.2	54.7	54.7	53.0	53.0	55.2	55.2	52.9
Empire W.S.	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.8
KCWA (M&I)	130.5	130.5	130.5	128.7	128.7	123.0	123.0	129.3
KCWA (Agric.)	903.2	824.3	824.3	935.6	935.6	975.1	975.1	783.0
Tulare	105.1	85.3	85.3	108.8	108.8	113.4	113.4	88.8
SLO	24.2	24.2	24.2	23.9	23.9	22.8	22.8	24.0
Santa Barbara	44.1	44.1	44.1	43.5	43.5	41.6	41.6	43.7
AVEK	134.2	136.9	136.9	132.4	132.4	132.4	132.4	135.8
Castaic (Agric.)	11.3	11.3	11.3	11.7	11.7	12.2	12.2	11.7
Castaic (M&I)	40.2	40.2	40.2	39.7	39.7	37.9	37.9	79.2
Coachella	107.8	127.2	127.2	106.4	106.4	106.4	106.4	127.8
Crestline	5.6	5.6	5.6	5.5	5.5	5.3	5.3	5.6
Desert	48.5	52.0	52.0	47.8	47.8	47.8	47.8	51.9
Littlerock	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.2
Mojave	49.3	71.4	71.4	48.6	48.6	50.8	50.8	72.8
MWDSC	1,853.5	1,853.5	1,853.5	1,828.4	1,828.4	1,796.3	1,796.3	1,835.6
Palmdale	16.8	20.3	20.3	16.5	16.5	15.8	15.8	20.5
San Bernardino	99.5	99.5	99.5	98.1	98.1	102.6	102.6	98.5
San Gabriel	27.9	27.9	27.9	27.5	27.5	28.8	28.8	27.7
San Gorgonio	16.8	16.8	16.8	16.5	16.5	15.8	15.8	16.6
Ventura	19.4	19.4	19.4	19.1	19.1	18.3	18.3	19.2
Total Agriculture	1,082.0	991.3	991.3	1,120.8	1,120.8	1,168.1	1,168.1	952.9
Total M&I	2,867.7	2,958.4	2,958.4	2,828.9	2,828.9	2,781.6	2,781.6	2,977.7
Total	3,949.7	3,949.7	3,949.7	3,949.7	3,949.7	3,949.7	3,949.7	3,930.6

Table 14d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	22.9	26.0	26.0	21.8	21.8	18.8	18.8	25.5
Solano	38.6	42.9	42.9	36.7	36.7	31.2	31.2	42.2
Zone 7	42.2	68.8	68.8	40.2	40.2	34.3	34.3	71.2
Alameda	38.6	38.6	38.6	36.7	36.7	31.7	31.7	37.1
Santa Clara	91.8	91.8	91.8	87.4	87.4	75.6	75.6	88.3
Oak Flat	4.4	4.4	4.4	5.0	5.0	5.7	5.7	5.0
Kings	3.1	6.9	6.9	3.5	3.5	4.0	4.0	7.9
Dudley Ridge	44.3	47.3	47.3	50.4	50.4	57.7	57.7	50.6
Empire W.S.	2.3	2.3	2.3	2.6	2.6	3.0	3.0	2.6
KCWA (M&I)	123.6	123.6	123.6	117.7	117.7	100.0	100.0	118.9
KCWA (Agric.)	781.6	713.3	713.3	890.6	890.6	1,018.8	1,018.8	748.9
Tulare	90.9	73.8	73.8	103.6	103.6	118.5	118.5	85.0
SLO	23.0	23.0	23.0	21.9	21.9	18.6	18.6	22.1
Santa Barbara	41.8	41.8	41.8	39.8	39.8	33.8	33.8	40.2
AVEK	127.1	129.4	129.4	121.0	121.0	120.6	120.6	124.9
Castaic (Agric.)	9.7	9.7	9.7	11.1	11.1	12.7	12.7	11.2
Castaic (M&I)	38.1	38.1	38.1	36.3	36.3	30.8	30.8	72.8
Coachella	102.1	118.9	118.9	97.2	97.2	96.9	96.9	117.5
Crestline	5.3	5.3	5.3	5.1	5.1	4.3	4.3	5.1
Desert	45.9	49.0	49.0	43.7	43.7	43.6	43.6	47.7
Littlerock	2.1	2.1	2.1	2.0	2.0	1.7	1.7	2.0
Mojave	46.6	65.8	65.8	44.4	44.4	50.8	50.8	66.9
MWDSC	1,755.3	1,755.3	1,755.3	1,670.9	1,670.9	1,567.2	1,567.2	1,687.8
Palmdale	15.9	19.0	19.0	15.1	15.1	12.8	12.8	18.8
San Bernardino	94.2	94.2	94.2	89.7	89.7	102.6	102.6	90.6
San Gabriel	26.4	26.4	26.4	25.2	25.2	28.8	28.8	25.4
San Gorgonio	15.9	15.9	15.9	15.1	15.1	12.8	12.8	15.3
Ventura	18.4	18.4	18.4	17.5	17.5	14.9	14.9	17.7
Total Agriculture	936.2	857.7	857.7	1,066.8	1,066.8	1,220.4	1,220.4	911.3
Total M&I	2,715.9	2,794.3	2,794.3	2,585.3	2,585.3	2,431.7	2,431.7	2,738.0
Total	3,652.1	3,652.1	3,652.1	3,652.1	3,652.1	3,652.1	3,652.1	3,649.3

Table 14e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	18.1	20.2	20.3	16.6	16.6	13.5	13.5	19.3
Solano	30.5	33.3	33.6	27.9	28.0	22.2	22.2	31.8
Zone 7	33.4	50.6	51.0	30.6	30.6	24.4	24.4	53.7
Alameda	30.5	30.5	30.8	27.9	28.0	22.8	22.8	28.0
Santa Clara	72.7	72.7	73.3	66.5	66.6	54.2	54.2	66.6
Oak Flat	2.8	2.8	2.9	3.7	3.7	4.4	4.5	3.8
Kings	2.0	4.5	4.5	2.6	2.6	3.2	3.2	6.0
Dudley Ridge	28.5	30.5	30.9	37.1	37.9	45.9	46.7	38.2
Empire W.S.	1.5	1.5	1.5	1.9	2.0	2.4	2.4	2.0
KCWA (M&I)	97.8	97.8	98.6	89.5	89.6	71.2	71.2	89.7
KCWA (Agric.)	503.8	459.7	465.2	655.9	668.6	811.3	824.9	564.9
Tulare	58.6	47.6	48.1	76.3	77.8	94.4	95.9	64.1
SLO	18.2	18.2	18.3	16.6	16.6	13.2	13.2	16.7
Santa Barbara	33.1	33.1	33.3	30.3	30.3	24.1	24.1	30.3
AVEK	100.6	102.1	102.9	92.1	92.1	89.6	89.7	94.2
Castaic (Agric.)	6.3	6.3	6.4	8.2	8.3	10.1	10.3	8.5
Castaic (M&I)	30.2	30.2	30.4	27.6	27.6	21.9	21.9	55.0
Coachella	80.8	91.6	92.4	74.0	74.0	72.0	72.0	88.7
Crestline	4.2	4.2	4.2	3.9	3.9	3.1	3.1	3.9
Desert	36.3	38.3	38.6	33.3	33.3	32.4	32.4	36.0
Littlerock	1.7	1.7	1.7	1.5	1.5	1.2	1.2	1.5
Mojave	36.9	49.3	49.7	33.8	33.8	38.9	39.0	50.5
MWDSC	1,389.3	1,389.3	1,400.5	1,271.5	1,272.6	1,146.9	1,147.4	1,273.2
Palmdale	12.6	14.6	14.7	11.5	11.5	9.1	9.1	14.2
San Bernardino	74.6	74.6	75.2	68.2	68.3	78.6	78.7	68.3
San Gabriel	20.9	20.9	21.1	19.2	19.2	22.1	22.1	19.2
San Gorgonio	12.6	12.6	12.7	11.5	11.5	9.1	9.1	11.5
Ventura	14.5	14.5	14.7	13.3	13.3	10.6	10.6	13.3
Total Agriculture	603.4	552.9	559.4	785.7	801.0	971.8	988.0	687.5
Total M&I	2,149.5	2,200.1	2,218.1	1,967.3	1,968.9	1,781.2	1,781.9	2,065.4
Total	2,753.0	2,753.0	2,777.5	2,753.0	2,769.9	2,753.0	2,769.9	2,752.8

Table 14f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	9.9	10.8	11.2	9.2	9.6	8.2	8.6	10.2
Solano	16.7	17.9	18.6	15.5	16.1	13.7	14.4	16.8
Zone 7	18.2	26.0	27.1	17.0	17.7	15.1	15.8	28.4
Alameda	16.7	16.7	17.2	15.5	16.1	13.9	14.5	14.8
Santa Clara	39.7	39.7	41.1	36.9	38.4	33.1	34.6	35.2
Oak Flat	1.3	1.3	1.4	1.7	1.7	1.9	2.0	2.0
Kings	0.9	2.0	2.1	1.2	1.2	1.3	1.4	3.2
Dudley Ridge	13.0	13.9	14.7	16.8	17.4	19.3	19.9	20.2
Empire W.S.	0.7	0.7	0.7	0.9	0.9	1.0	1.0	1.1
KCWA (M&I)	53.4	53.4	55.3	49.6	51.7	44.0	46.1	47.4
KCWA (Agric.)	229.0	209.0	220.9	297.4	307.8	341.3	351.7	298.8
Tulare	26.6	21.6	22.9	34.6	35.8	39.7	40.9	33.9
SLO	9.9	9.9	10.3	9.2	9.6	8.2	8.6	8.8
Santa Barbara	18.0	18.0	18.7	16.8	17.5	14.9	15.6	16.0
AVEK	54.9	55.6	57.6	51.1	53.2	50.6	52.8	49.8
Castaic (Agric.)	2.9	2.9	3.0	3.7	3.8	4.3	4.4	4.5
Castaic (M&I)	16.5	16.5	17.0	15.3	15.9	13.6	14.2	29.1
Coachella	44.1	49.0	50.9	41.0	42.7	40.7	42.4	46.9
Crestline	2.3	2.3	2.4	2.1	2.2	1.9	2.0	2.0
Desert	19.8	20.7	21.5	18.4	19.2	18.3	19.1	19.0
Littlerock	0.9	0.9	0.9	0.8	0.9	0.8	0.8	0.8
Mojave	20.1	25.8	26.8	18.7	19.5	20.6	21.3	26.7
MWDSC	758.0	758.0	785.1	705.1	734.2	669.7	698.9	673.5
Palmdale	6.9	7.8	8.1	6.4	6.6	5.7	5.9	7.5
San Bernardino	40.7	40.7	42.1	37.8	39.4	41.5	43.1	36.1
San Gabriel	11.4	11.4	11.8	10.6	11.1	11.7	12.1	10.1
San Gorgonio	6.9	6.9	7.1	6.4	6.6	5.7	5.9	6.1
Ventura	7.9	7.9	8.2	7.4	7.7	6.5	6.8	7.0
Total Agriculture	274.3	251.3	265.7	356.2	368.7	408.9	421.3	363.6
Total M&I	1,172.8	1,195.8	1,239.0	1,090.9	1,136.0	1,038.3	1,083.4	1,092.5
Total	1,447.1	1,447.1	1,504.7	1,447.1	1,504.7	1,447.2	1,504.7	1,456.1

Figure 15a - Average Annual Scheduled SWP Deliveries in the 2020 Scenarios

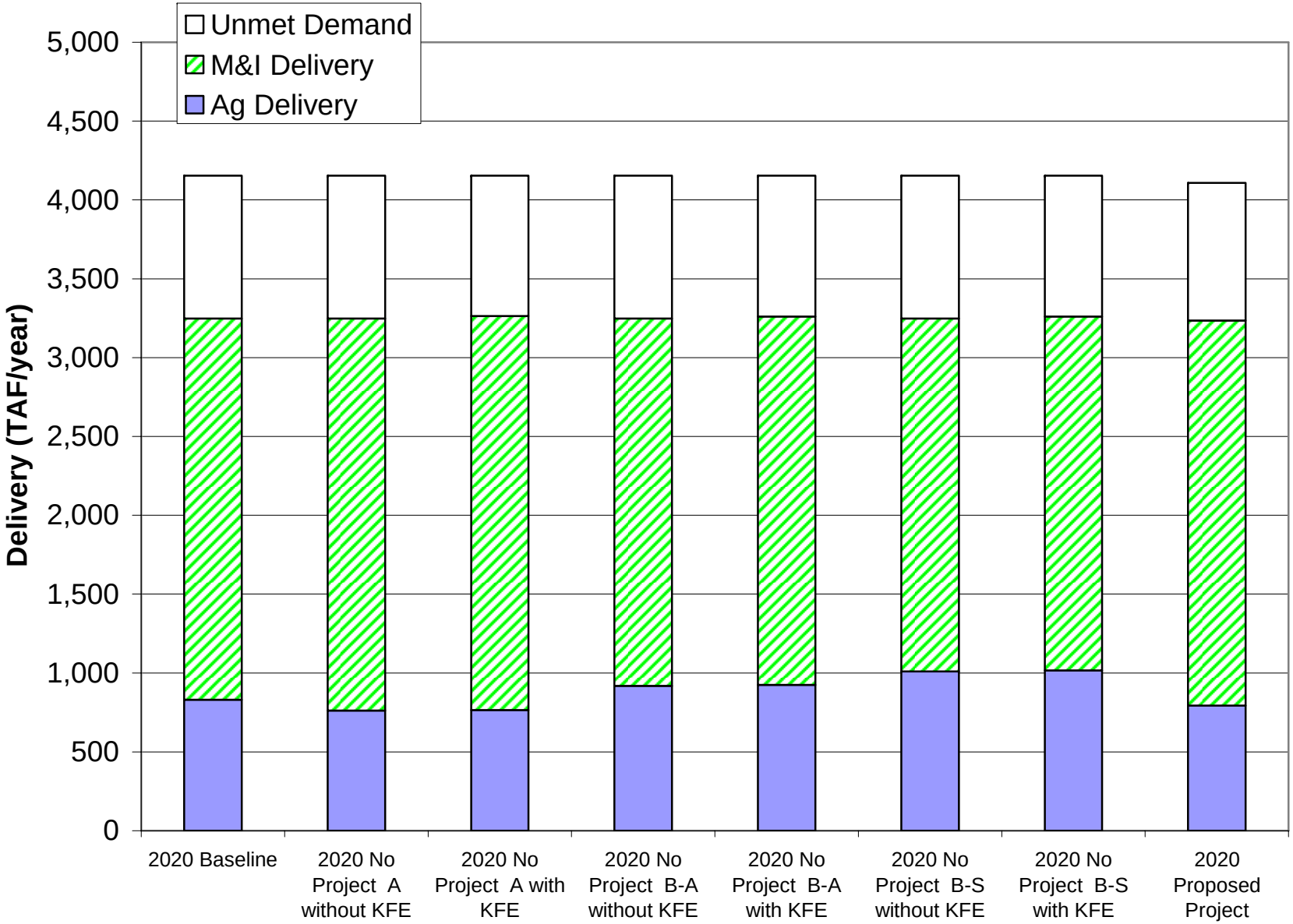


Figure 15b - Average Annual Scheduled SWP Deliveries in Wet Years in the 2020 Scenarios

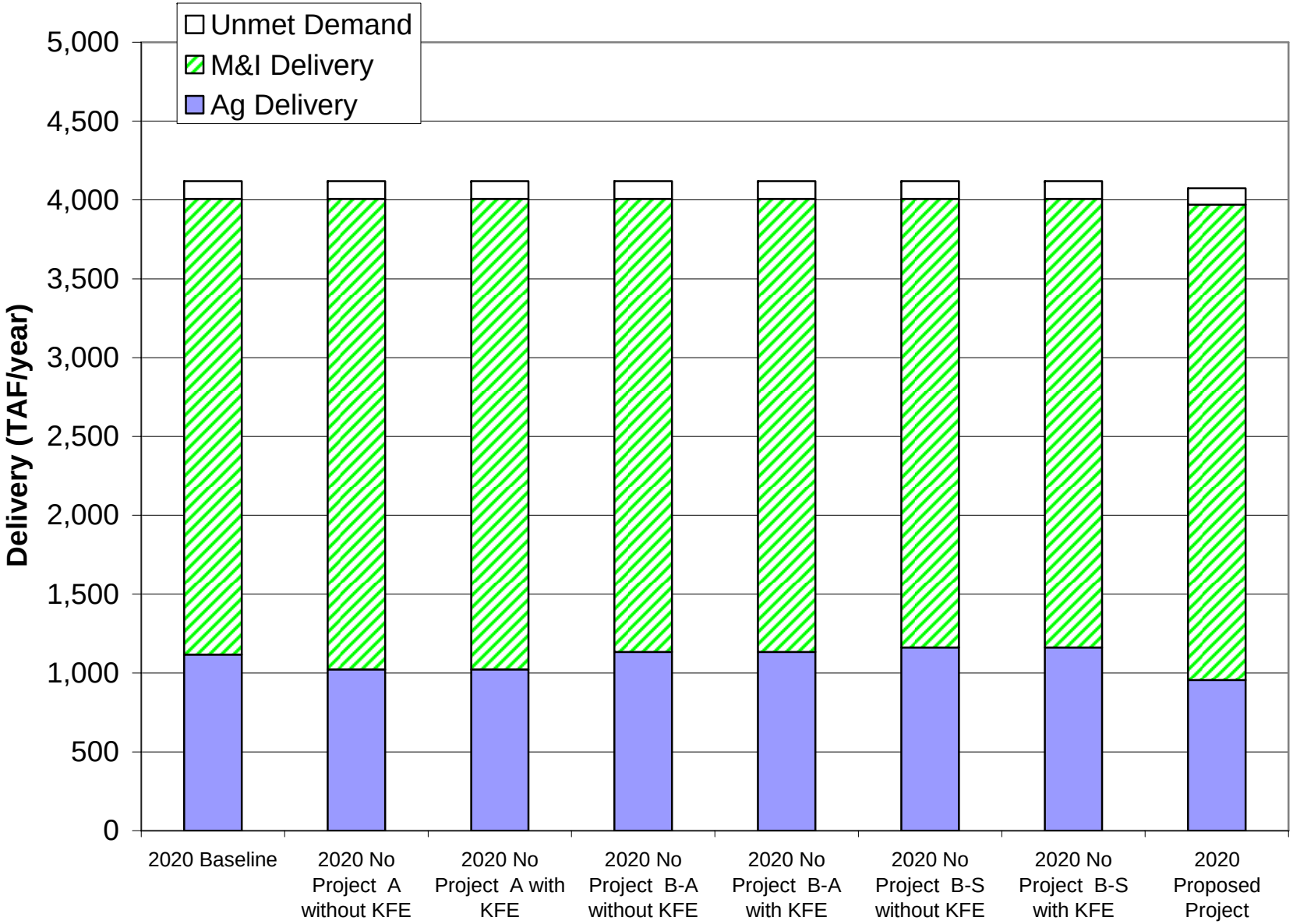


Figure 15c - Average Annual Scheduled SWP Deliveries in Above Normal Years in the 2020 Scenarios

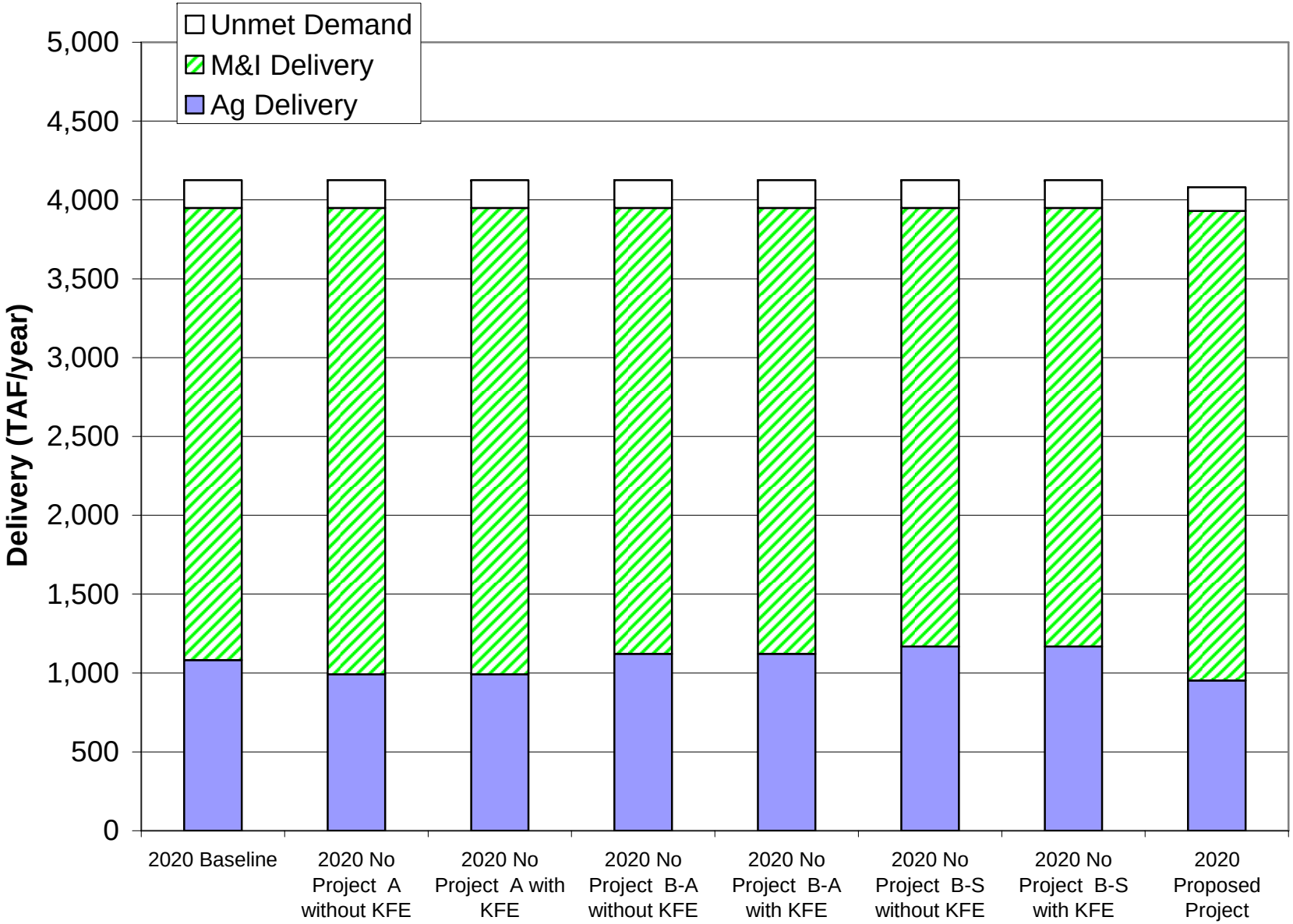


Figure 15d - Average Annual Scheduled SWP Deliveries in Below Normal Years in the 2020 Scenarios

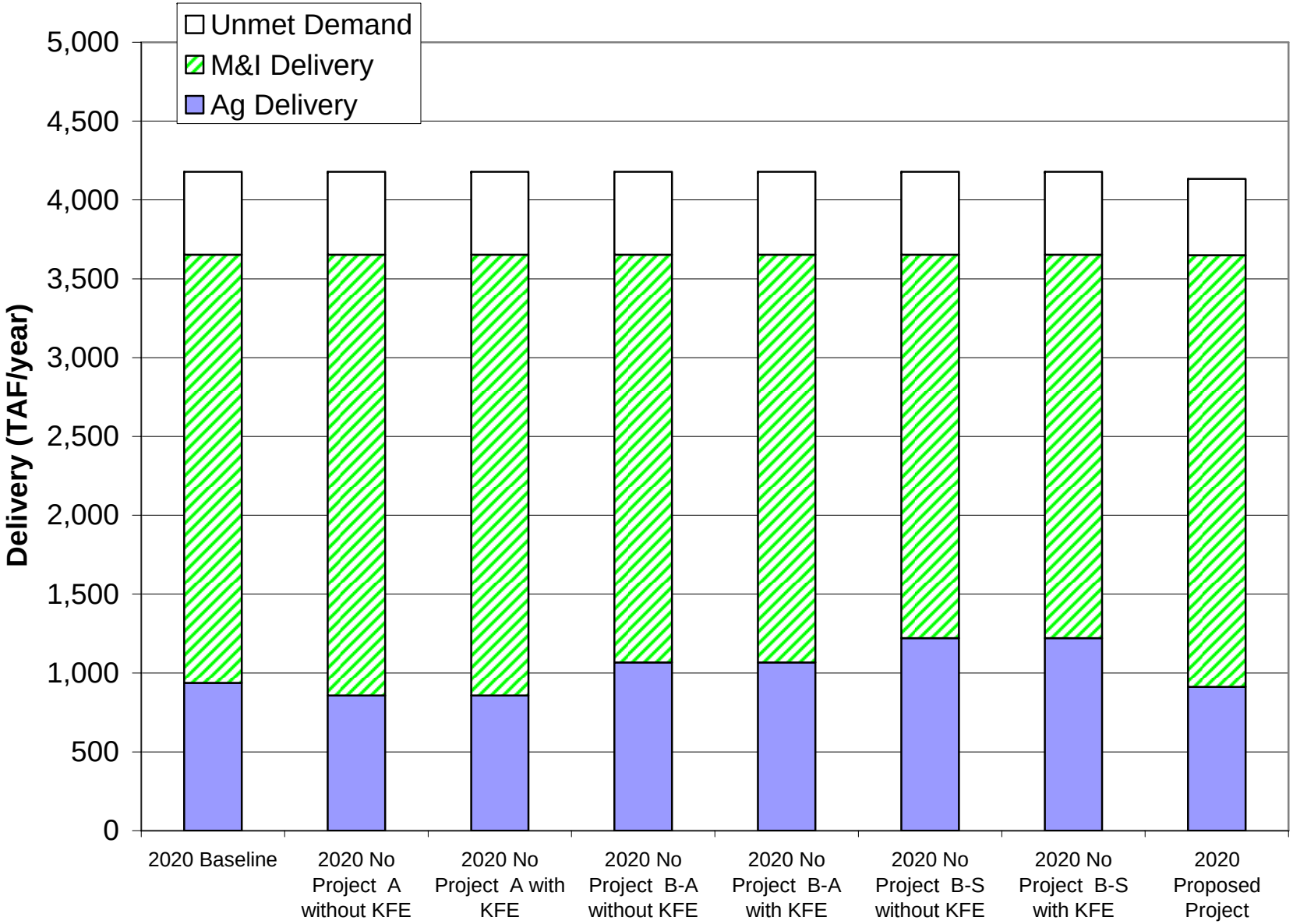


Figure 15e - Average Annual Scheduled SWP Deliveries in Dry Years in the 2020 Scenarios

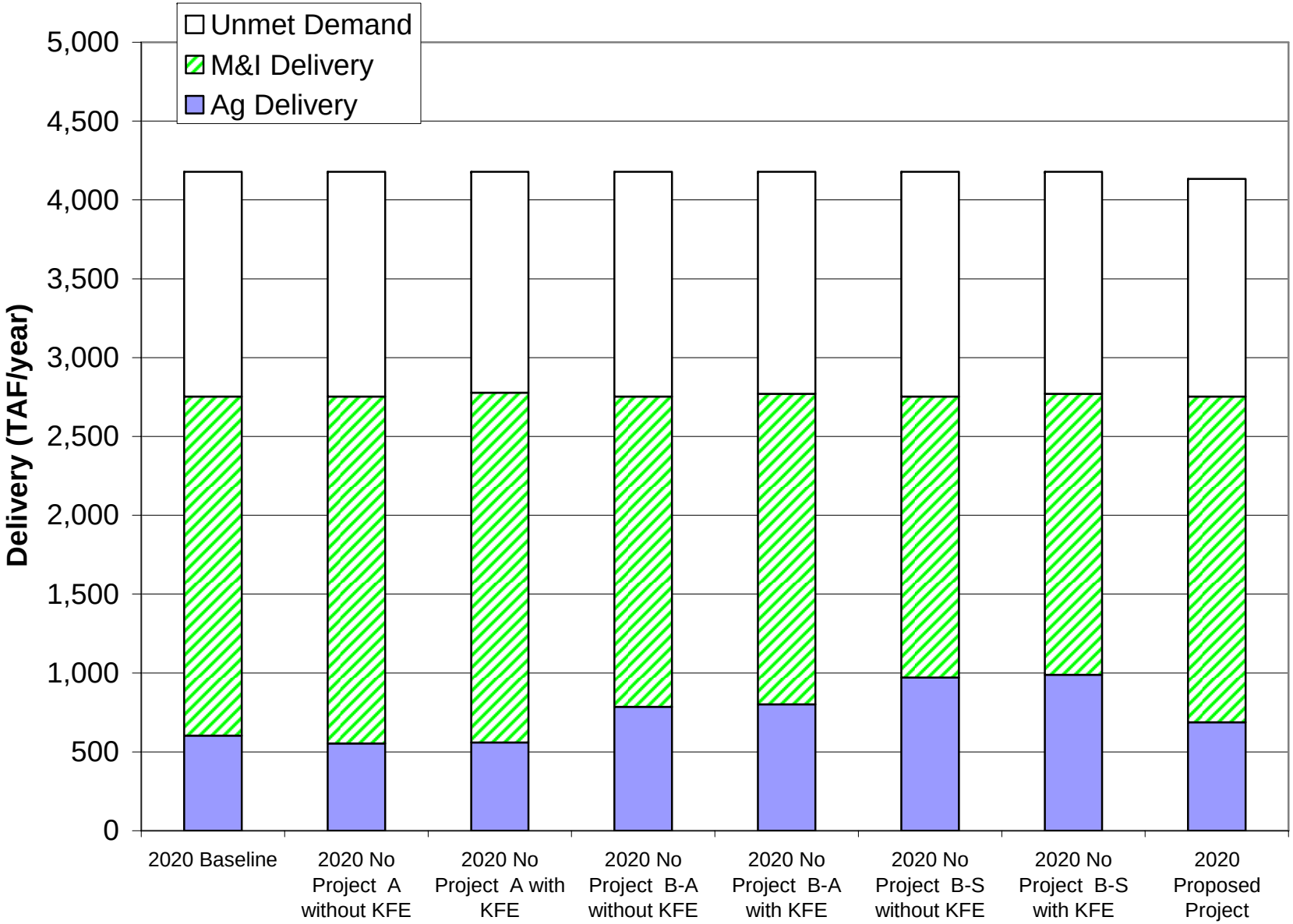


Figure 15f - Average Annual Scheduled SWP Deliveries in Critical Years in the 2020 Scenarios

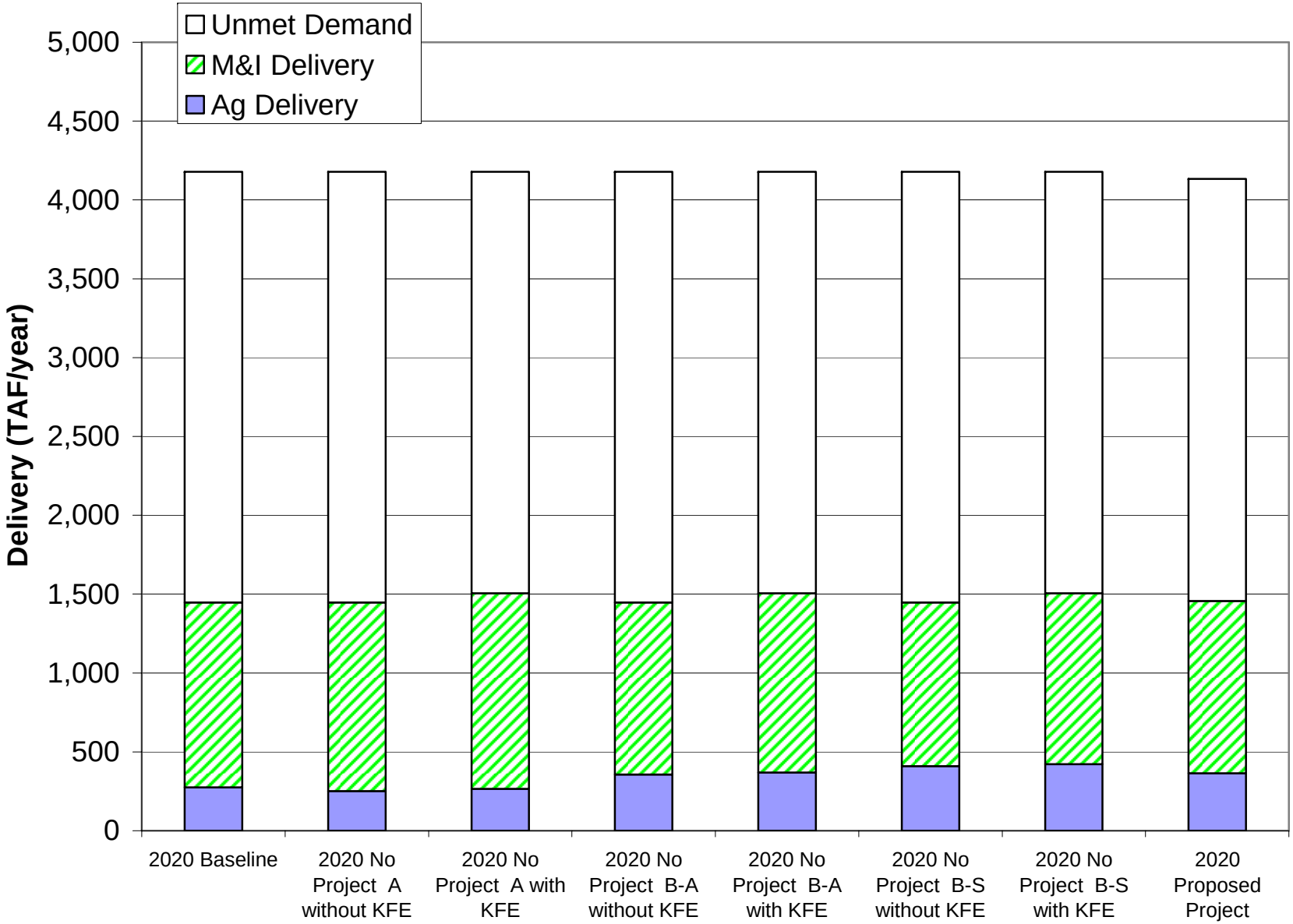


Table 15a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	1.7	1.0	1.0	0.8	1.0	0.8	1.0	0.8	1.7
Solano	1.8	1.1	1.1	0.9	1.1	0.9	1.1	0.9	2.1
Zone 7	1.9	1.1	1.2	1.1	1.1	1.1	1.1	1.1	2.2
Alameda	2.2	1.4	1.5	1.4	1.4	1.3	1.4	1.3	2.1
Santa Clara	8.2	5.0	5.3	4.8	5.0	4.6	5.0	4.6	7.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	3.1	2.1	2.2	2.2	2.1	2.1	2.1	2.1	2.2
Empire W.S.	2.5	1.6	1.7	1.6	1.6	1.5	1.6	1.5	1.0
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	143.6	99.6	104.1	103.1	99.6	97.4	99.6	97.4	81.8
Tulare	40.3	26.7	28.6	27.6	26.7	25.6	26.7	25.6	16.7
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	2.5	1.7	1.7	1.7	1.7	1.6	1.7	1.6	2.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	1.8	1.1	1.1	0.9	1.1	0.9	1.1	0.9	2.2
Coachella	4.5	2.9	3.1	2.8	2.9	2.6	2.9	2.6	2.7
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	10.6	6.8	6.9	6.3	6.8	6.1	6.8	6.1	5.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	171.1	119.3	123.8	119.6	119.3	116.3	119.3	116.3	164.0
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	189.4	130.1	136.6	134.4	130.1	126.7	130.1	126.7	101.6
Total M&I	206.4	141.3	146.7	140.4	141.3	136.3	141.3	136.3	192.3
Total	395.9	271.4	283.4	274.9	271.4	263.0	271.4	263.0	294.0

Table 15b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	3.1	2.1	2.0	1.7	2.1	1.7	2.1	1.7	3.1
Solano	3.3	2.3	2.3	2.0	2.3	2.0	2.3	2.0	4.2
Zone 7	3.5	2.3	2.4	2.3	2.3	2.2	2.3	2.2	4.3
Alameda	4.1	2.9	3.1	2.9	2.9	2.8	2.9	2.8	4.1
Santa Clara	15.2	10.5	11.0	10.1	10.5	9.8	10.5	9.8	13.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	5.6	4.2	4.3	4.3	4.2	4.1	4.2	4.1	4.3
Empire W.S.	4.6	3.2	3.4	3.2	3.2	3.0	3.2	3.0	1.9
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	265.2	198.2	207.0	203.8	198.2	194.4	198.2	194.4	152.0
Tulare	75.1	53.9	57.9	55.6	53.9	52.5	53.9	52.5	31.9
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	4.6	3.4	3.5	3.4	3.4	3.4	3.4	3.4	4.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	3.4	2.3	2.3	2.0	2.3	2.0	2.3	2.0	4.4
Coachella	8.4	6.0	6.2	5.8	6.0	5.4	6.0	5.4	4.6
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	19.6	14.3	14.1	13.0	14.3	12.9	14.3	12.9	11.1
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	261.0	215.4	213.6	210.3	215.4	211.9	215.4	211.9	304.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	350.5	259.6	272.5	267.0	259.6	254.0	259.6	254.0	190.0
Total M&I	326.2	261.6	260.5	253.5	261.6	254.0	261.6	254.0	358.5
Total	676.7	521.2	533.0	520.4	521.2	508.0	521.2	508.0	548.5

Table 15c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	1.6	0.7	0.7	0.5	0.7	0.5	0.7	0.5	1.8
Solano	1.8	0.7	0.7	0.6	0.7	0.5	0.7	0.5	2.2
Zone 7	2.0	0.7	0.9	0.8	0.7	0.7	0.7	0.7	2.3
Alameda	2.3	1.0	1.2	1.1	1.0	1.0	1.0	1.0	2.2
Santa Clara	8.6	3.6	4.1	3.5	3.6	3.2	3.6	3.2	7.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	3.7	2.3	2.4	2.3	2.3	2.3	2.3	2.3	2.3
Empire W.S.	2.8	1.5	1.8	1.5	1.5	1.2	1.5	1.2	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	162.9	101.1	105.8	104.5	101.1	98.0	101.1	98.0	86.5
Tulare	44.5	25.0	28.5	26.1	25.0	22.6	25.0	22.6	15.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	2.9	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	1.9	0.7	0.7	0.5	0.7	0.5	0.7	0.5	2.4
Coachella	5.0	2.6	3.0	2.7	2.6	2.2	2.6	2.2	3.0
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	11.9	5.7	6.5	5.4	5.7	4.8	5.7	4.8	5.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	221.2	109.4	127.8	116.9	109.4	104.2	109.4	104.2	173.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	213.9	130.0	138.5	134.5	130.0	124.0	130.0	124.0	104.7
Total M&I	259.1	126.7	147.2	133.6	126.7	119.3	126.7	119.3	203.4
Total	473.0	256.7	285.6	268.1	256.7	243.3	256.7	243.3	308.1

Table 15d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	1.8	0.7	0.8	0.6	0.7	0.6	0.7	0.6	1.3
Solano	1.9	0.8	0.9	0.7	0.8	0.7	0.8	0.7	1.4
Zone 7	2.0	0.9	1.1	1.0	0.9	0.8	0.9	0.8	1.5
Alameda	2.2	1.0	1.1	1.0	1.0	0.9	1.0	0.9	1.4
Santa Clara	8.4	3.8	4.2	3.8	3.8	3.5	3.8	3.5	5.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Empire W.S.	2.2	1.2	1.3	1.3	1.2	1.1	1.2	1.1	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	119.4	70.0	72.3	70.5	70.0	67.6	70.0	67.6	65.1
Tulare	34.4	18.8	19.5	19.4	18.8	18.1	18.8	18.1	14.0
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	2.3	1.2	1.3	1.2	1.2	1.1	1.2	1.1	1.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	2.0	0.8	0.8	0.7	0.8	0.7	0.8	0.7	1.5
Coachella	4.3	2.0	2.2	2.0	2.0	1.9	2.0	1.9	2.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	10.2	5.0	5.3	4.8	5.0	4.7	5.0	4.7	4.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	186.1	107.2	117.2	112.5	107.2	103.5	107.2	103.5	130.6
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	158.5	91.5	94.6	92.6	91.5	88.3	91.5	88.3	81.4
Total M&I	221.2	123.4	135.0	128.2	123.4	118.5	123.4	118.5	151.9
Total	379.7	214.9	229.6	220.9	214.9	206.8	214.9	206.8	233.3

Table 15e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	0.5	0.4	0.4	0.3	0.4	0.3	0.4	0.3	0.8
Solano	0.6	0.4	0.4	0.3	0.4	0.3	0.4	0.3	1.0
Zone 7	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.1
Alameda	0.9	0.6	0.7	0.6	0.6	0.6	0.6	0.6	1.0
Santa Clara	3.1	2.2	2.3	2.0	2.2	2.0	2.2	2.0	3.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.4	0.9	1.0	1.1	0.9	0.9	0.9	0.9	1.1
Empire W.S.	1.1	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.4
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	66.6	46.2	49.9	53.0	46.2	45.6	46.2	45.6	40.7
Tulare	17.7	12.6	13.2	13.2	12.6	11.9	12.6	11.9	7.6
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.1	0.7	0.8	0.8	0.7	0.7	0.7	0.7	1.1
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.6	0.4	0.4	0.3	0.4	0.3	0.4	0.3	1.1
Coachella	1.7	1.2	1.3	1.2	1.2	1.0	1.2	1.0	1.5
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.9	2.8	2.8	2.4	2.8	2.3	2.8	2.3	2.7
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	91.5	65.8	68.7	65.5	65.8	63.4	65.8	63.4	81.7
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	86.9	60.5	64.9	68.1	60.5	59.1	60.5	59.1	49.7
Total M&I	104.4	75.0	78.3	73.9	75.0	71.3	75.0	71.3	95.7
Total	191.3	135.5	143.2	142.0	135.5	130.4	135.5	130.4	145.4

Table 15f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 1994 and 2003 Scenarios

SWP CONTRACTOR	1994 Baseline	2003 Baseline	2003 No Project A without KFE	2003 No Project A with KFE	2003 No Proj B-A without KFE	2003 No Proj B-A with KFE	2003 No Proj B-S without KFE	2003 No Proj B-S with KFE	2003 Proposed Project
Napa	0.4	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.4
Solano	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Zone 7	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Alameda	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Santa Clara	1.8	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	33.3	22.0	22.3	20.8	22.0	22.0	22.0	22.0	22.2
Tulare	9.1	5.9	5.9	5.7	5.9	5.9	5.9	5.9	5.3
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Coachella	1.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.9
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.2	1.5	1.5	1.4	1.5	1.5	1.5	1.5	1.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	50.4	35.1	35.2	34.4	35.1	35.1	35.1	35.1	44.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	43.6	28.8	29.1	27.4	28.8	28.8	28.8	28.8	28.2
Total M&I	57.9	40.2	40.3	39.5	40.2	40.2	40.2	40.2	51.9
Total	101.6	69.0	69.4	67.0	69.0	69.0	69.0	69.0	80.1

Figure 16a - Average Annual Unscheduled SWP Deliveries in the 1994 and 2003 Scenarios

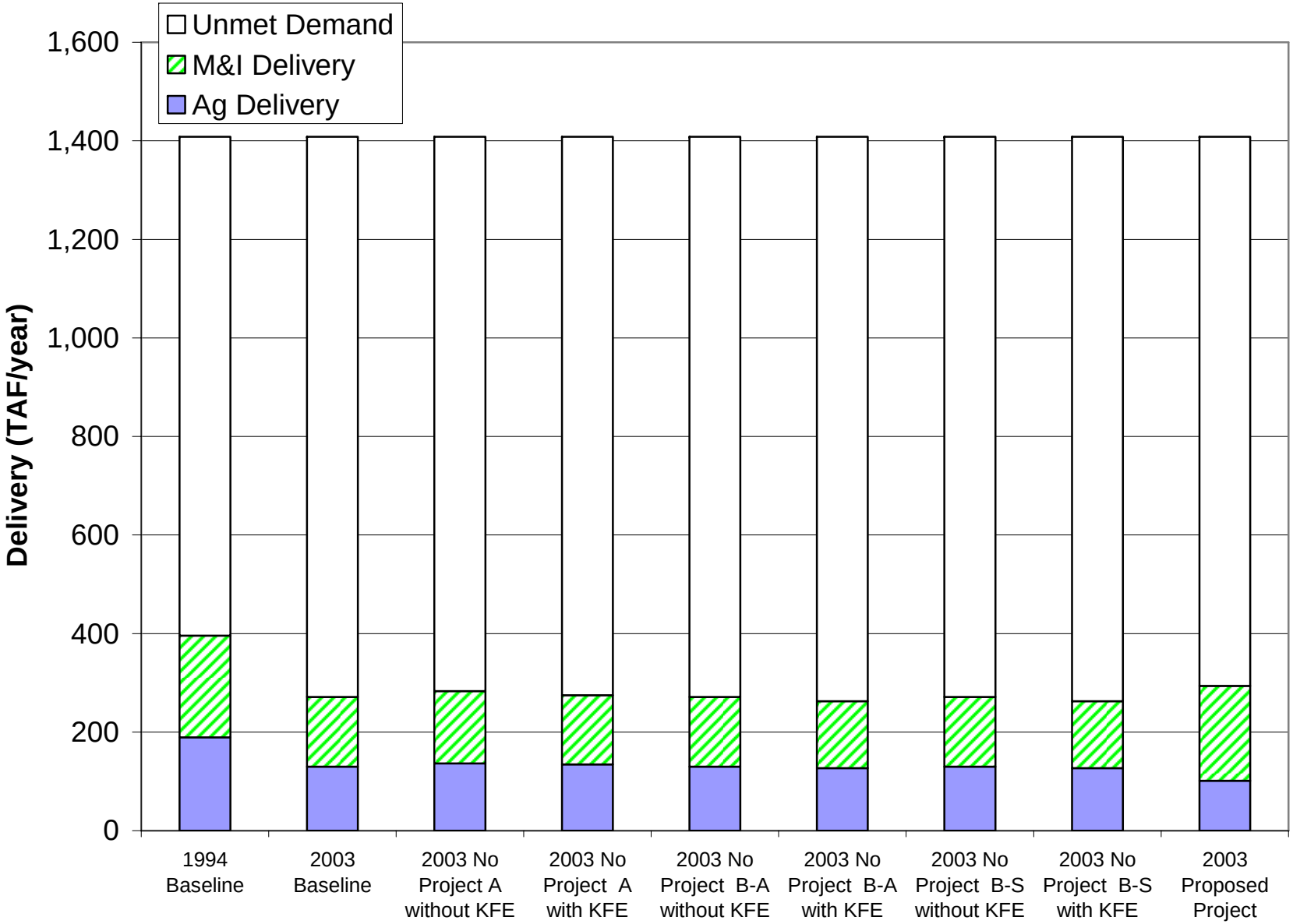


Figure 16b - Average Annual Unscheduled SWP Deliveries in Wet Years in the 1994 and 2003 Scenarios

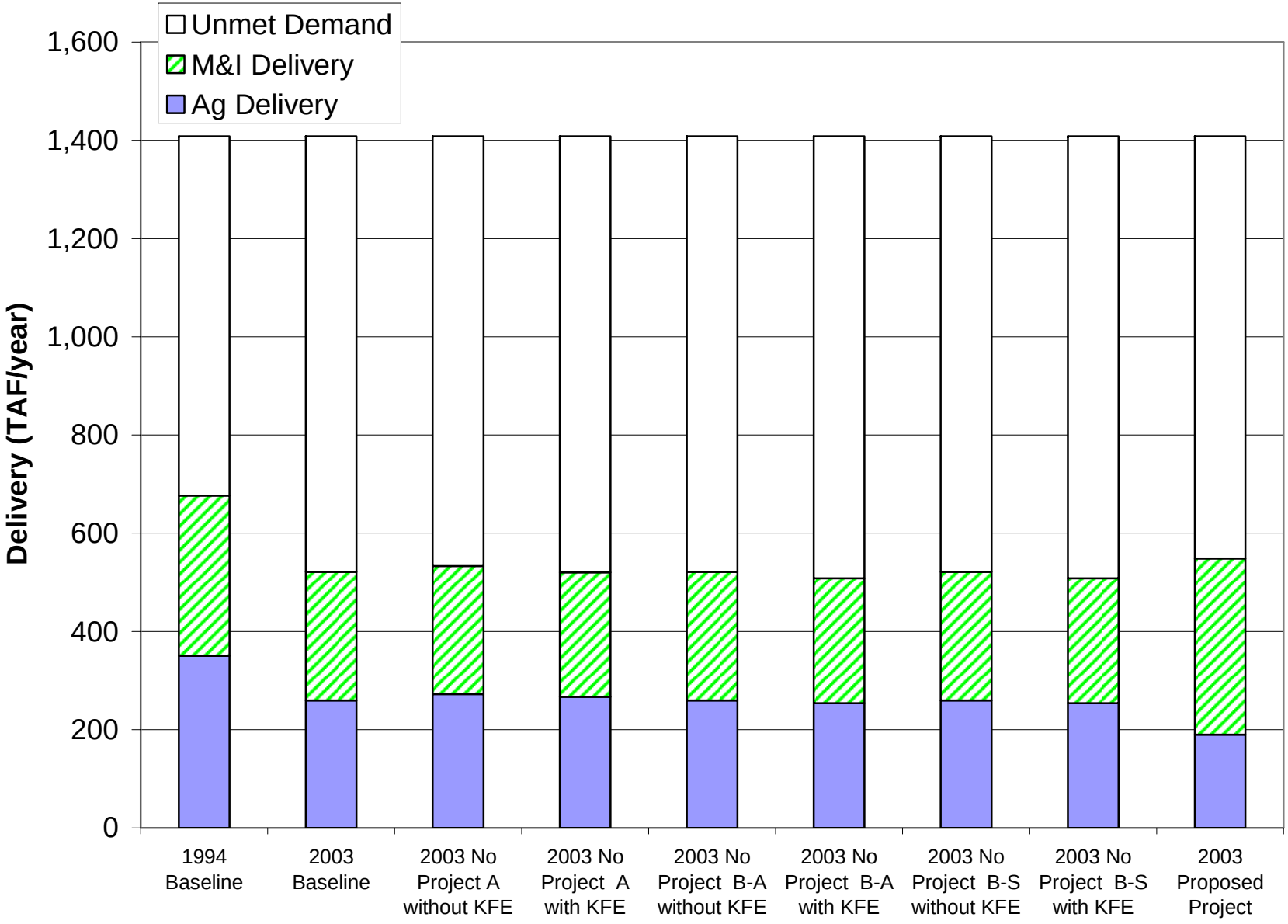


Figure 16c - Average Annual Unscheduled SWP Deliveries in Above Normal Years in the 1994 and 2003 Scenarios

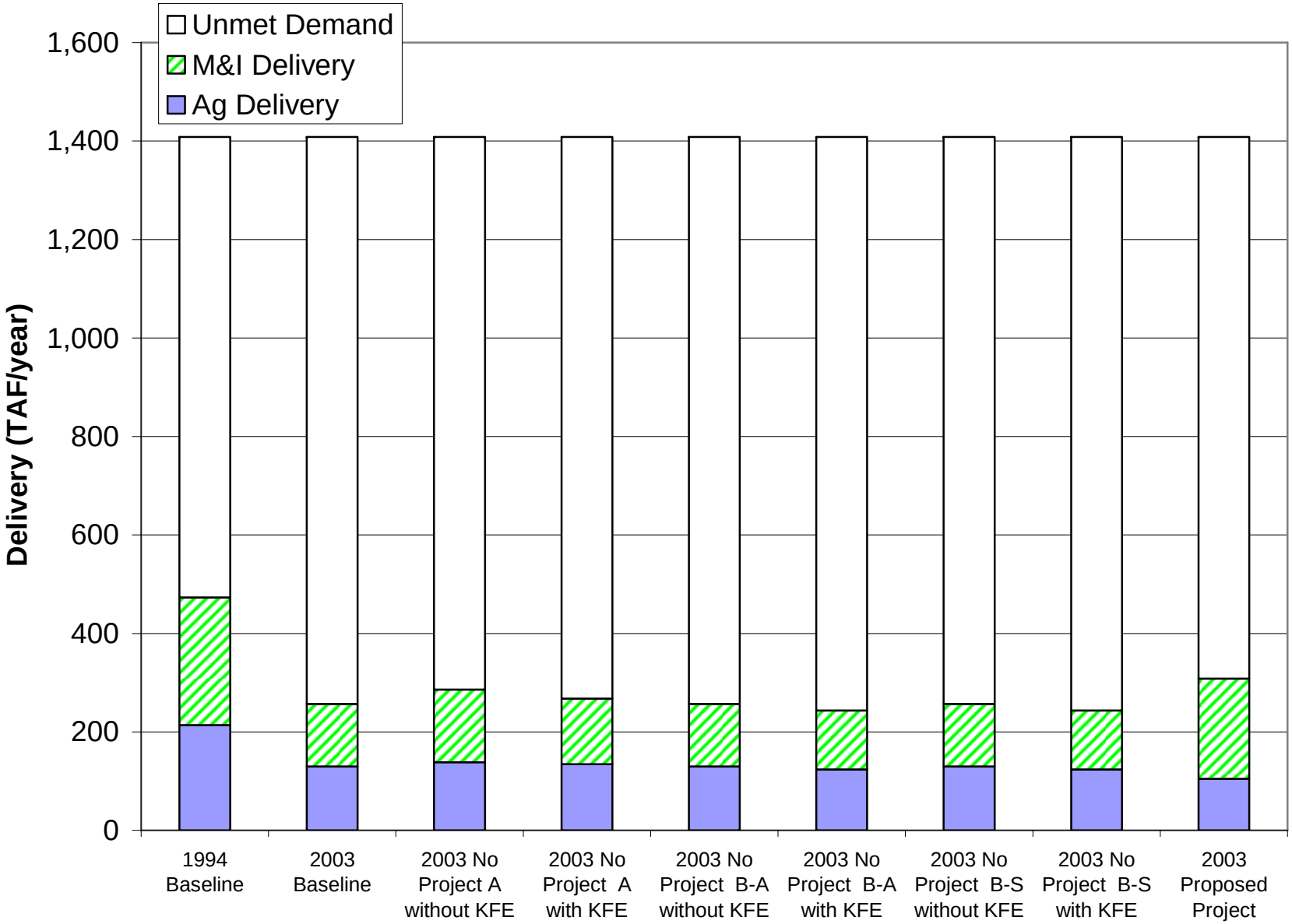


Figure 16d - Average Annual Unscheduled SWP Deliveries in Below Normal Years in the 1994 and 2003 Scenarios

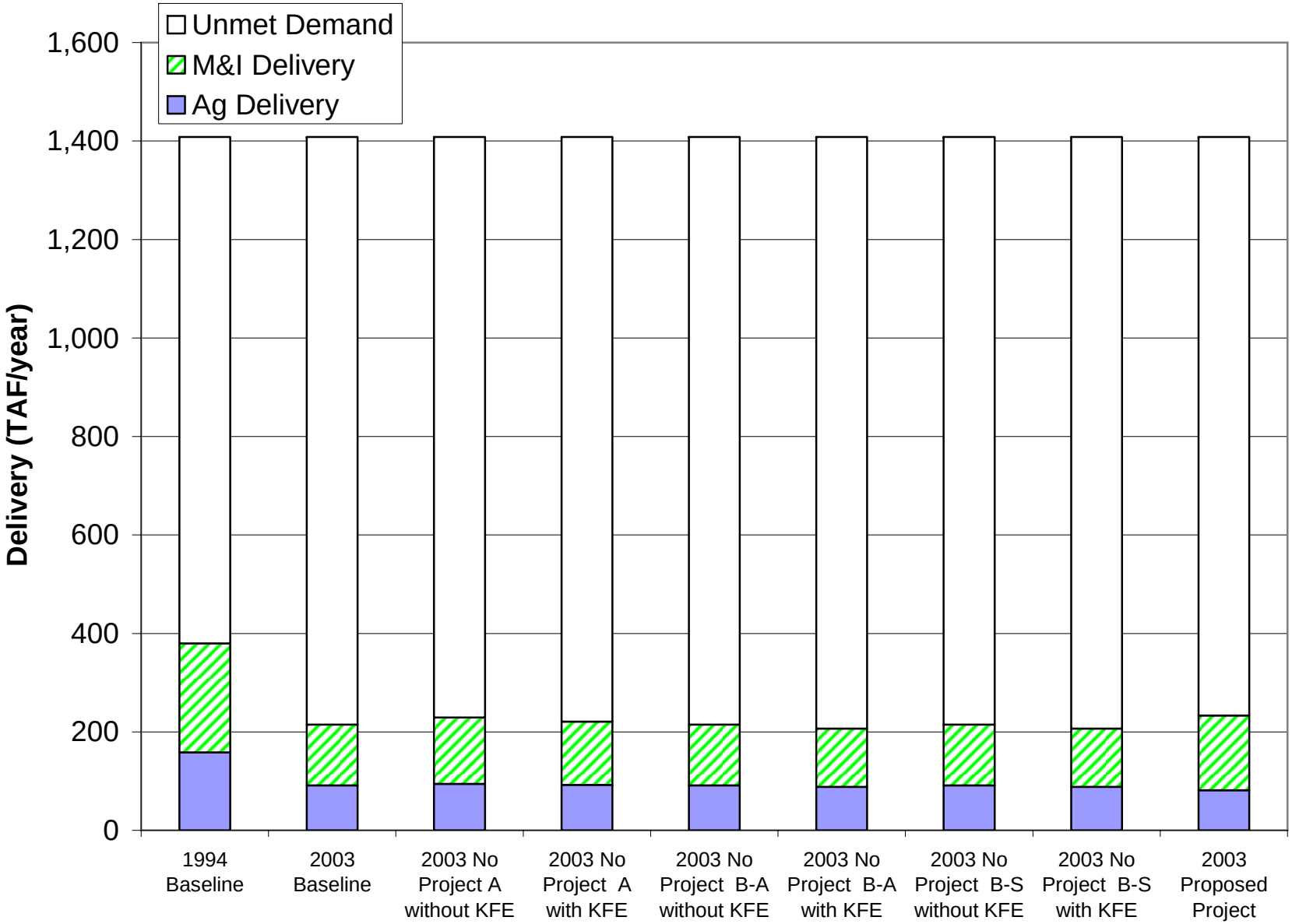


Figure 16e - Average Annual Unscheduled SWP Deliveries in Dry Years in the 1994 and 2003 Scenarios

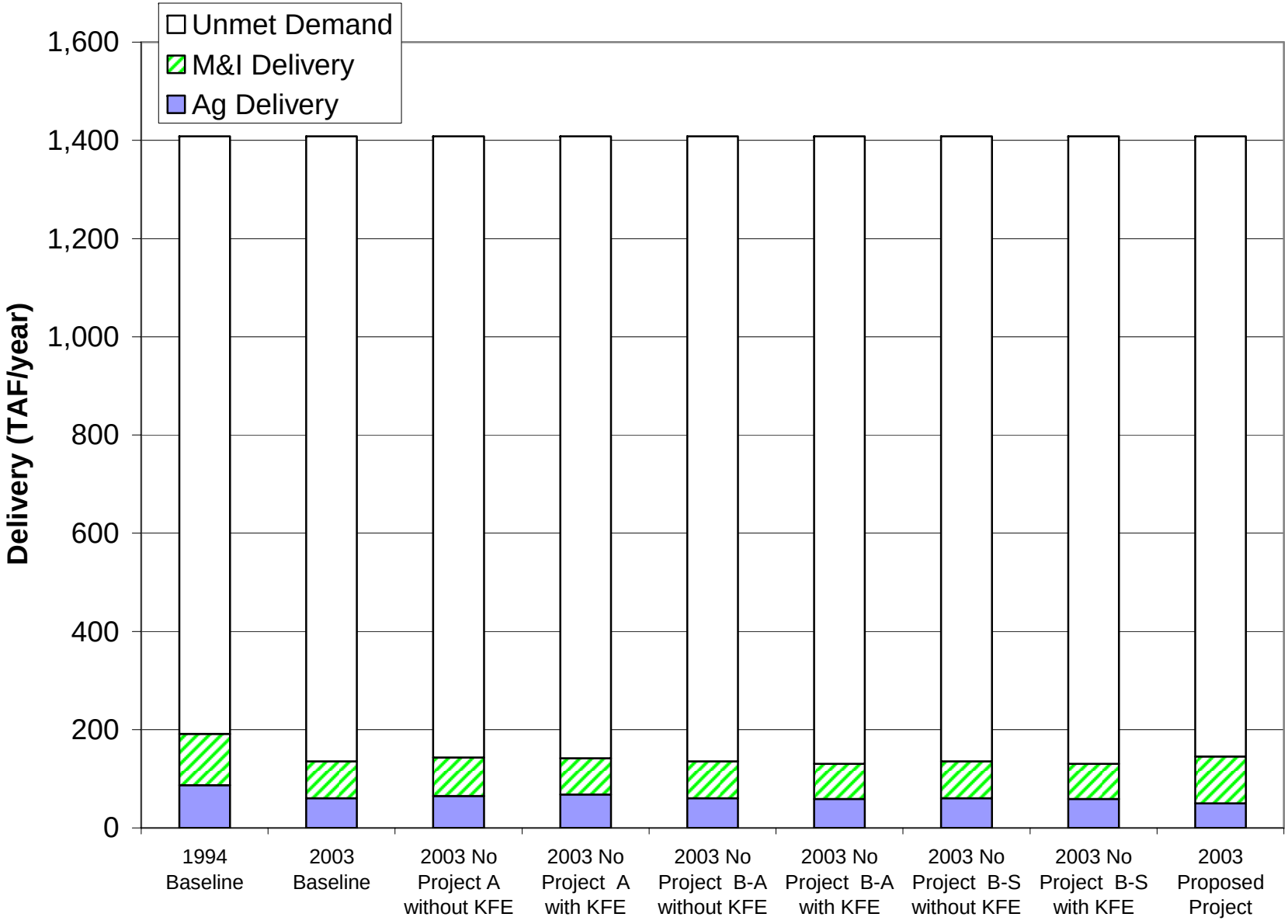


Figure 16f - Average Annual Unscheduled SWP Deliveries in Critical Years in the 1994 and 2003 Scenarios

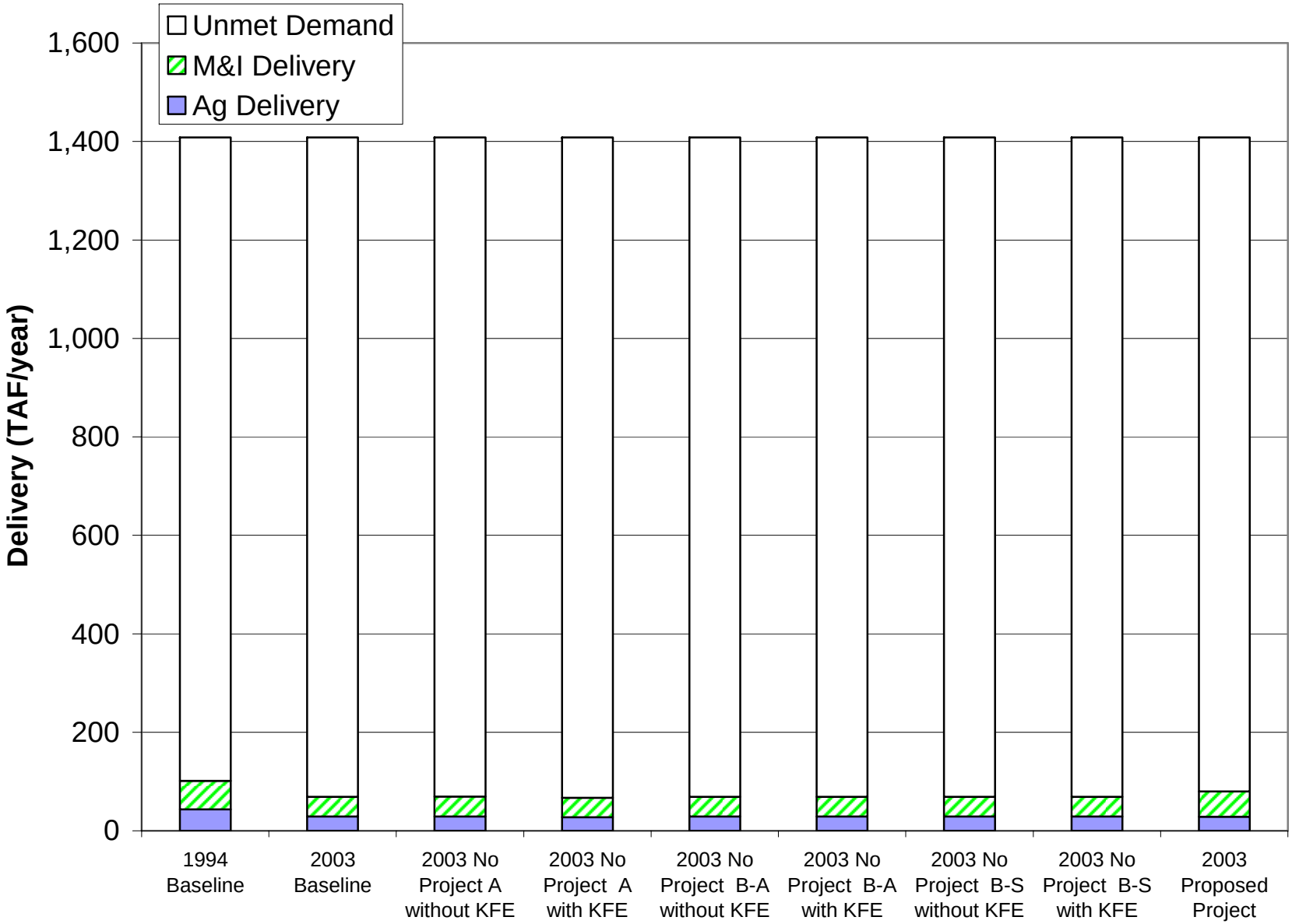


Table 16a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.2	0.2	0.1	0.2	0.1	0.2	0.1	1.3
Solano	0.3	0.3	0.2	0.3	0.2	0.3	0.2	1.5
Zone 7	0.4	0.5	0.4	0.4	0.3	0.4	0.3	1.6
Alameda	0.7	0.7	0.6	0.7	0.6	0.7	0.6	1.4
Santa Clara	2.2	2.3	1.8	2.2	1.9	2.2	1.9	4.9
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.6	1.6	1.5	1.6	1.5	1.6	1.5	1.5
Empire W.S.	1.1	1.1	1.0	1.1	1.0	1.1	1.0	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	70.7	70.8	66.2	70.7	66.7	70.7	66.7	54.2
Tulare	18.1	17.9	16.2	18.1	16.5	18.1	16.5	7.2
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.6
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.2	0.2	0.3	0.2	0.3	0.2	1.6
Coachella	1.9	2.0	1.7	1.9	1.7	1.9	1.7	3.1
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.6	3.6	3.2	3.6	3.2	3.6	3.2	3.6
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	74.6	74.5	66.4	74.6	67.2	74.6	67.2	88.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	91.5	91.5	84.8	91.5	85.7	91.5	85.7	63.2
Total M&I	85.3	85.3	75.5	85.3	76.4	85.3	76.4	109.0
Total	176.8	176.8	160.4	176.8	162.1	176.8	162.1	172.2

Table 16b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.2	0.2	0.1	0.2	0.1	0.2	0.1	2.3
Solano	0.3	0.3	0.1	0.3	0.2	0.3	0.2	2.7
Zone 7	0.5	0.6	0.4	0.4	0.3	0.5	0.4	2.9
Alameda	1.1	1.1	0.9	1.1	1.0	1.1	1.0	2.6
Santa Clara	3.3	3.3	2.6	3.3	2.7	3.3	2.7	8.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.7	2.8	2.6	2.7	2.6	2.7	2.6	2.8
Empire W.S.	1.6	1.6	1.5	1.6	1.5	1.6	1.5	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	118.6	118.9	109.4	118.6	111.2	118.6	111.2	92.5
Tulare	29.2	28.7	25.8	29.2	26.8	29.2	26.8	10.8
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.8	1.8	1.5	1.8	1.6	1.8	1.6	2.9
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.3	0.1	0.3	0.2	0.3	0.2	2.9
Coachella	3.3	3.3	2.9	3.3	3.0	3.3	3.0	5.6
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	5.7	5.7	5.1	5.7	5.3	5.7	5.3	6.0
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	107.2	107.0	95.9	107.2	96.8	107.2	96.8	133.9
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	152.1	152.0	139.3	152.1	142.1	152.1	142.1	106.4
Total M&I	123.6	123.6	109.7	123.5	111.1	123.6	111.2	170.3
Total	275.7	275.7	248.9	275.5	253.2	275.7	253.3	276.8

Table 16c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Solano	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.6
Zone 7	0.2	0.3	0.3	0.4	0.3	0.2	0.2	1.7
Alameda	0.7	0.7	0.7	0.7	0.6	0.7	0.6	1.6
Santa Clara	2.1	2.1	1.8	2.1	1.8	2.1	1.8	5.7
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.8	1.8	1.7	1.8	1.7	1.8	1.7	1.6
Empire W.S.	1.6	1.6	1.2	1.6	1.2	1.6	1.2	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	86.1	86.1	82.9	86.1	82.9	86.1	82.9	60.0
Tulare	24.3	24.3	20.4	24.3	20.5	24.3	20.5	5.8
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	1.0	0.9	1.0	0.9	1.0	0.9	1.8
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.7
Coachella	2.0	2.0	1.8	2.0	1.8	2.0	1.8	3.3
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.7	3.7	3.2	3.7	3.2	3.7	3.2	3.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	94.0	93.9	78.8	94.0	78.9	94.0	78.9	115.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	113.8	113.8	106.2	113.8	106.3	113.8	106.3	67.6
Total M&I	103.8	103.9	87.6	104.0	87.7	103.8	87.5	138.2
Total	217.7	217.7	193.8	217.8	194.0	217.7	193.8	205.8

Table 16d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.2	0.2	0.1	0.2	0.1	0.2	0.1	1.1
Solano	0.3	0.3	0.1	0.3	0.1	0.3	0.1	1.2
Zone 7	0.4	0.5	0.4	0.4	0.3	0.4	0.3	1.2
Alameda	0.7	0.7	0.6	0.7	0.6	0.7	0.6	1.2
Santa Clara	2.3	2.4	1.7	2.3	1.7	2.3	1.7	4.2
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.2
Empire W.S.	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	61.3	61.4	56.7	61.3	56.7	61.3	56.7	48.3
Tulare	16.1	16.0	14.4	16.1	14.5	16.1	14.5	7.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	1.0	0.8	1.0	0.8	1.0	0.8	1.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.3	0.1	0.3	0.1	0.3	0.1	1.3
Coachella	1.8	1.8	1.5	1.8	1.5	1.8	1.5	2.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.4	3.4	2.8	3.4	2.8	3.4	2.8	3.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	70.9	70.8	61.6	70.9	63.9	70.9	63.9	75.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	79.7	79.7	73.3	79.7	73.5	79.7	73.5	56.8
Total M&I	81.3	81.3	69.8	81.2	72.1	81.3	72.1	92.7
Total	161.0	161.0	143.1	161.0	145.5	161.0	145.5	149.4

Table 16e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.6
Solano	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.6
Zone 7	0.3	0.3	0.3	0.4	0.3	0.3	0.2	0.7
Alameda	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6
Santa Clara	1.4	1.4	1.2	1.4	1.1	1.4	1.1	2.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7
Empire W.S.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	37.4	37.6	35.0	37.4	34.9	37.4	34.9	23.7
Tulare	8.9	8.8	8.5	8.9	8.7	8.9	8.7	4.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.8
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.8
Coachella	1.0	1.1	0.9	1.0	0.9	1.0	0.9	1.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	1.9	1.9	1.6	1.9	1.6	1.9	1.6	1.8
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	45.8	45.7	41.1	45.8	41.2	45.8	41.2	46.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	47.7	47.7	44.9	47.7	44.9	47.7	44.9	28.7
Total M&I	51.9	51.9	46.4	52.0	46.5	51.9	46.4	56.2
Total	99.7	99.7	91.3	99.8	91.4	99.7	91.3	84.8

Table 16f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the 2020 Scenarios

SWP CONTRACTOR	2020 Baseline	2020 No Project A without KFE	2020 No Project A with KFE	2020 No Proj B-A without KFE	2020 No Proj B-A with KFE	20203 No Proj B-S without KFE	2020 No Proj B-S with KFE	2020 Proposed Project
Napa	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Solano	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Zone 7	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.5
Alameda	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Santa Clara	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	24.6	24.6	24.6	24.6	24.6	24.6	24.6	25.9
Tulare	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.0
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Coachella	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.1
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	40.7	40.7	40.7	40.7	40.7	40.7	40.7	51.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7
Total M&I	47.5	47.5	47.5	47.6	47.5	47.5	47.5	60.1
Total	80.2	80.2	80.2	80.2	80.1	80.2	80.2	92.9

Figure 17a - Average Annual Unscheduled SWP Deliveries in the 2020 Scenarios

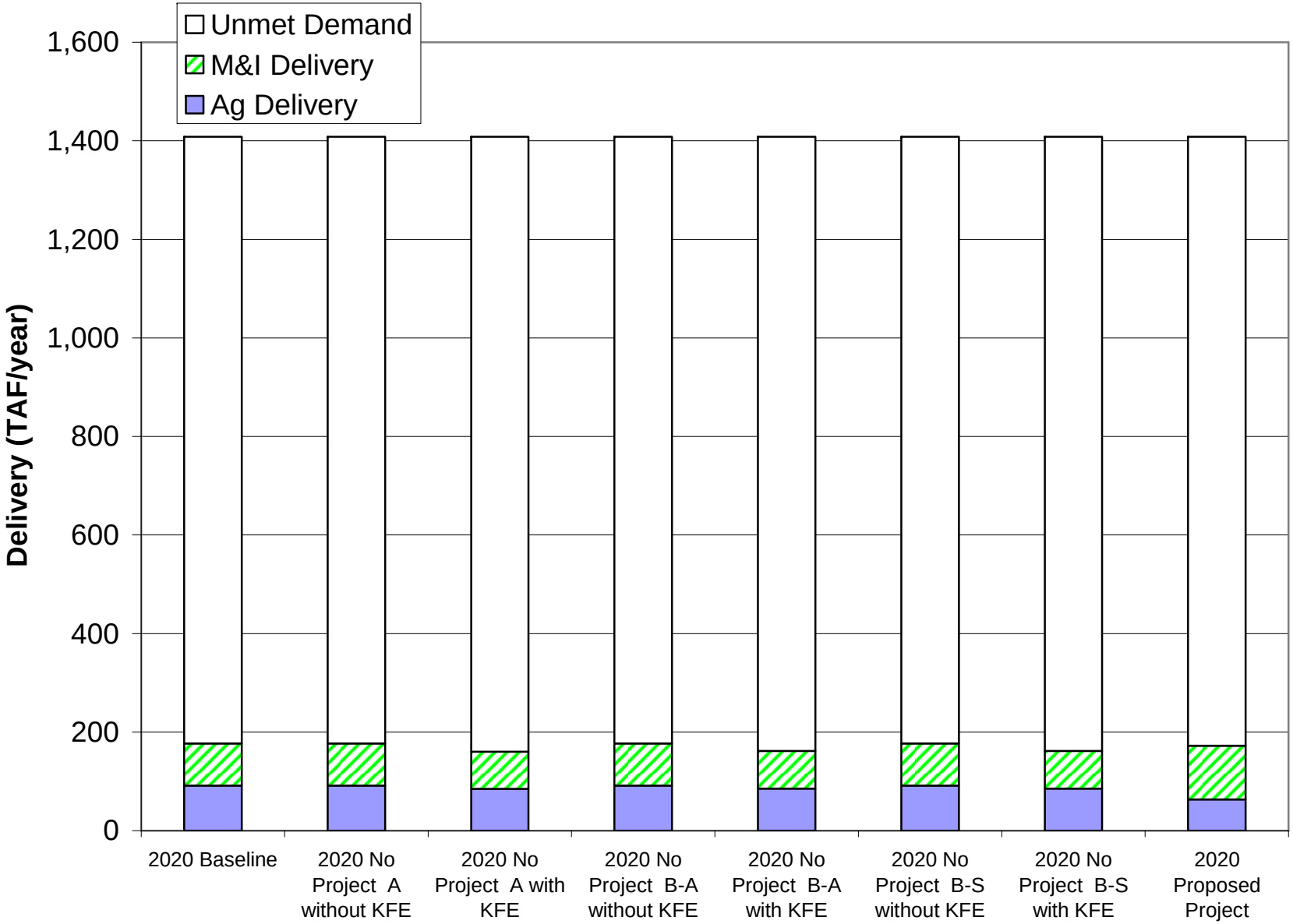


Figure 17b - Average Annual Unscheduled SWP Deliveries in Wet Years in the 2020 Scenarios

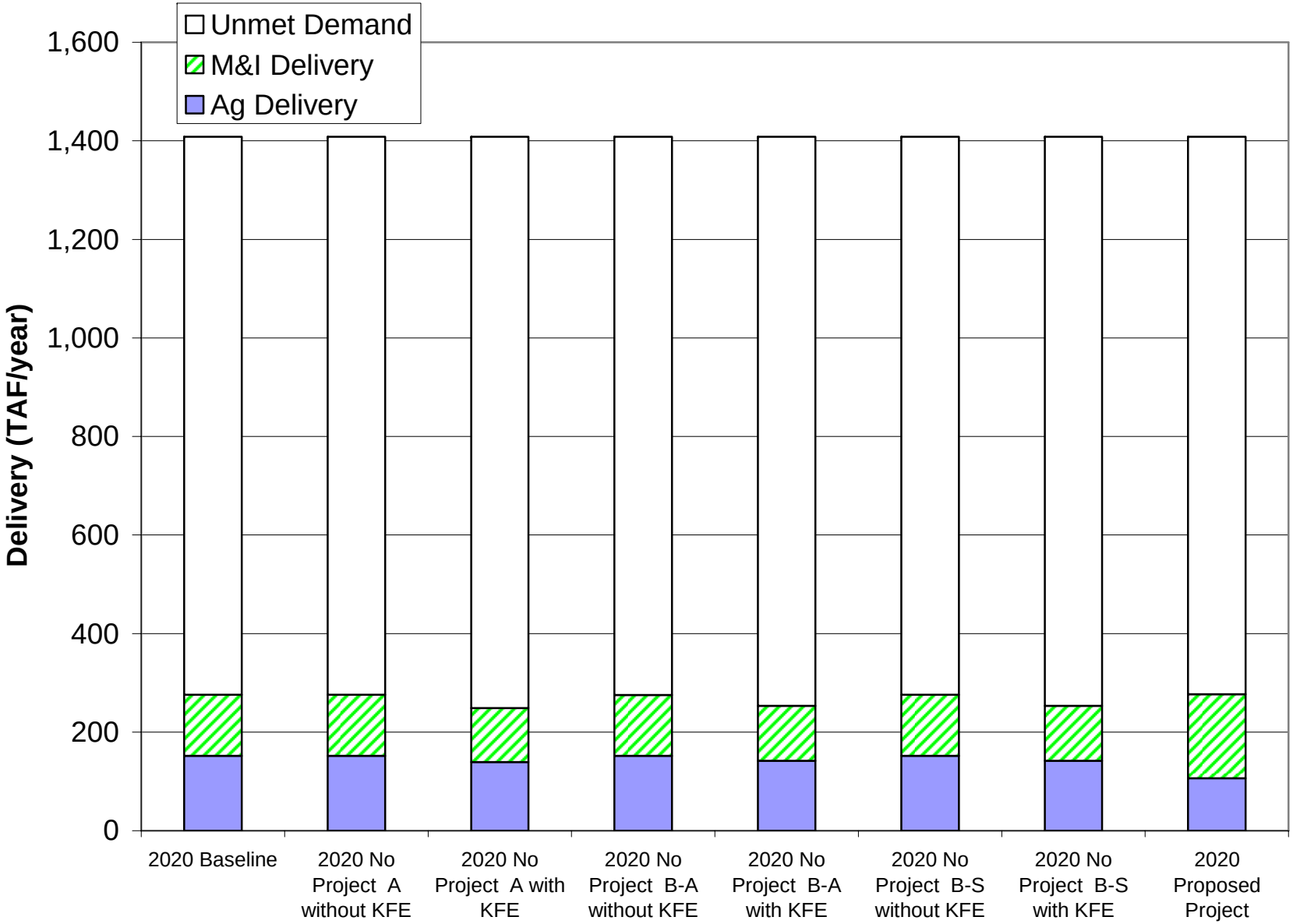


Figure 17c - Average Annual Unscheduled SWP Deliveries in Above Normal Years in the 2020 Scenarios

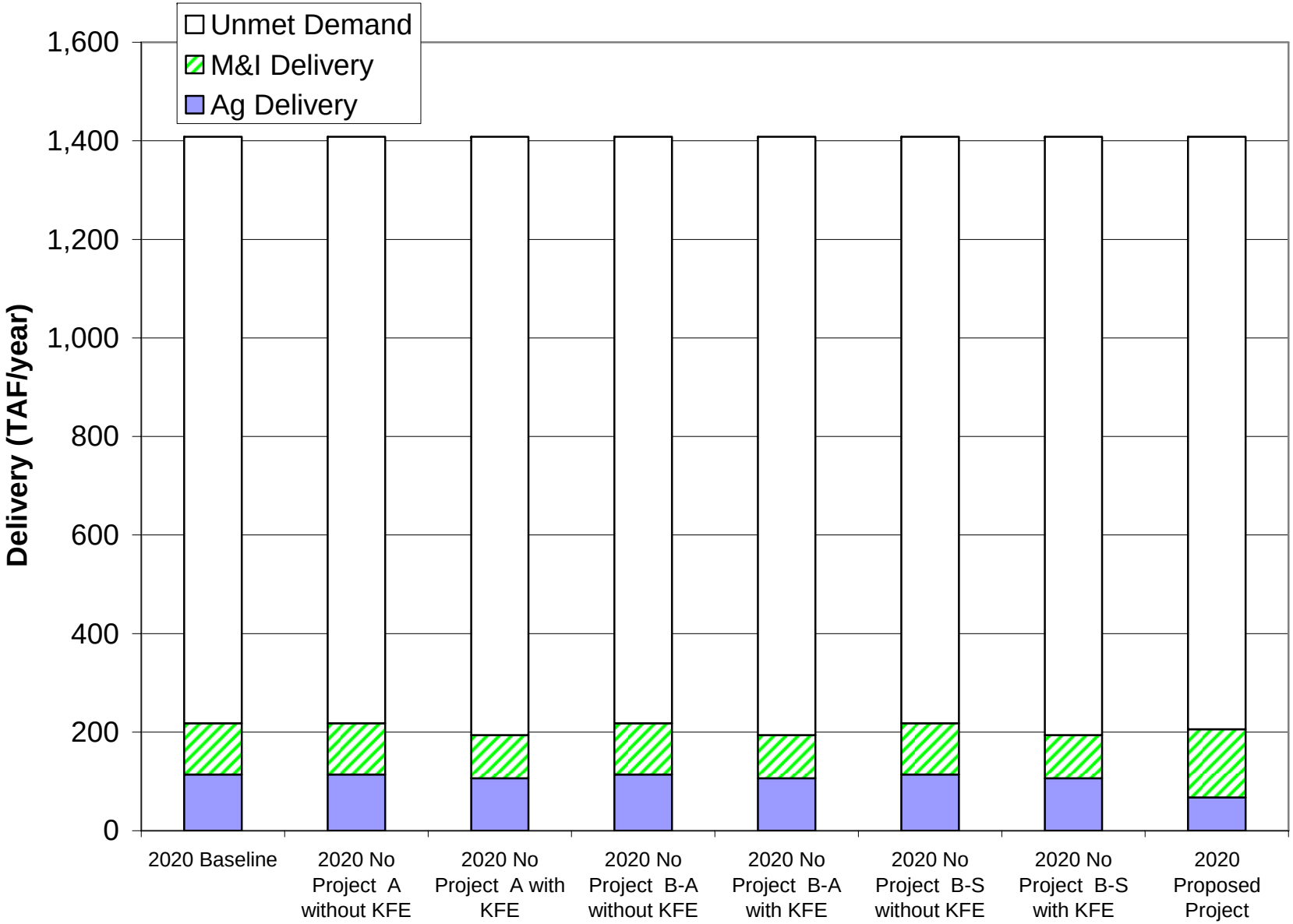


Figure 17d - Average Annual Unscheduled SWP Deliveries in Below Normal Years in the 2020 Scenarios

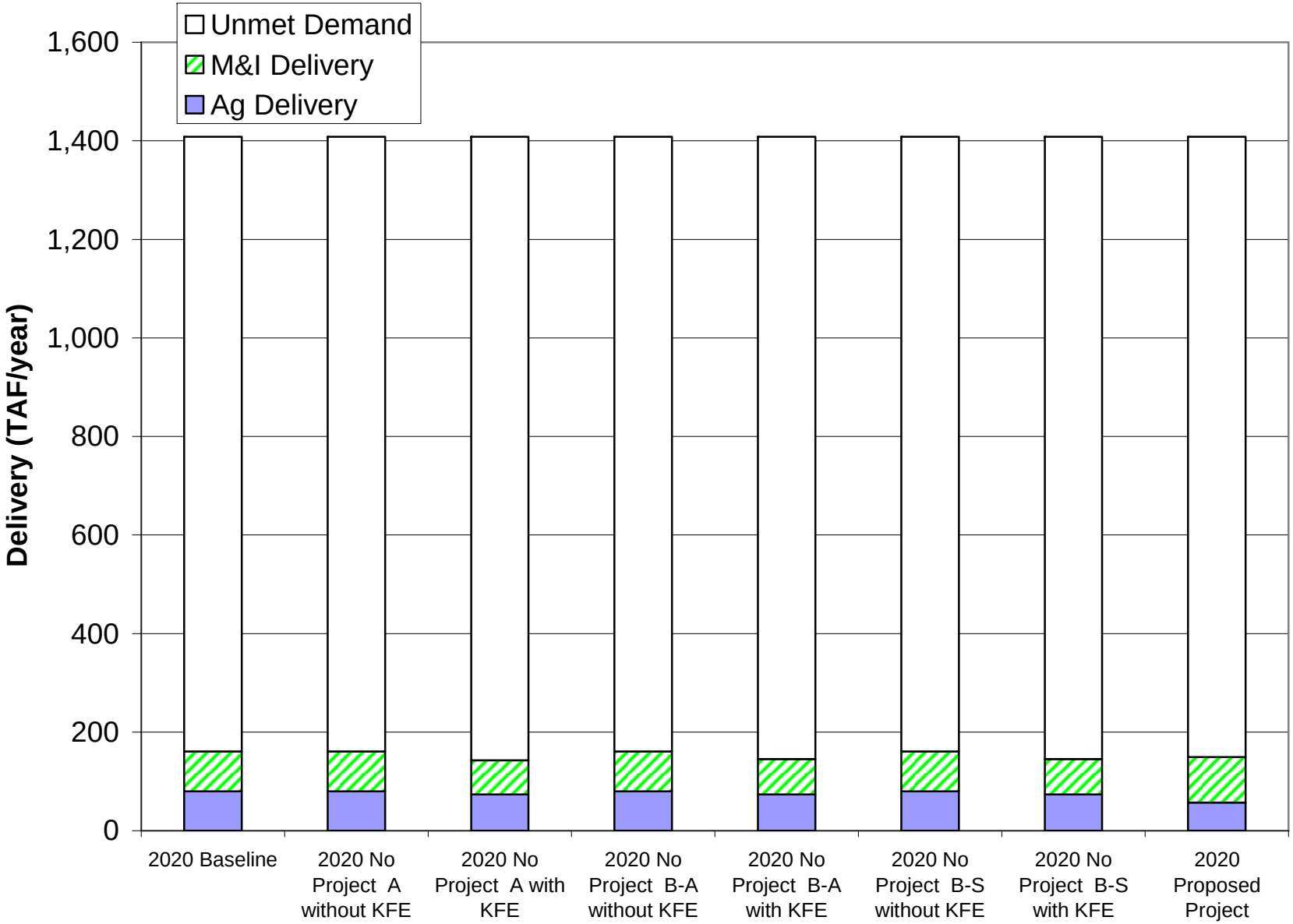


Figure 17e - Average Annual Unscheduled SWP Deliveries in Dry Years in the 2020 Scenarios

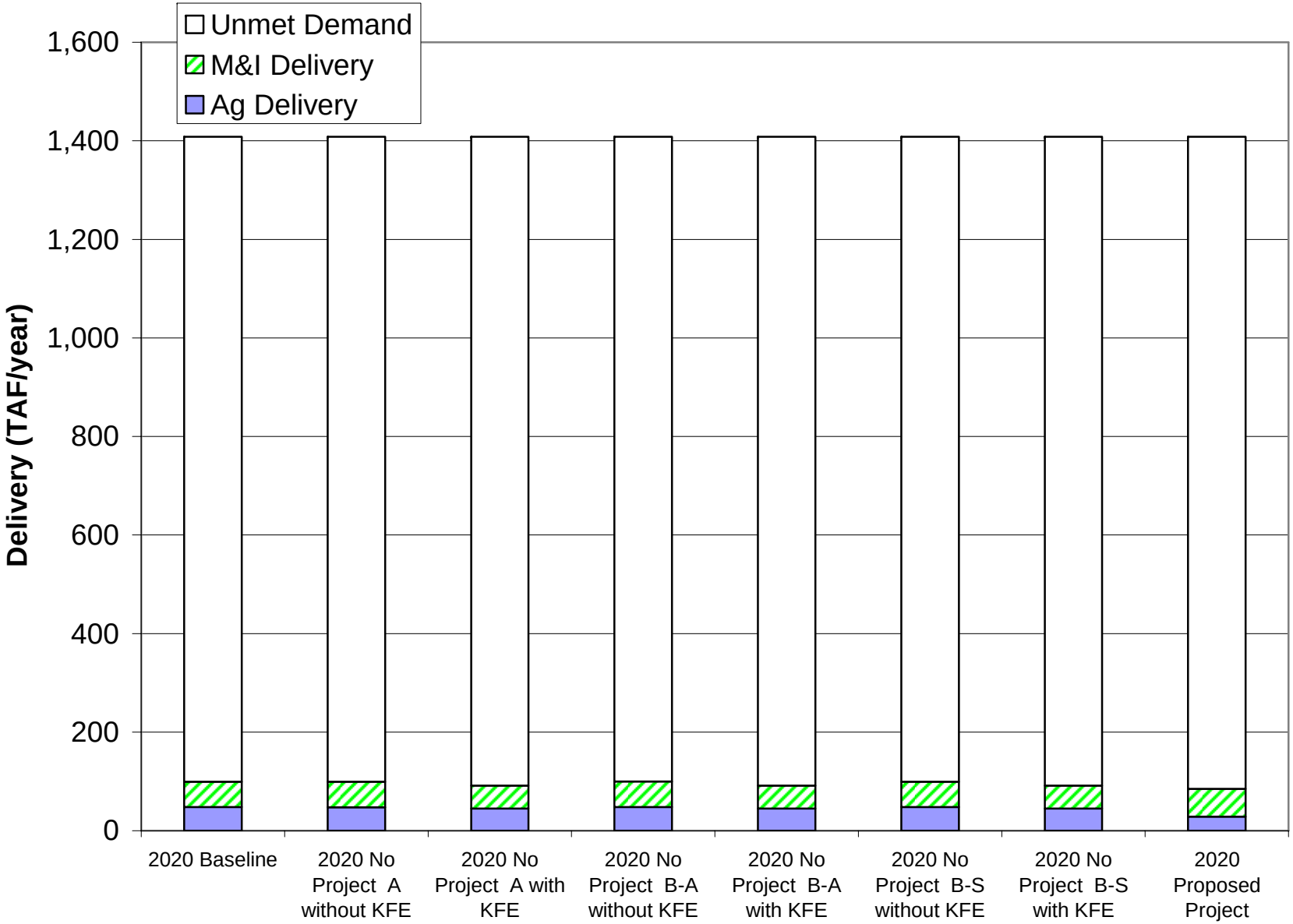
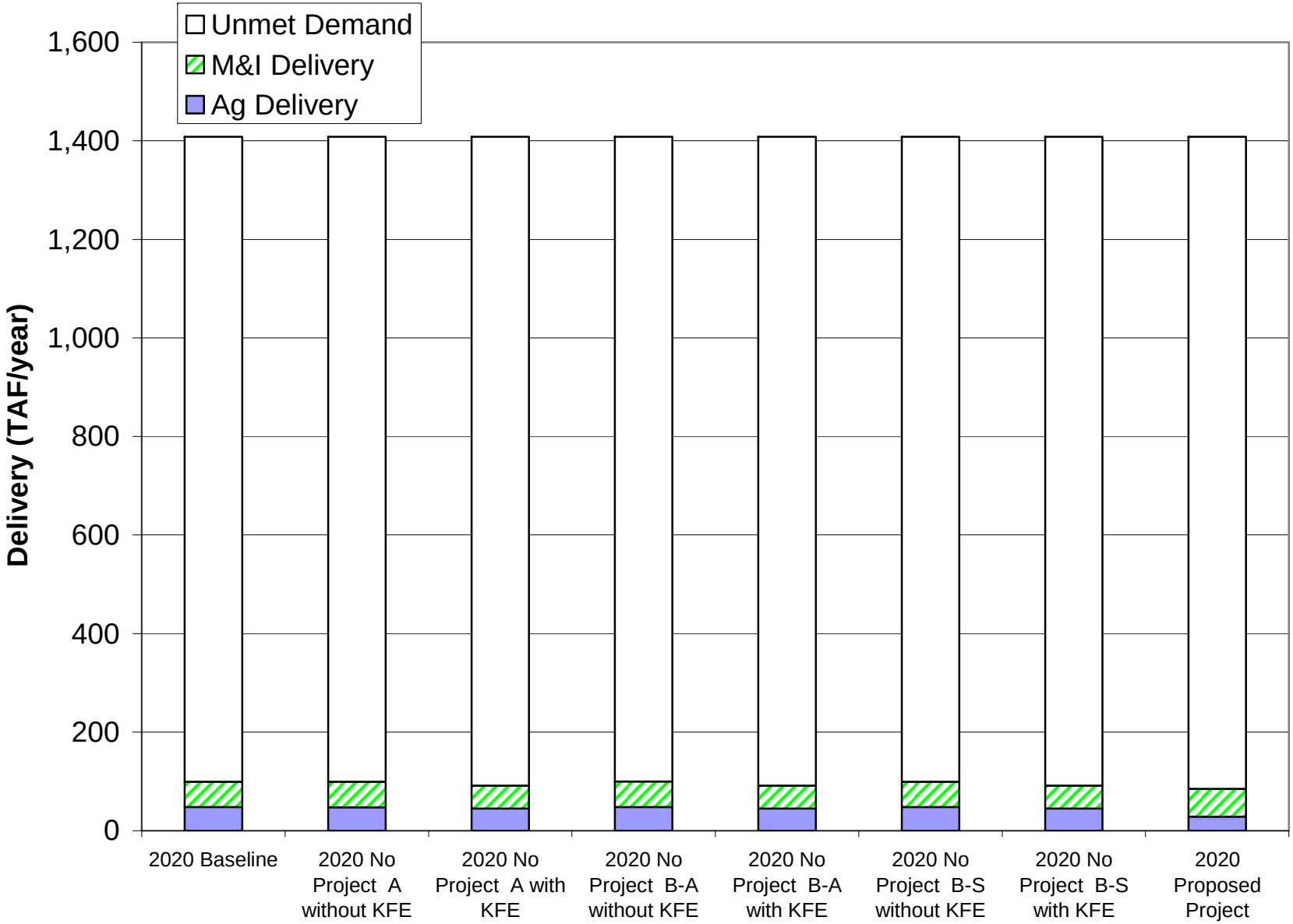


Figure 17f - Average Annual Unscheduled SWP Deliveries in Critical Years in the 2020 Scenarios



3.1.3. Article 18(a) Agricultural Deficiency in No Project Scenarios

Under Article 18(a) in the Baseline and No Project Alternatives, agricultural contractors receive an initial cut in Table A deliveries in years when SWP allocation is less than 100%. This cut can total up to 50% of their Table A amounts in any one year or up to a cumulative total of 100% of their Table A amounts over any seven year period. Table 17 shows the average annual agricultural deficiency in each Baseline and No Project scenario and the number of years in which deficiencies occurred in each scenario. Figures 18a through 18c show the frequency distribution of agricultural deficiencies and Figures 19a through 19c show the cumulative deficiencies throughout the course of the simulation at each level of development.

Table 17 - Agricultural Deficiency in each No Project Scenario

Scenario	Number of Years with Agricultural Deficiency	Average Annual Agricultural Deficiency (TAF/year)
1994 Baseline	19	77.3
2003 Baseline	33	92.4
2003 No Project A without KFE	20	87.4
2003 No Project A with KFE	20	87.4
2003 No Project B without KFE	7	20.9
2003 No Project B with KFE	5	20.7
2020 Baseline	29	148.5
2020 No Project A without KFE	29	148.5
2020 No Project A with KFE	29	148.5
2020 No Project B without KFE	8	23.8
2020 No Project B with KFE	7	21.1

There are larger agricultural deficiencies at the 2020 level of development as compared to the 1994 and 2003 levels of development because M&I demands increase and therefore reduce the amount of water available for delivery to agriculture.

Agricultural deficiencies are similar in the Baseline and No Project Alternative A scenarios at each level of development. In the 2003 level of development, the Baseline has more years with agricultural deficiencies than in No Project Alternative A, but the quantities during these additional years are small, resulting in only minor differences in average and cumulative agricultural deficiencies.

Agricultural deficiencies occur more often in the Baseline and No Project Alternative A as compared to No Project Alternative B. In No Project Alternative B Table A amounts are reduced, which greatly reduces the number of years in which Table A allocations are less than 100%.

Figure 18a - Frequency of Article 18(a) Agricultural Deficiency at the 1994 Level of Development

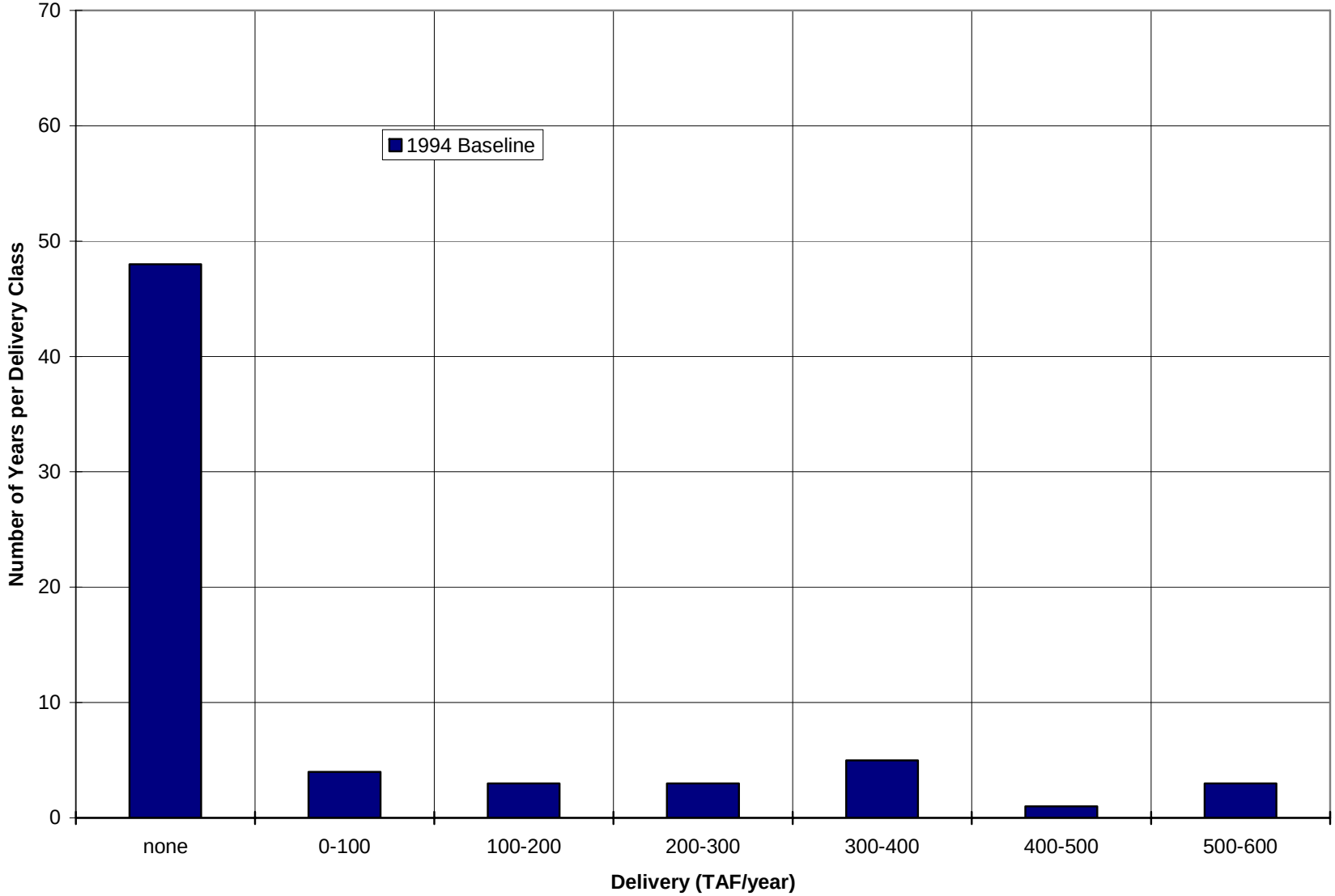


Figure 18b - Frequency of Article 18(a) Agricultural Deficiency at the 2003 Level of Development

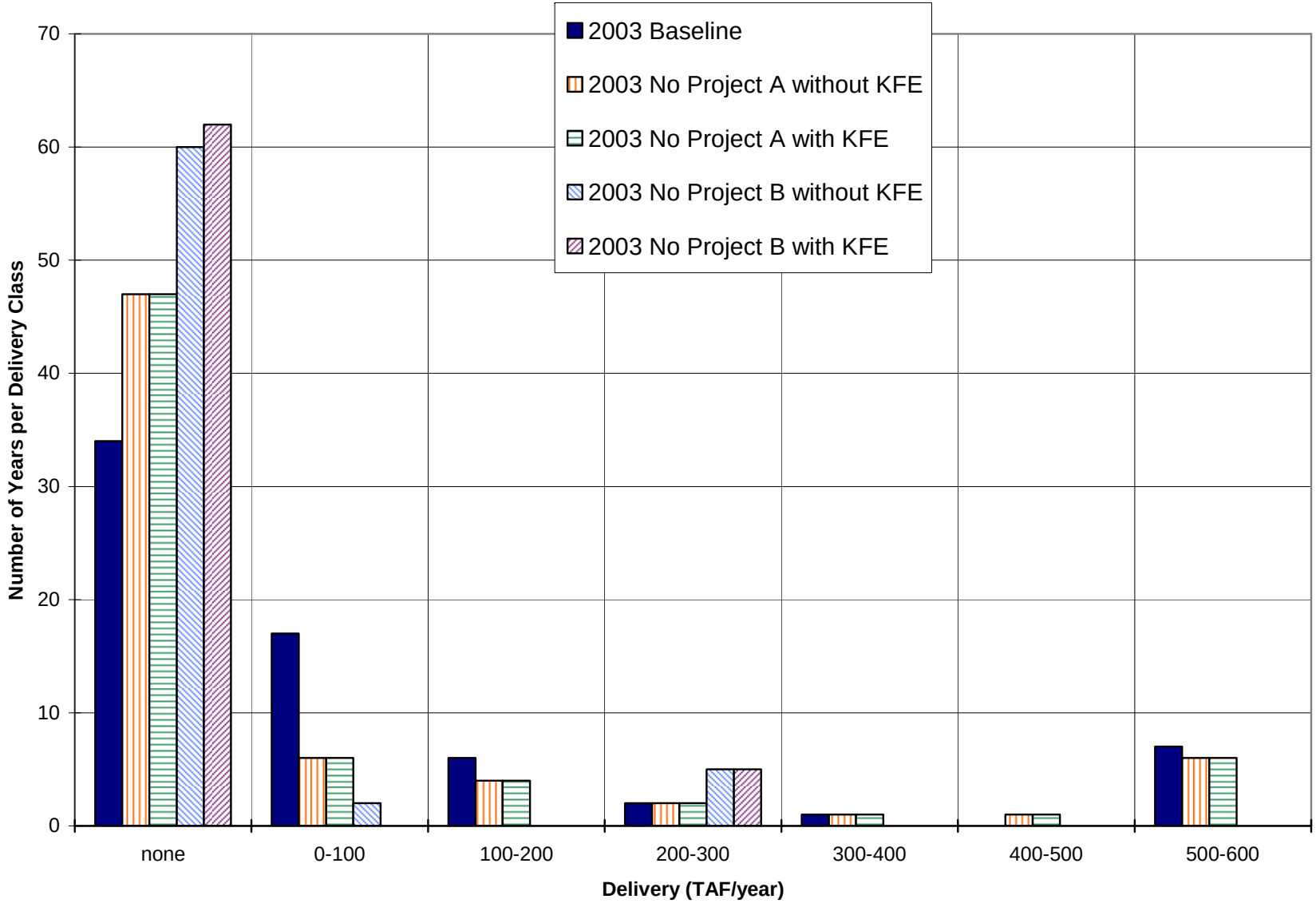


Figure 18c - Frequency of Article 18(a) Agricultural Deficiency at the 2020 Level of Development

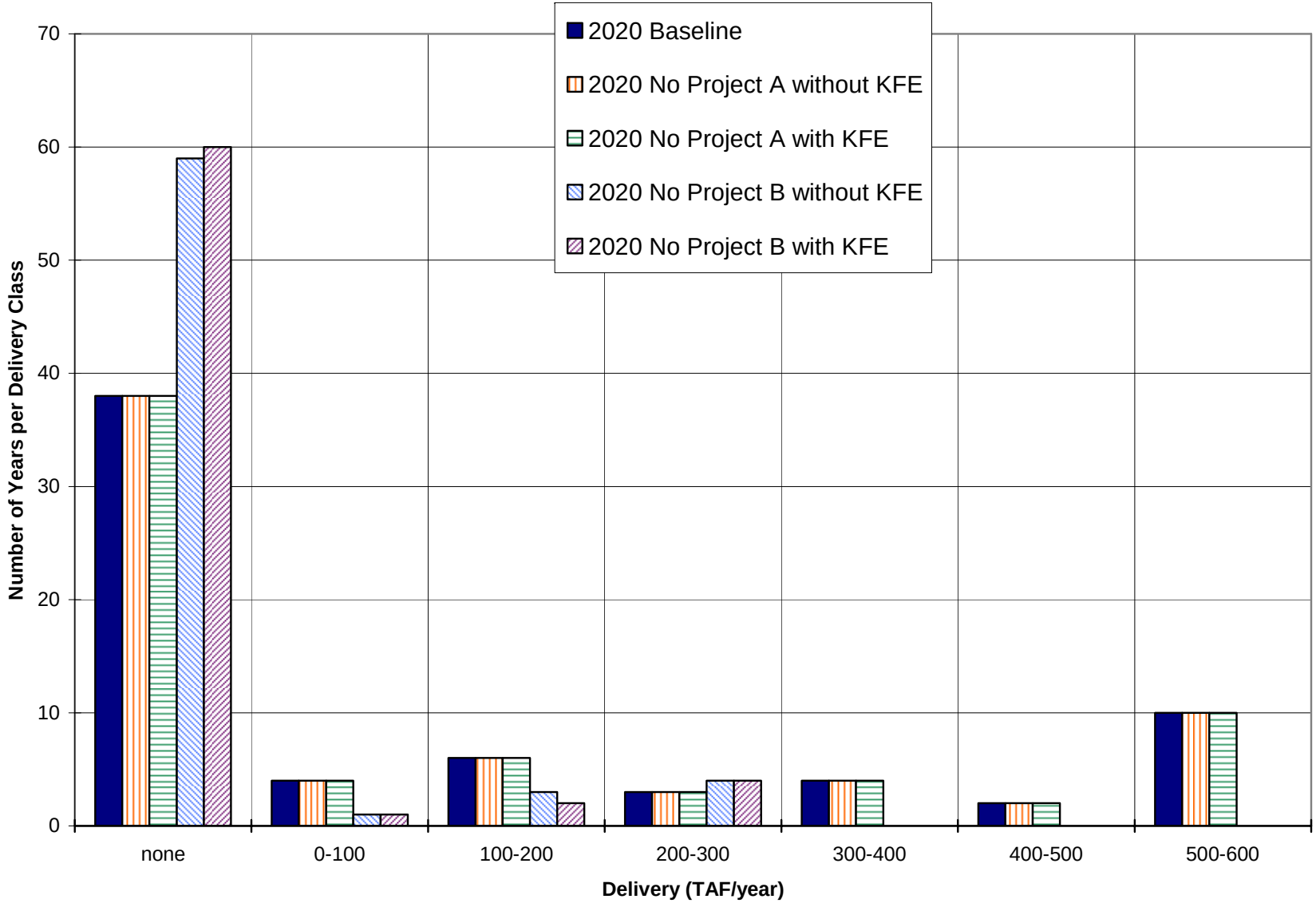


Figure 19a - Cumulative Article 18(a) Agricultural Deficiency at the 1994 Level of Development

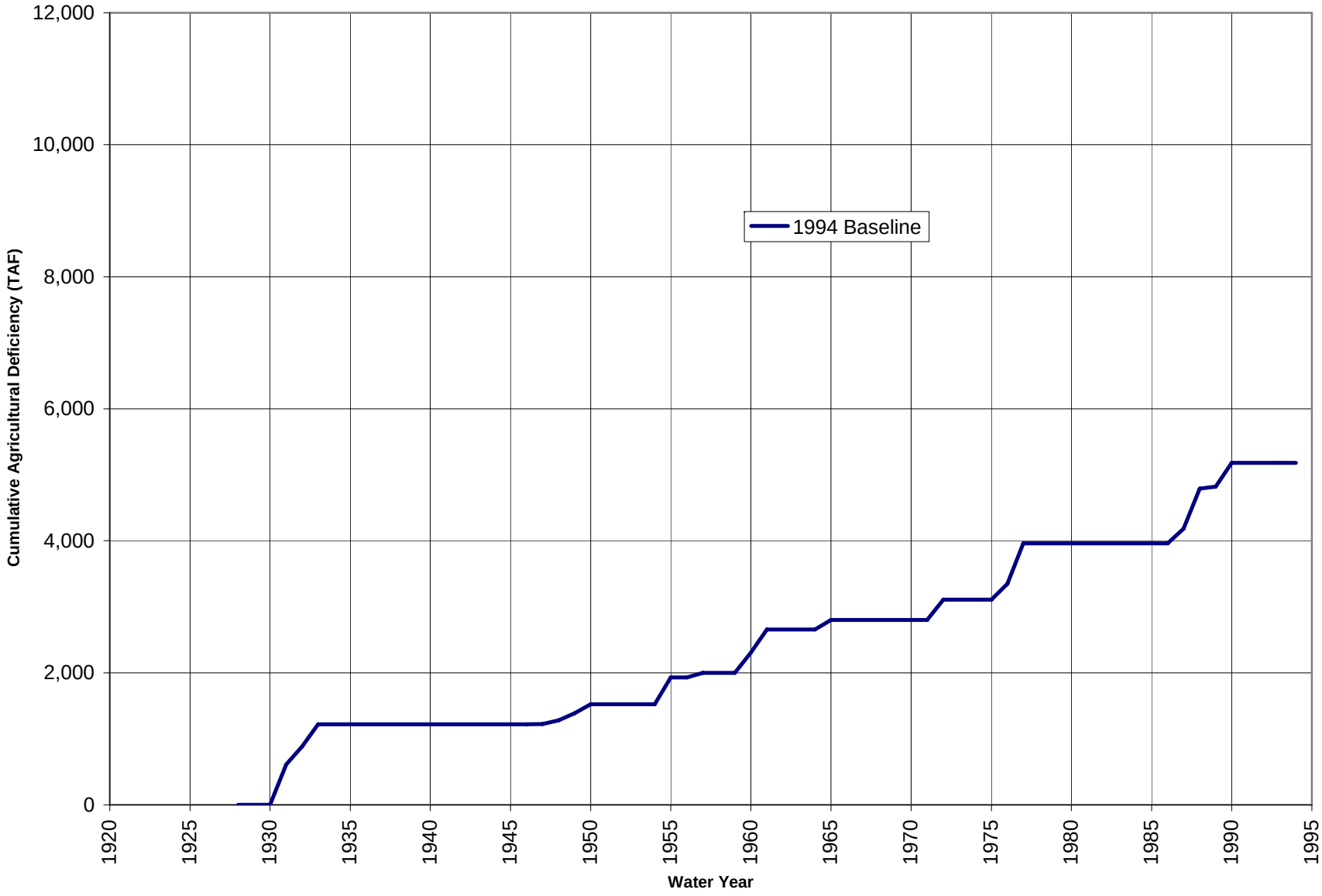


Figure 19b - Cumulative Article 18(a) Agricultural Deficiency at the 2003 Level of Development

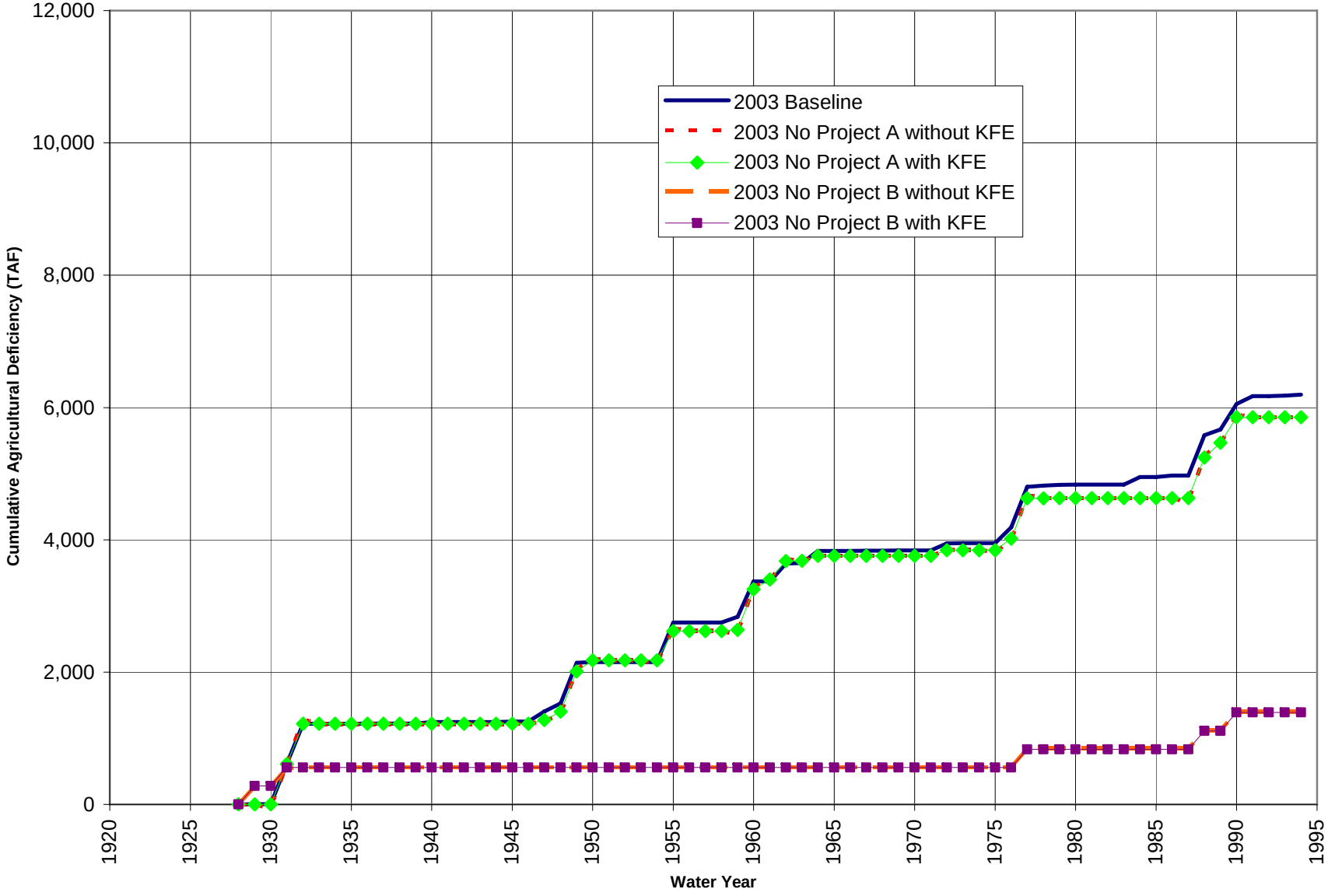
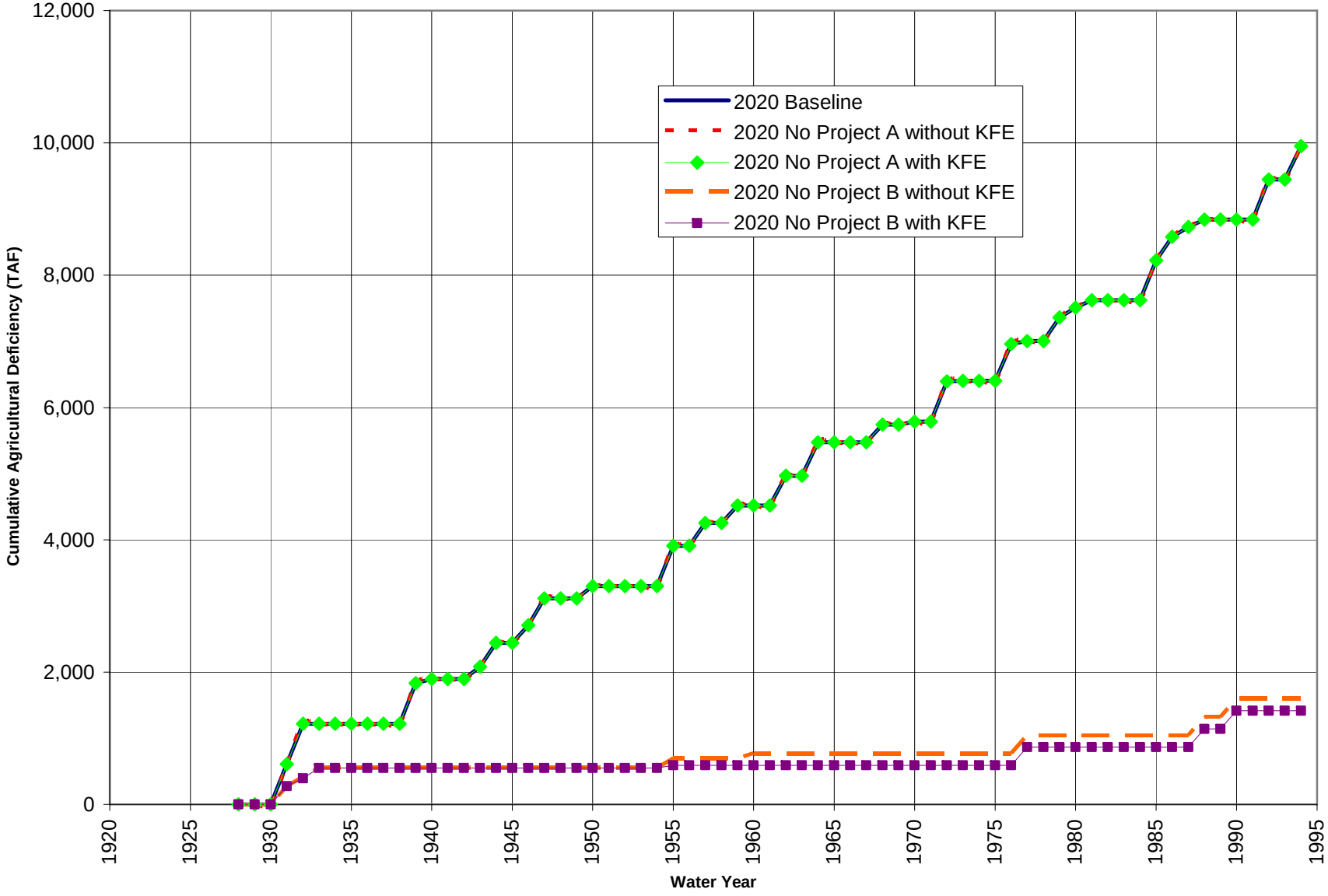


Figure 19c - Cumulative Article 18(a) Agricultural Deficiency at the 2020 Level of Development



3.1.4. Differences Between the Baseline and the Proposed Project and No Project Alternatives

Tables 18a through 18d show the difference in average annual scheduled deliveries to each contractor at the 2003 level of development in each scenario relative to the Baseline for all years and for dry and critical years. Tables 19a through 19d show the same information for the 2020 scenarios.

In both 2003 and 2020, M&I contractors receive more scheduled deliveries in the No Project A scenario and the Proposed Project scenario than in the Baseline, while agricultural contractors receive less deliveries in the No Project A scenario and the Proposed Project scenario than in the Baseline. In the No Project B scenarios, agricultural contractors receive more scheduled deliveries and M&I contractors receive less relative to the Baseline. In No Project Alternative A, this occurs because of Table A transfers from agricultural contractors to M&I contractors. In the Proposed Project, there are more Table A transfers than in No Project Alternative A, but the increase in M&I deliveries is less because the Table A allocation rules shift from those in which M&I contractors receive priority in deliveries to those in which agricultural and M&I contractors share cuts equally. In the No Project B scenarios, the XA Amount allocation rules result in greater deliveries to agricultural contractors than occur under the Baseline, with the increase in agricultural deliveries and reduction in M&I deliveries being greatest in No Project Alternative B-S.

Table 18a - Change in Average Annual Scheduled Deliveries from the Baseline at the 2003 Level of Development (TAF/year)

SWP CONTRACTOR	2003 Baseline		2003 No Project A	2003 No Project A without KFE		2003 No Project A with KFE		2003 Proposed Project		
	Max Demand	Value	Max Demand	Value	Change	Value	Change	Max Demand	Value	Change
Napa	6.8	6.4	6.8	6.5	0.0	6.5	0.0	6.8	6.4	0.0
Solano	37.7	34.2	37.7	34.2	0.0	34.4	0.2	37.7	34.3	0.0
Zone 7	46.0	40.8	66.5	57.3	16.2	57.5	16.3	66.5	59.3	18.5
Alameda	35.2	31.9	35.2	31.9	0.0	32.0	0.1	35.2	35.2	3.3
Santa Clara	84.7	76.6	84.7	76.7	0.1	76.9	0.4	84.7	75.3	-1.3
Oak Flat	5.7	4.3	5.7	4.5	0.1	4.5	0.1	5.7	4.7	0.3
Kings	4.0	3.0	9.0	7.1	0.2	7.2	0.2	9.0	7.3	4.3
Dudley Ridge	57.7	43.9	61.7	48.2	1.0	48.3	1.1	57.3	46.8	3.0
Empire W.S.	3.0	2.3	3.0	2.3	0.1	2.3	0.1	3.0	2.4	0.2
KCWA (M&I)	134.6	119.4	134.6	119.5	0.0	119.8	0.4	134.6	117.8	-1.6
KCWA (Agric.)	1,018.8	774.7	945.8	736.8	-41.5	738.0	-40.3	864.1	705.7	-69.0
Tulare	118.5	90.1	96.3	74.6	1.6	74.7	1.8	96.3	78.6	-11.5
SLO	4.4	4.3	4.4	4.3	0.0	4.3	0.0	4.4	4.2	0.0
Santa Barbara	26.3	25.2	26.3	25.2	0.0	25.3	0.1	26.3	24.9	-0.2
AVEK	64.9	61.8	64.9	61.8	0.0	62.1	0.3	64.9	61.3	-0.5
Castaic (Agric.)	12.7	9.7	12.7	9.9	0.2	9.9	0.2	12.7	10.4	0.7
Castaic (M&I)	41.5	36.8	41.5	36.8	0.0	36.9	0.1	68.6	61.1	24.3
Coachella	19.3	17.5	19.3	17.5	0.0	17.6	0.1	19.3	17.8	0.3
Crestline	1.9	1.9	1.9	1.9	0.0	1.9	0.0	1.9	1.8	0.0
Desert	31.2	28.3	31.2	28.3	0.0	28.4	0.1	31.2	27.8	-0.5
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.0	13.2	13.0	0.0	13.1	0.0	13.2	13.0	0.0
MWDSC	2,011.5	1,310.0	2,011.5	1,311.4	1.2	1,315.5	5.4	2,011.5	1,284.6	-25.4
Palmdale	14.9	13.5	14.9	13.5	0.0	13.5	0.1	14.9	13.5	0.1
San Bernardino	69.8	64.4	69.8	64.5	0.1	64.7	0.3	69.8	63.5	-0.9
San Gabriel	18.1	16.8	18.1	16.8	0.0	16.9	0.1	18.1	16.6	-0.2
San Gorgonio	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0
Ventura	5.0	4.9	5.0	4.9	0.0	4.9	0.0	5.0	4.9	0.0
Total Agriculture	1,220.4	928.0	1,134.2	883.5	-38.3	884.9	-36.8	1,048.1	855.9	-72.1
Total M&I	2,667.1	1,907.7	2,687.6	1,926.1	17.8	1,932.2	23.9	2,714.7	1,923.6	15.9
Total	3,887.5	2,835.7	3,821.8	2,809.7	-20.4	2,817.2	-12.9	3,762.8	2,779.5	-56.2

Table 18b - Change in Average Annual Scheduled Deliveries from the Baseline at the 2003 Level of Development (TAF/year)

SWP CONTRACTOR	2003 Baseline		2003 No Project B	2003 No Project B-A without KFE		2003 No Project B-A with KFE		2003 No Project B-S without KFE		2003 No Project B-S with KFE	
	Max Demand	Value	Max Demand	Value	Value	Change	Value	Change	Change	Value	Change
Napa	6.8	6.4	6.8	6.4	0.0	6.4	0.0	7.2	0.8	7.2	0.8
Solano	37.7	34.2	37.7	33.3	-0.9	33.4	-0.8	30.4	-3.8	30.5	-3.7
Zone 7	46.0	40.8	46.0	38.3	-2.6	38.3	-2.5	36.8	-4.0	36.8	-4.0
Alameda	35.2	31.9	35.2	30.8	-1.0	30.9	-1.0	29.9	-2.0	29.9	-1.9
Santa Clara	84.7	76.6	84.7	74.0	-2.6	74.2	-2.4	71.7	-4.9	71.8	-4.8
Oak Flat	5.7	4.3	5.7	4.6	0.3	4.6	0.3	5.2	0.9	5.3	0.9
Kings	4.0	3.0	4.0	3.2	0.2	3.3	0.2	3.7	0.7	3.7	0.7
Dudley Ridge	57.7	43.9	57.7	46.8	2.9	46.9	3.0	53.8	9.9	53.9	10.0
Empire W.S.	3.0	2.3	3.0	2.4	0.2	2.4	0.2	2.8	0.5	2.8	0.5
KCWA (M&I)	134.6	119.4	134.6	111.9	-7.5	112.2	-7.2	108.1	-11.3	108.4	-11.1
KCWA (Agric.)	1,018.8	774.7	1,018.8	826.8	52.1	828.5	53.8	834.2	59.5	836.1	61.4
Tulare	118.5	90.1	118.5	96.2	6.1	96.4	6.3	110.4	20.3	110.6	20.5
SLO	4.4	4.3	4.4	4.2	0.0	4.3	0.0	4.2	0.0	4.3	0.0
Santa Barbara	26.3	25.2	26.3	25.1	-0.1	25.2	0.0	24.5	-0.7	24.6	-0.6
AVEK	64.9	61.8	64.9	61.5	-0.3	61.8	0.0	61.4	-0.4	61.6	-0.2
Castaic (Agric.)	12.7	9.7	12.7	10.3	0.6	10.3	0.7	11.8	2.2	11.9	2.2
Castaic (M&I)	41.5	36.8	41.5	34.5	-2.3	34.6	-2.2	33.1	-3.7	33.2	-3.6
Coachella	19.3	17.5	19.3	16.9	-0.6	17.0	-0.5	16.6	-0.8	16.7	-0.8
Crestline	1.9	1.9	1.9	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0
Desert	31.2	28.3	31.2	27.5	-0.8	27.5	-0.8	27.0	-1.3	27.1	-1.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.0	13.2	13.0	0.0	13.1	0.0	13.0	0.0	13.1	0.0
MWDSC	2,011.5	1,310.0	2,011.5	1,268.2	-41.8	1,271.9	-38.0	1,250.8	-59.2	1,254.4	-55.6
Palmdale	14.9	13.5	14.9	13.0	-0.5	13.0	-0.5	12.5	-0.9	12.5	-0.9
San Bernardino	69.8	64.4	69.8	63.3	-1.1	63.5	-0.9	63.1	-1.3	63.3	-1.1
San Gabriel	18.1	16.8	18.1	16.6	-0.2	16.6	-0.2	16.5	-0.3	16.6	-0.2
San Gorgonio	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
Ventura	5.0	4.9	5.0	4.9	0.0	4.9	0.0	4.9	0.0	4.9	0.0
Total Agriculture	1,220.4	928.0	1,220.4	990.4	62.4	992.4	64.4	1,021.9	93.9	1,024.3	96.3
Total M&I	2,667.1	1,907.7	2,667.1	1,845.3	-62.4	1,850.7	-57.0	1,813.8	-93.9	1,818.9	-88.8
Total	3,887.5	2,835.7	3,887.5	2,835.7	0.0	2,843.2	7.4	2,835.7	0.0	2,843.2	7.5

Table 18c - Change in Average Annual Scheduled Deliveries from the Baseline in Dry & Critical Years at the 2003 Level of Development (TAF/year)

SWP CONTRACTOR	2003 Baseline		2003 No Project A	2003 No Project A without KFE		2003 No Project A with KFE		2003 Proposed Project		
	Max Demand	Value	Max Demand	Value	Change	Value	Change	Max Demand	Value	Change
Napa	6.8	5.8	6.8	5.9	0.0	6.0	0.1	6.8	5.7	-0.1
Solano	37.7	28.4	37.7	28.4	0.1	28.7	0.4	37.7	28.5	0.1
Zone 7	46.0	32.1	66.5	42.7	10.4	43.0	10.7	66.5	47.2	15.0
Alameda	35.2	26.2	35.2	26.4	0.1	26.7	0.4	35.2	35.2	9.0
Santa Clara	84.7	62.9	84.7	63.3	0.3	63.9	0.9	84.7	59.5	-3.4
Oak Flat	5.7	2.8	5.7	2.9	0.1	2.9	0.1	5.7	3.5	0.6
Kings	4.0	2.0	9.0	4.6	0.1	4.6	0.2	9.0	5.5	3.5
Dudley Ridge	57.7	28.7	61.7	31.7	0.9	31.9	1.1	57.3	34.8	6.1
Empire W.S.	3.0	1.5	3.0	1.5	0.0	1.6	0.1	3.0	1.8	0.3
KCWA (M&I)	134.6	93.9	134.6	94.0	0.1	94.9	0.9	134.6	89.6	-4.4
KCWA (Agric.)	1,018.8	506.2	945.8	486.0	-23.0	489.2	-19.8	864.1	524.4	18.2
Tulare	118.5	58.9	96.3	49.5	1.4	49.8	1.7	96.3	58.4	-0.5
SLO	4.4	4.0	4.4	4.0	0.0	4.1	0.1	4.4	3.9	-0.1
Santa Barbara	26.3	23.3	26.3	23.4	0.1	23.7	0.3	26.3	22.7	-0.6
AVEK	64.9	56.6	64.9	56.7	0.1	57.4	0.8	64.9	55.3	-1.3
Castaic (Agric.)	12.7	6.3	12.7	6.5	0.2	6.6	0.2	12.7	7.7	1.4
Castaic (M&I)	41.5	29.0	41.5	29.0	0.0	29.3	0.3	68.6	48.5	19.6
Coachella	19.3	14.4	19.3	14.5	0.1	14.6	0.2	19.3	15.3	0.9
Crestline	1.9	1.8	1.9	1.8	0.0	1.8	0.0	1.9	1.8	0.0
Desert	31.2	23.4	31.2	23.5	0.1	23.8	0.4	31.2	22.2	-1.3
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	12.8	13.2	12.8	0.0	12.8	0.1	13.2	12.8	0.0
MWDSC	2,011.5	1,103.8	2,011.5	1,107.5	3.3	1,118.6	14.4	2,011.5	1,043.3	-60.4
Palmdale	14.9	11.0	14.9	11.1	0.0	11.2	0.2	14.9	11.2	0.2
San Bernardino	69.8	55.3	69.8	55.5	0.2	56.1	0.7	69.8	52.9	-2.4
San Gabriel	18.1	14.7	18.1	14.7	0.0	14.8	0.2	18.1	14.1	-0.6
San Gorgonio	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0
Ventura	5.0	4.8	5.0	4.8	0.0	4.9	0.0	5.0	4.8	0.0
Total Agriculture	1,220.4	606.4	1,134.2	582.8	-20.3	586.6	-16.5	1,048.1	636.1	29.7
Total M&I	2,667.1	1,604.4	2,687.6	1,620.0	14.8	1,636.4	31.1	2,714.7	1,574.4	-29.9
Total	3,887.5	2,210.8	3,821.8	2,202.8	-5.5	2,222.9	14.6	3,762.8	2,210.5	-0.2

Table 18d - Change in Average Annual Scheduled Deliveries from the Baseline in Dry & Critical Years at the 2003 Level of Development (TAF/year)

SWP CONTRACTOR	2003 Baseline		2003 No Project B	2003 No Project B-A without KFE		2003 No Project B-A with KFE		2003 No Project B-S without KFE		2003 No Project B-S with KFE	
	Max Demand	Value	Max Demand	Value	Value	Change	Value	Change	Change	Value	Change
Napa	6.8	5.8	6.8	5.7	-0.1	5.7	-0.1	6.6	0.8	6.7	0.9
Solano	37.7	28.4	37.7	26.1	-2.3	26.3	-2.1	22.0	-6.4	22.2	-6.2
Zone 7	46.0	32.1	46.0	27.8	-4.3	28.1	-4.0	25.9	-6.2	26.1	-6.0
Alameda	35.2	26.2	35.2	23.9	-2.3	24.2	-2.1	22.4	-3.9	22.6	-3.6
Santa Clara	84.7	62.9	84.7	57.2	-5.7	57.8	-5.2	53.5	-9.4	54.0	-9.0
Oak Flat	5.7	2.8	5.7	3.4	0.5	3.4	0.6	3.8	0.9	3.8	1.0
Kings	4.0	2.0	4.0	2.4	0.4	2.4	0.4	2.7	0.8	2.8	0.8
Dudley Ridge	57.7	28.7	57.7	34.0	5.4	34.3	5.6	39.5	10.9	39.8	11.2
Empire W.S.	3.0	1.5	3.0	1.8	0.3	1.8	0.3	2.1	0.6	2.1	0.6
KCWA (M&I)	134.6	93.9	134.6	81.5	-12.5	82.2	-11.8	75.9	-18.0	76.6	-17.4
KCWA (Agric.)	1,018.8	506.2	1,018.8	601.1	94.9	605.7	99.5	630.2	123.9	635.4	129.2
Tulare	118.5	58.9	118.5	69.9	11.0	70.4	11.6	81.2	22.3	81.8	22.9
SLO	4.4	4.0	4.4	4.0	0.0	4.0	0.0	4.0	0.0	4.0	0.0
Santa Barbara	26.3	23.3	26.3	23.1	-0.2	23.4	0.1	21.7	-1.6	21.9	-1.4
AVEK	64.9	56.6	64.9	55.8	-0.8	56.5	-0.1	55.8	-0.8	56.5	-0.1
Castaic (Agric.)	12.7	6.3	12.7	7.5	1.2	7.6	1.2	8.7	2.4	8.8	2.5
Castaic (M&I)	41.5	29.0	41.5	25.1	-3.8	25.3	-3.6	23.3	-5.7	23.5	-5.5
Coachella	19.3	14.4	19.3	13.1	-1.3	13.3	-1.1	12.7	-1.7	12.8	-1.6
Crestline	1.9	1.8	1.9	1.8	0.0	1.8	0.0	1.8	0.0	1.8	0.0
Desert	31.2	23.4	31.2	21.5	-1.9	21.7	-1.7	20.8	-2.6	21.0	-2.5
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	12.8	13.2	12.7	0.0	12.8	0.0	12.7	0.0	12.8	0.0
MWDSC	2,011.5	1,103.8	2,011.5	1,030.1	-73.6	1,040.2	-63.6	1,003.1	-100.6	1,012.6	-91.2
Palmdale	14.9	11.0	14.9	10.0	-1.0	10.1	-1.0	9.3	-1.8	9.3	-1.7
San Bernardino	69.8	55.3	69.8	52.3	-3.0	52.8	-2.5	52.2	-3.1	52.7	-2.6
San Gabriel	18.1	14.7	18.1	14.0	-0.6	14.2	-0.5	14.0	-0.6	14.2	-0.5
San Gorgonio	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
Ventura	5.0	4.8	5.0	4.8	0.0	4.9	0.0	4.8	0.0	4.9	0.0
Total Agriculture	1,220.4	606.4	1,220.4	720.1	113.7	725.5	119.2	768.1	161.7	774.4	168.0
Total M&I	2,667.1	1,604.4	2,667.1	1,490.7	-113.7	1,505.2	-99.2	1,442.6	-161.7	1,456.3	-148.0
Total	3,887.5	2,210.8	3,887.5	2,210.8	0.0	2,230.8	20.0	2,210.8	0.0	2,230.8	20.0

Table 19a - Change in Average Annual Scheduled Deliveries from the Baseline at the 2020 Level of Development (TAF/year)

SWP CONTRACTOR	2020 Baseline		2020 No Project A	2020 No Project A without KFE		2020 No Project A with KFE		2020 Proposed Project		
	Max Demand	Value	Max Demand	Value	Change	Value	Change	Max Demand	Value	Change
Napa	24.9	20.3	28.9	23.1	2.8	23.2	2.9	28.9	22.8	2.4
Solano	42.0	34.3	47.8	38.2	3.9	38.4	4.0	47.8	37.6	3.3
Zone 7	46.0	37.6	80.6	61.2	23.6	61.5	23.9	80.6	63.5	25.9
Alameda	42.0	34.3	42.0	34.3	0.0	34.5	0.1	42.0	33.1	-1.3
Santa Clara	100.0	81.7	100.0	81.7	0.0	82.1	0.4	100.0	78.7	-3.0
Oak Flat	5.7	3.9	5.7	3.9	0.0	3.9	0.0	5.7	4.4	0.5
Kings	4.0	2.7	4.0	6.1	3.4	6.2	3.4	4.0	6.9	4.2
Dudley Ridge	57.7	39.3	61.7	42.0	2.7	42.2	2.9	57.3	44.1	4.8
Empire W.S.	3.0	2.0	3.0	2.0	0.0	2.1	0.0	3.0	2.3	0.3
KCWA (M&I)	134.6	110.0	134.6	110.0	0.0	110.5	0.5	134.6	106.0	-4.0
KCWA (Agric.)	1,018.8	694.1	929.8	633.5	-60.6	636.6	-57.5	848.1	652.0	-42.1
Tulare	118.5	80.7	96.3	65.6	-15.2	65.9	-14.9	96.3	74.0	-6.8
SLO	25.0	20.4	25.0	20.4	0.0	20.5	0.1	25.0	19.7	-0.7
Santa Barbara	45.5	37.2	45.5	37.2	0.0	37.3	0.2	45.5	35.8	-1.4
AVEK	138.4	113.1	141.4	115.1	2.0	115.6	2.5	141.4	111.3	-1.8
Castaic (Agric.)	12.7	8.7	12.7	8.7	0.0	8.7	0.0	12.7	9.8	1.1
Castaic (M&I)	41.5	33.9	41.5	33.9	0.0	34.1	0.1	82.5	65.0	31.0
Coachella	111.2	90.9	133.1	105.8	14.9	106.3	15.4	133.1	104.8	13.9
Crestline	5.8	4.7	5.8	4.7	0.0	4.8	0.0	5.8	4.6	-0.2
Desert	50.0	40.9	54.0	43.6	2.7	43.8	2.9	54.0	42.5	1.7
Littlerock	2.3	1.9	2.3	1.9	0.0	1.9	0.0	2.3	1.8	-0.1
Mojave	50.8	41.5	75.8	58.5	17.0	58.8	17.3	75.8	59.7	18.2
MWDSC	1,911.5	1,562.0	1,911.5	1,562.0	0.0	1,568.8	6.8	1,911.5	1,505.1	-56.9
Palmdale	17.3	14.1	21.3	16.9	2.7	16.9	2.8	21.3	16.8	2.6
San Bernardino	102.6	83.8	102.6	83.8	0.0	84.2	0.4	102.6	80.8	-3.1
San Gabriel	28.8	23.5	28.8	23.5	0.0	23.6	0.1	28.8	22.7	-0.9
San Gorgonio	17.3	14.1	17.3	14.1	0.0	14.2	0.1	17.3	13.6	-0.5
Ventura	20.0	16.3	20.0	16.3	0.0	16.4	0.1	20.0	15.7	-0.6
Total Agriculture	1,220.4	831.4	1,118.1	761.7	-69.7	765.5	-66.0	1,032.1	793.5	-38.0
Total M&I	2,957.5	2,416.8	3,059.8	2,486.5	69.7	2,497.3	80.5	3,100.8	2,441.6	24.7
Total	4,177.9	3,248.2	4,177.9	3,248.2	0.0	3,262.8	14.6	4,132.9	3,235.0	-13.2

Table 19b - Change in Average Annual Scheduled Deliveries from the Baseline at the 2020 Level of Development (TAF/year)

SWP CONTRACTOR	2020 Baseline		2020 No Project B	2020 No Project B-A without KFE		2020 No Project B-A with KFE		2020 No Project B-S without KFE		2020 No Project B-S with KFE	
	Max Demand	Value	Max Demand	Value	Value	Change	Value	Change	Change	Value	Change
Napa	24.9	20.3	24.9	19.6	-0.7	19.7	-0.7	18.0	-2.4	18.0	-2.3
Solano	42.0	34.3	42.0	33.1	-1.2	33.2	-1.1	30.0	-4.3	30.1	-4.2
Zone 7	46.0	37.6	46.0	36.2	-1.4	36.4	-1.2	32.9	-4.7	33.1	-4.5
Alameda	42.0	34.3	42.0	33.1	-1.2	33.2	-1.1	30.3	-4.0	30.4	-3.9
Santa Clara	100.0	81.7	100.0	78.8	-3.0	79.0	-2.7	72.2	-9.5	72.4	-9.3
Oak Flat	5.7	3.9	5.7	4.3	0.4	4.3	0.4	4.7	0.8	4.7	0.8
Kings	4.0	2.7	4.0	3.0	0.3	3.0	0.3	3.3	0.6	3.3	0.6
Dudley Ridge	57.7	39.3	57.7	43.4	4.1	43.7	4.4	47.8	8.5	48.0	8.7
Empire W.S.	3.0	2.0	3.0	2.3	0.2	2.3	0.2	2.5	0.4	2.5	0.5
KCWA (M&I)	134.6	110.0	134.6	106.0	-4.0	106.4	-3.6	96.2	-13.8	96.5	-13.5
KCWA (Agric.)	1,018.8	694.1	1,018.8	767.0	72.9	771.4	77.3	843.7	149.6	848.2	154.1
Tulare	118.5	80.7	118.5	89.2	8.5	89.7	9.0	98.1	17.4	98.7	17.9
SLO	25.0	20.4	25.0	19.7	-0.7	19.8	-0.7	17.9	-2.6	17.9	-2.5
Santa Barbara	45.5	37.2	45.5	35.8	-1.3	35.9	-1.2	32.5	-4.7	32.6	-4.6
AVEK	138.4	113.1	138.4	109.0	-4.1	109.4	-3.7	108.3	-4.8	108.7	-4.4
Castaic (Agric.)	12.7	8.7	12.7	9.6	0.9	9.6	1.0	10.5	1.9	10.6	1.9
Castaic (M&I)	41.5	33.9	41.5	32.7	-1.2	32.8	-1.1	29.7	-4.3	29.8	-4.2
Coachella	111.2	90.9	111.2	87.6	-3.3	87.9	-3.0	87.0	-3.9	87.3	-3.6
Crestline	5.8	4.7	5.8	4.6	-0.2	4.6	-0.2	4.1	-0.6	4.2	-0.6
Desert	50.0	40.9	50.0	39.4	-1.5	39.5	-1.3	39.1	-1.7	39.3	-1.6
Littlerock	2.3	1.9	2.3	1.8	-0.1	1.8	-0.1	1.7	-0.2	1.7	-0.2
Mojave	50.8	41.5	50.8	40.0	-1.5	40.1	-1.4	43.2	1.7	43.3	1.8
MWDSC	1,911.5	1,562.0	1,911.5	1,505.6	-56.4	1,510.6	-51.4	1,443.8	-118.2	1,448.7	-113.3
Palmdale	17.3	14.1	17.3	13.6	-0.5	13.7	-0.5	12.4	-1.8	12.4	-1.7
San Bernardino	102.6	83.8	102.6	80.8	-3.0	81.1	-2.8	87.3	3.4	87.5	3.7
San Gabriel	28.8	23.5	28.8	22.7	-0.9	22.8	-0.8	24.5	1.0	24.6	1.0
San Gorgonio	17.3	14.1	17.3	13.6	-0.5	13.7	-0.5	12.4	-1.8	12.4	-1.7
Ventura	20.0	16.3	20.0	15.8	-0.6	15.8	-0.5	14.3	-2.1	14.3	-2.0
Total Agriculture	1,220.4	831.4	1,220.4	918.8	87.3	924.0	92.6	1,010.6	179.2	1,016.0	184.6
Total M&I	2,957.5	2,416.8	2,957.5	2,329.5	-87.3	2,337.2	-79.6	2,237.6	-179.2	2,245.2	-171.6
Total	4,177.9	3,248.2	4,177.9	3,248.2	0.0	3,261.2	13.0	3,248.2	0.0	3,261.2	13.0

Table 19c - Change in Average Annual Scheduled Deliveries from the Baseline in Dry & Critical Years at the 2020 Level of Development (TAF/year)

SWP CONTRACTOR	2020 Baseline		2020 No Project A	2020 No Project A without KFE		2020 No Project A with KFE		2020 Proposed Project		
	Max Demand	Value	Max Demand	Value	Change	Value	Change	Max Demand	Value	Change
Napa	24.9	14.5	28.9	16.1	1.6	16.3	1.9	28.9	15.3	0.8
Solano	42.0	24.4	47.8	26.5	2.1	27.0	2.5	47.8	25.2	0.8
Zone 7	46.0	26.7	80.6	39.8	13.0	40.5	13.8	80.6	42.6	15.8
Alameda	42.0	24.4	42.0	24.4	0.0	24.8	0.4	42.0	22.2	-2.2
Santa Clara	100.0	58.1	100.0	58.1	0.0	59.1	1.0	100.0	52.8	-5.3
Oak Flat	5.7	2.1	5.7	2.1	0.0	2.2	0.1	5.7	3.0	0.9
Kings	4.0	1.5	4.0	3.4	1.9	3.5	2.0	4.0	4.8	3.2
Dudley Ridge	57.7	21.7	61.7	23.2	1.5	23.7	2.0	57.3	30.3	8.6
Empire W.S.	3.0	1.1	3.0	1.1	0.0	1.2	0.0	3.0	1.6	0.5
KCWA (M&I)	134.6	78.3	134.6	78.3	0.0	79.5	1.3	134.6	71.1	-7.2
KCWA (Agric.)	1,018.8	382.9	929.8	349.4	-33.5	357.7	-25.1	848.1	447.8	65.0
Tulare	118.5	44.5	96.3	36.2	-8.4	37.0	-7.5	96.3	50.8	6.3
SLO	25.0	14.5	25.0	14.5	0.0	14.8	0.2	25.0	13.2	-1.3
Santa Barbara	45.5	26.4	45.5	26.4	0.0	26.9	0.4	45.5	24.0	-2.4
AVEK	138.4	80.5	141.4	81.6	1.1	83.0	2.5	141.4	74.7	-5.8
Castaic (Agric.)	12.7	4.8	12.7	4.8	0.0	4.9	0.1	12.7	6.7	1.9
Castaic (M&I)	41.5	24.1	41.5	24.1	0.0	24.5	0.4	82.5	43.6	19.4
Coachella	111.2	64.7	133.1	72.9	8.2	74.1	9.5	133.1	70.3	5.6
Crestline	5.8	3.4	5.8	3.4	0.0	3.4	0.1	5.8	3.1	-0.3
Desert	50.0	29.1	54.0	30.6	1.5	31.1	2.0	54.0	28.5	-0.6
Littlerock	2.3	1.3	2.3	1.3	0.0	1.4	0.0	2.3	1.2	-0.1
Mojave	50.8	29.5	75.8	38.9	9.4	39.6	10.1	75.8	40.0	10.5
MWDSC	1,911.5	1,111.5	1,911.5	1,111.5	0.0	1,129.7	18.2	1,911.5	1,009.3	-102.2
Palmdale	17.3	10.1	21.3	11.6	1.5	11.8	1.7	21.3	11.2	1.2
San Bernardino	102.6	59.7	102.6	59.7	0.0	60.6	1.0	102.6	54.2	-5.5
San Gabriel	28.8	16.7	28.8	16.7	0.0	17.0	0.3	28.8	15.2	-1.5
San Gorgonio	17.3	10.1	17.3	10.1	0.0	10.2	0.2	17.3	9.1	-0.9
Ventura	20.0	11.6	20.0	11.6	0.0	11.8	0.2	20.0	10.6	-1.1
Total Agriculture	1,220.4	458.6	1,118.1	420.2	-38.5	430.2	-28.5	1,032.1	545.0	86.3
Total M&I	2,957.5	1,719.8	3,059.8	1,758.2	38.4	1,787.3	67.5	3,100.8	1,637.3	-82.5
Total	4,177.9	2,178.4	4,177.9	2,178.4	0.0	2,217.4	39.0	4,132.9	2,182.3	3.9

Table 19d - Change in Average Annual Scheduled Deliveries from the Baseline in Dry & Critical Years at the 2020 Level of Development (TAF/year)

SWP CONTRACTOR	2020 Baseline		2020 No Project B	2020 No Project B-A without KFE		2020 No Project B-A with KFE		2020 No Project B-S without KFE		2020 No Project B-S with KFE	
	Max Demand	Value	Max Demand	Value	Value	Change	Value	Change	Change	Value	Change
Napa	24.9	14.5	24.9	13.3	-1.2	13.5	-1.0	11.2	-3.3	11.4	-3.1
Solano	42.0	24.4	42.0	22.5	-2.0	22.8	-1.7	18.5	-5.9	18.8	-5.7
Zone 7	46.0	26.7	46.0	24.6	-2.1	24.9	-1.8	20.3	-6.4	20.6	-6.1
Alameda	42.0	24.4	42.0	22.5	-2.0	22.8	-1.7	18.9	-5.6	19.2	-5.3
Santa Clara	100.0	58.1	100.0	53.5	-4.7	54.2	-4.0	44.9	-13.2	45.6	-12.6
Oak Flat	5.7	2.1	5.7	2.8	0.6	2.9	0.7	3.3	1.2	3.4	1.2
Kings	4.0	1.5	4.0	2.0	0.5	2.0	0.5	2.4	0.9	2.4	0.9
Dudley Ridge	57.7	21.7	57.7	28.2	6.5	28.9	7.2	34.2	12.6	34.9	13.2
Empire W.S.	3.0	1.1	3.0	1.5	0.3	1.5	0.4	1.8	0.7	1.8	0.7
KCWA (M&I)	134.6	78.3	134.6	72.0	-6.3	72.9	-5.3	59.2	-19.1	60.1	-18.1
KCWA (Agric.)	1,018.8	382.9	1,018.8	498.1	115.3	509.9	127.0	604.5	221.7	616.7	233.8
Tulare	118.5	44.5	118.5	57.9	13.4	59.3	14.8	70.3	25.8	71.7	27.2
SLO	25.0	14.5	25.0	13.4	-1.2	13.5	-1.0	11.0	-3.5	11.2	-3.4
Santa Barbara	45.5	26.4	45.5	24.3	-2.1	24.6	-1.8	20.0	-6.4	20.3	-6.1
AVEK	138.4	80.5	138.4	74.0	-6.5	75.0	-5.5	72.5	-8.0	73.4	-7.1
Castaic (Agric.)	12.7	4.8	12.7	6.2	1.4	6.4	1.6	7.5	2.8	7.7	2.9
Castaic (M&I)	41.5	24.1	41.5	22.2	-1.9	22.5	-1.6	18.3	-5.9	18.5	-5.6
Coachella	111.2	64.7	111.2	59.5	-5.2	60.3	-4.4	58.2	-6.4	59.0	-5.7
Crestline	5.8	3.4	5.8	3.1	-0.3	3.1	-0.2	2.6	-0.8	2.6	-0.8
Desert	50.0	29.1	50.0	26.7	-2.3	27.1	-2.0	26.2	-2.9	26.5	-2.5
Littlerock	2.3	1.3	2.3	1.2	-0.1	1.2	-0.1	1.0	-0.3	1.0	-0.3
Mojave	50.8	29.5	50.8	27.2	-2.4	27.5	-2.0	30.9	1.3	31.2	1.7
MWDSC	1,911.5	1,111.5	1,911.5	1,022.3	-89.2	1,035.7	-75.8	936.9	-174.6	950.0	-161.5
Palmdale	17.3	10.1	17.3	9.3	-0.8	9.4	-0.7	7.6	-2.4	7.7	-2.3
San Bernardino	102.6	59.7	102.6	54.9	-4.8	55.6	-4.1	62.3	2.6	63.0	3.4
San Gabriel	28.8	16.7	28.8	15.4	-1.3	15.6	-1.1	17.5	0.7	17.7	0.9
San Gorgonio	17.3	10.1	17.3	9.3	-0.8	9.4	-0.7	7.6	-2.4	7.7	-2.3
Ventura	20.0	11.6	20.0	10.7	-0.9	10.8	-0.8	8.8	-2.8	8.9	-2.7
Total Agriculture	1,220.4	458.6	1,220.4	596.7	138.1	610.7	152.1	724.1	265.5	738.6	280.0
Total M&I	2,957.5	1,719.8	2,957.5	1,581.7	-138.1	1,602.5	-117.3	1,454.3	-265.4	1,474.6	-245.2
Total	4,177.9	2,178.4	4,177.9	2,178.4	0.0	2,213.2	34.8	2,178.4	0.0	2,213.2	34.8

3.2. Central Valley Project Deliveries

Table 20 shows the average annual deliveries to Central Valley Project (CVP) contractors in all years and in each year type in each scenario. Because the CVP has the same demand in each scenario, the deliveries are similar between the scenarios in all year types.

Table 20 - Average Annual Deliveries to CVP Contractors (TAF/year)

Scenario	Demand	Delivery					
		All Years	*Wet Years*	*Above Normal Years*	*Below Normal Years*	*Dry Years*	*Critical Years*
1994 Baseline	3,460.0	1,762.5	2,224.7	2,078.4	1,859.7	1,605.8	725.9
2003 Baseline	3,460.0	1,741.9	2,238.0	2,049.5	1,858.3	1,562.3	657.0
2003 Proposed Project	3,460.0	1,740.0	2,246.0	2,053.2	1,844.0	1,552.8	656.9
2003 No Project A	3,460.0	1,741.7	2,244.6	2,052.6	1,848.4	1,551.8	666.8
2003 No Project B	3,460.0	1,741.9	2,238.0	2,049.5	1,858.3	1,562.3	657.0
2020 Baseline	3,460.0	1,769.7	2,330.6	2,157.9	1,815.0	1,510.6	686.3
2020 Proposed Project	3,460.0	1,775.2	2,336.0	2,160.2	1,839.1	1,503.8	688.3
2020 No Project A	3,460.0	1,769.7	2,330.6	2,157.9	1,815.0	1,510.6	686.3
2020 No Project B	3,460.0	1,769.7	2,330.6	2,157.9	1,815.0	1,510.6	686.3

3.3. Deliveries to Feather River Area Contractors

Table 21 shows the average annual deliveries to Feather River Service Area (FRSA) agricultural contractors in all years and in each year type in each scenario. Tables 22 and 23 show the same information for the County of Butte and City of Yuba City. In all cases, the deliveries are similar at each level of development between the scenarios in all year types.

Table 21 - Average Annual Deliveries to FRSA Agricultural Contractors (TAF/year)

Scenario	Demand	Delivery					
		All Years	*Wet Years*	*Above Normal Years*	*Below Normal Years*	*Dry Years*	*Critical Years*
1994 Baseline	796.0	762.1	787.3	792.4	788.5	794.0	619.7
2003 Baseline	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2003 Proposed Project	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2003 No Project A	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2003 No Project B	796.0	762.1	787.2	792.3	788.5	793.9	619.7
2020 Baseline	796.0	760.0	783.9	789.5	786.7	793.0	618.7
2020 Proposed Project	796.0	760.0	783.9	789.5	786.7	793.0	618.6
2020 No Project A	796.0	760.0	783.9	789.5	786.7	793.0	618.7
2020 No Project B	796.0	760.0	783.9	789.5	786.7	793.0	618.7

Table 22 - Average Annual Deliveries to County of Butte (TAF/year)

Scenario	Demand	Delivery					
		All Years	*Wet Years*	*Above Normal Years*	*Below Normal Years*	*Dry Years*	*Critical Years*
1994 Baseline	0.2	0.1	0.1	0.1	0.1	0.1	0.1
2003 Baseline	0.5	0.3	0.3	0.3	0.3	0.3	0.2
2003 Proposed Project	0.5	0.3	0.3	0.3	0.3	0.3	0.2
2003 No Project A	0.5	0.3	0.3	0.3	0.3	0.3	0.3
2003 No Project B	0.5	0.3	0.3	0.3	0.3	0.3	0.2
2020 Baseline	27.5	13.1	13.1	15.2	14.5	12.5	11.0
2020 Proposed Project	27.5	13.3	13.3	15.4	14.6	12.7	11.3
2020 No Project A	27.5	13.2	13.1	15.3	14.5	12.7	11.3
2020 No Project B	27.5	13.2	13.1	15.3	14.5	12.7	11.3

Table 23 - Average Annual Deliveries to City of Yuba City (TAF/year)

Scenario	Demand	Delivery					
		All Years	*Wet Years*	*Above Normal Years*	*Below Normal Years*	*Dry Years*	*Critical Years*
1994 Baseline	0.9	0.5	0.5	0.5	0.5	0.3	0.6
2003 Baseline	1.2	0.6	0.6	0.7	0.5	0.5	0.9
2003 Proposed Project	1.2	0.6	0.6	0.7	0.5	0.5	0.9
2003 No Project A	1.2	0.6	0.6	0.6	0.6	0.5	0.9
2003 No Project B	1.2	0.6	0.6	0.7	0.5	0.5	0.9
2020 Baseline	9.6	4.0	3.8	4.5	3.2	3.2	5.8
2020 Proposed Project	9.6	4.0	3.8	4.5	3.2	3.2	6.0
2020 No Project A	9.6	4.0	3.8	4.5	3.2	3.2	5.9
2020 No Project B	9.6	4.0	3.8	4.5	3.2	3.2	5.9

3.4. Flows in the Delta and in North of Delta Rivers

To evaluate the impacts on flows in the Delta and in North of Delta rivers, the EIR will evaluate the following flows and parameters in each of the scenarios (with the applicable CALSIM arc in parenthesis):

- American River flow (C303)
- Feather River flow (C203)
- Sacramento River flow into the Delta (C169)
- San Joaquin River flow at Vernalis (C644)
- Delta Outflow (C407 + D407)
- Minimum Required Delta Outflow (D407)
- SWP Banks Pumping (D419_SWP)
- CVP Banks Pumping (D419_CVP)
- X2 Position (X2_PRV)
- Export/Import Ratio (D418+D419/DELTA-INFLOW)

In the sections below, the EIR compares both annual and monthly values for each of these parameters.

3.4.1. Annual Comparison

Tables 24a and 24b show average annual values in all years and in wet, above normal, below normal, dry and critical years for each parameter in each scenario. The annual values of each of these parameters in the No Project and Proposed Project scenarios are comparable to the Baseline at both the 2003 and 2020 levels of development. Most of the parameters in most year types differ by less than 1%. The only parameter that differs by more than 1% is CVP use of Banks pumping plant. In 2003, CVP use of Banks is greater in the Baseline than in the No Project A and Proposed Project scenarios. In 2020, CVP use of Banks is higher in the Proposed Project than in the Baseline on average but lower in dry and critical years.

A comparison of the parameters between the different year types indicates that as the level of development advances from 1994 to 2003 and then to 2020, the most significant differences are that SWP Banks pumping increases in many years to try to meet the increased SWP demand, with a corresponding decrease in Delta outflow.

3.4.2. Monthly Comparison

Tables 25a through 34b show monthly statistics for each parameter in each scenario. While there is more variation in the monthly values than in the annual values, the values for each parameter are similar between the Baseline and the No Project and Proposed Project scenarios at the same level of development. For every parameter at both levels of development, the difference in all of the statistical measures is less than 1% in a majority of months. And at both the 2003 and 2020 levels of development, no monthly average or median value differs by more than 10% as compared to the Baseline.

Table 24a - Average Annual Flows and Other Delta Parameters for the 1994 and 2003 Scenarios

	American River Flow (TAF/yr)	Feather River Flow (TAF/yr)	Sacramento River Flow into the Delta (TAF/yr)	San Joaquin River at Vernalis (Taf/yr)	Delta Outflow (TAF/yr)	Minimum Required Delta Outflow (TAF/yr)	SWP Banks Pumping (TAF/yr)	CVP Banks Pumping (TAF/yr)	Average X2 Position (km)	Average E/I ratio
1994 Baseline										
All Years	2,401.5	3,011.5	16,106.1	2,805.8	14,435.0	5,551.4	2,945.0	87.3	75.8	0.36
Wet Years	3,856.1	4,802.8	24,593.1	4,902.1	27,790.3	6,801.7	3,628.8	96.7	68.9	0.31
Above Normal Years	2,868.9	3,284.4	19,058.6	3,052.1	16,903.8	6,609.0	3,364.8	144.1	73.6	0.37
Below Normal Years	2,101.0	2,489.1	13,829.9	2,391.5	9,858.7	5,466.6	3,104.2	85.9	76.9	0.40
Dry Years	1,520.0	2,057.4	11,198.5	1,540.1	6,653.3	4,593.3	2,673.2	81.0	79.9	0.42
Critical Years	992.5	1,530.6	7,992.3	1,103.2	4,720.6	3,858.4	1,575.3	33.2	82.6	0.34
2003 Baseline										
All Years	2,416.9	3,081.1	16,307.3	2,864.8	14,656.6	5,609.0	3,000.2	147.7	75.6	0.35
Wet Years	3,883.9	4,826.5	24,655.8	5,039.7	28,007.7	6,821.2	3,592.9	186.0	68.9	0.30
Above Normal Years	2,887.5	3,276.5	19,398.0	2,993.7	17,153.2	6,778.5	3,436.5	181.6	73.5	0.36
Below Normal Years	2,034.8	2,584.1	13,908.0	2,346.9	9,687.8	5,441.9	3,240.0	179.7	77.0	0.40
Dry Years	1,479.3	2,097.6	11,009.5	1,542.3	6,375.0	4,577.5	2,712.8	123.6	79.9	0.40
Critical Years	1,009.4	1,587.3	8,177.8	1,100.0	4,751.7	3,958.3	1,647.7	43.3	82.5	0.32
2003 No Project Alternative A										
All Years	2,416.8	3,080.4	16,298.3	2,864.7	14,673.4	5,607.0	2,983.9	143.3	75.6	0.35
Wet Years	3,883.7	4,837.3	24,642.9	5,040.0	28,028.3	6,826.1	3,586.4	179.8	68.9	0.30
Above Normal Years	2,885.6	3,270.5	19,388.9	2,993.5	17,162.6	6,767.2	3,432.9	175.5	73.5	0.36
Below Normal Years	2,035.9	2,550.6	13,868.7	2,346.1	9,700.6	5,434.5	3,199.9	177.2	77.0	0.40
Dry Years	1,468.4	2,118.4	11,021.2	1,542.2	6,405.8	4,574.0	2,690.5	118.9	79.9	0.40
Critical Years	1,023.2	1,581.1	8,185.2	1,100.3	4,754.5	3,960.0	1,638.9	41.2	82.5	0.32
2003 No Project Alternative B										
All Years	2,416.9	3,081.1	16,307.3	2,864.8	14,656.6	5,609.0	3,000.2	147.7	75.6	0.35
Wet Years	3,883.9	4,826.5	24,655.8	5,039.7	28,007.7	6,821.2	3,592.9	186.0	68.9	0.30
Above Normal Years	2,887.5	3,276.5	19,398.0	2,993.7	17,153.2	6,778.5	3,436.5	181.6	73.5	0.36
Below Normal Years	2,034.8	2,584.1	13,908.0	2,346.9	9,687.8	5,441.9	3,240.0	179.7	77.0	0.40
Dry Years	1,479.3	2,097.6	11,009.5	1,542.3	6,375.0	4,577.5	2,712.8	123.6	79.9	0.40
Critical Years	1,009.4	1,587.3	8,177.8	1,100.0	4,751.7	3,958.3	1,647.7	43.3	82.5	0.32
2003 Proposed Project										
All Years	2,416.9	3,080.6	16,299.0	2,864.7	14,699.0	5,603.6	2,959.5	142.3	75.6	0.35
Wet Years	3,883.2	4,835.2	24,633.8	5,039.5	28,068.5	6,819.1	3,542.9	178.4	68.8	0.30
Above Normal Years	2,889.3	3,249.8	19,369.1	2,993.5	17,186.4	6,769.4	3,389.3	177.0	73.5	0.35
Below Normal Years	2,038.8	2,564.2	13,882.0	2,346.6	9,742.0	5,425.2	3,188.2	172.7	77.0	0.40
Dry Years	1,471.1	2,119.7	11,039.8	1,542.2	6,413.0	4,578.0	2,675.4	120.3	79.9	0.40
Critical Years	1,015.1	1,585.5	8,182.8	1,100.4	4,759.9	3,956.1	1,638.5	40.1	82.5	0.32

Table 24b - Average Annual Flows and Other Delta Parameters for the 2020 Scenarios

	American River Flow (TAF/yr)	Feather River Flow (TAF/yr)	Sacramento River Flow into the Delta (TAF/yr)	San Joaquin River at Vernalis (Taf/yr)	Delta Outflow (TAF/yr)	Minimum Required Delta Outflow (TAF/yr)	SWP Banks Pumping (TAF/yr)	CVP Banks Pumping (TAF/yr)	Average X2 Position (km)	Average E/I ratio
2020 Baseline										
All Years	2,190.9	3,071.3	16,181.0	2,869.1	14,180.1	5,678.3	3,289.0	143.3	76.0	0.36
Wet Years	3,601.4	4,851.1	24,383.9	5,063.8	26,920.2	6,933.3	4,191.0	219.1	69.5	0.33
Above Normal Years	2,613.0	3,341.4	19,373.2	3,006.3	16,699.0	6,868.2	3,774.8	125.6	74.0	0.37
Below Normal Years	1,829.4	2,548.8	13,816.1	2,348.3	9,447.5	5,473.0	3,436.7	125.4	77.3	0.41
Dry Years	1,266.2	2,050.4	10,870.8	1,526.0	6,147.0	4,645.0	2,812.9	131.8	80.2	0.41
Critical Years	885.3	1,531.3	8,208.1	1,091.1	4,772.1	3,980.8	1,682.6	56.0	82.5	0.32
2020 No Project Alternative A										
All Years	2,190.9	3,071.3	16,181.0	2,869.1	14,180.1	5,678.3	3,289.0	143.3	76.0	0.36
Wet Years	3,601.4	4,851.1	24,383.9	5,063.8	26,920.2	6,933.3	4,191.0	219.1	69.5	0.33
Above Normal Years	2,613.0	3,341.4	19,373.2	3,006.3	16,699.0	6,868.2	3,774.8	125.6	74.0	0.37
Below Normal Years	1,829.4	2,548.8	13,816.1	2,348.3	9,447.5	5,473.0	3,436.7	125.4	77.3	0.41
Dry Years	1,266.2	2,050.4	10,870.8	1,526.0	6,147.0	4,645.0	2,812.9	131.8	80.2	0.41
Critical Years	885.3	1,531.3	8,208.1	1,091.1	4,772.1	3,980.8	1,682.6	56.0	82.5	0.32
2020 No Project Alternative B										
All Years	2,190.9	3,071.3	16,181.0	2,869.1	14,180.1	5,678.3	3,289.0	143.3	76.0	0.36
Wet Years	3,601.4	4,851.1	24,383.9	5,063.8	26,920.2	6,933.3	4,191.0	219.1	69.5	0.33
Above Normal Years	2,613.0	3,341.4	19,373.2	3,006.3	16,699.0	6,868.2	3,774.8	125.6	74.0	0.37
Below Normal Years	1,829.4	2,548.8	13,816.1	2,348.3	9,447.5	5,473.0	3,436.7	125.4	77.3	0.41
Dry Years	1,266.2	2,050.4	10,870.8	1,526.0	6,147.0	4,645.0	2,812.9	131.8	80.2	0.41
Critical Years	885.3	1,531.3	8,208.1	1,091.1	4,772.1	3,980.8	1,682.6	56.0	82.5	0.32
2020 Proposed Project										
All Years	2,190.3	3,071.2	16,179.0	2,869.1	14,193.7	5,680.6	3,279.4	144.3	76.0	0.36
Wet Years	3,596.9	4,850.8	24,387.3	5,064.3	26,934.7	6,933.3	4,184.1	219.1	69.5	0.33
Above Normal Years	2,614.5	3,353.2	19,370.9	3,006.3	16,735.4	6,864.4	3,751.3	133.6	74.0	0.37
Below Normal Years	1,830.1	2,525.5	13,799.2	2,348.0	9,444.0	5,477.3	3,420.4	130.9	77.3	0.41
Dry Years	1,268.7	2,071.9	10,887.7	1,526.0	6,177.5	4,658.7	2,813.0	129.8	80.1	0.40
Critical Years	884.3	1,521.6	8,189.8	1,091.0	4,764.4	3,975.2	1,675.3	51.4	82.5	0.32

Table 25a - Monthly Statistics for American River Flow in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	104.2	165.1	207.7	254.5	281.8	225.9	207.2	223.9	233.5	238.5	135.5	123.6
Minimum	33.5	22.3	30.7	24.9	22.2	25.3	18.5	21.9	14.4	21.8	11.6	16.7
Median	100.0	116.5	116.8	117.2	189.5	148.2	172.7	176.9	196.8	277.4	131.0	94.7
Maximum	240.6	1036.8	1216.5	1296.2	1833.9	1019.1	861.8	697.9	859.9	362.2	303.5	302.5
St. Dev.	27.1	161.1	245.0	275.3	282.9	204.3	148.2	158.5	147.2	74.3	77.3	87.4
2003 Baseline												
Average	110.9	159.4	203.7	249.9	284.1	227.5	203.1	222.5	232.9	235.5	150.2	121.7
Minimum	33.8	22.3	30.7	25.1	22.2	24.6	11.2	11.6	12.9	50.3	11.6	16.7
Median	101.0	113.9	116.6	115.9	180.1	150.0	159.2	176.8	198.0	272.6	154.6	96.6
Maximum	281.3	985.5	1138.1	1296.1	1833.8	1019.1	861.7	697.9	859.9	362.1	303.5	302.5
St. Dev.	29.6	158.3	242.7	276.6	281.2	204.3	146.7	159.9	147.4	72.8	85.6	80.4
2003 No Project Alternative A												
Average	107.9	162.8	204.6	247.7	284.2	227.1	203.3	222.3	233.3	238.1	150.6	119.3
Minimum	23.1	22.3	30.7	15.4	13.9	20.1	18.5	21.9	12.6	47.1	16.2	16.8
Median	101.1	114.9	116.6	115.7	184.4	150.8	158.8	176.8	197.9	272.6	142.0	95.1
Maximum	267.5	987.7	1158.1	1296.1	1833.8	1019.1	861.7	697.9	859.9	362.1	303.5	302.5
St. Dev.	33.0	157.4	242.9	278.4	281.3	204.6	146.8	160.1	146.3	70.5	84.4	84.1
2003 No Project Alternative B												
Average	110.9	159.4	203.7	249.9	284.1	227.5	203.1	222.5	232.9	235.5	150.2	121.7
Minimum	33.8	22.3	30.7	25.1	22.2	24.6	11.2	11.6	12.9	50.3	11.6	16.7
Median	101.0	113.9	116.6	115.9	180.1	150.0	159.2	176.8	198.0	272.6	154.6	96.6
Maximum	281.3	985.5	1138.1	1296.1	1833.8	1019.1	861.7	697.9	859.9	362.1	303.5	302.5
St. Dev.	29.6	158.3	242.7	276.6	281.2	204.3	146.7	159.9	147.4	72.8	85.6	80.4
2003 Proposed Project Alternative												
Average	108.7	161.6	204.7	250.1	283.2	227.7	203.3	222.4	233.9	237.2	149.4	119.1
Minimum	33.9	22.3	30.7	25.0	22.2	24.6	18.5	21.9	12.8	57.3	16.2	16.7
Median	100.8	114.4	116.8	115.5	171.9	158.1	160.8	176.8	197.6	274.1	142.0	94.1
Maximum	298.5	993.2	1159.2	1296.1	1833.8	1019.1	861.7	697.9	859.9	362.1	303.5	302.5
St. Dev.	31.8	158.2	242.8	276.9	281.6	204.3	146.4	159.9	146.6	72.9	83.4	83.6

Table 25b - Monthly Statistics for American River Flow in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	101.7	145.3	193.8	235.1	262.1	214.2	187.1	199.1	208.0	214.4	122.5	93.2
Minimum	23.1	22.3	30.7	15.4	19.6	25.2	19.0	22.8	13.8	11.6	11.6	16.7
Median	98.2	109.6	105.8	105.6	159.4	133.6	146.7	157.9	178.3	242.2	110.8	86.5
Maximum	198.2	986.9	1192.9	1283.6	1822.8	1000.5	842.9	663.0	816.1	318.2	287.9	277.6
St. Dev.	30.8	156.7	243.2	272.8	285.2	203.4	141.9	149.0	141.6	84.5	78.3	64.8
2020 No Project Alternative A												
Average	101.7	145.3	193.8	235.1	262.1	214.2	187.1	199.1	208.0	214.4	122.5	93.2
Minimum	23.1	22.3	30.7	15.4	19.6	25.2	19.0	22.8	13.8	11.6	11.6	16.7
Median	98.2	109.6	105.8	105.6	159.4	133.6	146.7	157.9	178.3	242.2	110.8	86.5
Maximum	198.2	986.9	1192.9	1283.6	1822.8	1000.5	842.9	663.0	816.1	318.2	287.9	277.6
St. Dev.	30.8	156.7	243.2	272.8	285.2	203.4	141.9	149.0	141.6	84.5	78.3	64.8
2020 No Project Alternative B												
Average	101.7	145.3	193.8	235.1	262.1	214.2	187.1	199.1	208.0	214.4	122.5	93.2
Minimum	23.1	22.3	30.7	15.4	19.6	25.2	19.0	22.8	13.8	11.6	11.6	16.7
Median	98.2	109.6	105.8	105.6	159.4	133.6	146.7	157.9	178.3	242.2	110.8	86.5
Maximum	198.2	986.9	1192.9	1283.6	1822.8	1000.5	842.9	663.0	816.1	318.2	287.9	277.6
St. Dev.	30.8	156.7	243.2	272.8	285.2	203.4	141.9	149.0	141.6	84.5	78.3	64.8
2020 Proposed Project Alternative												
Average	100.6	145.3	191.9	234.3	263.3	215.0	187.0	199.7	207.6	215.0	122.0	94.1
Minimum	23.1	22.3	30.7	15.4	20.1	26.5	18.9	22.8	16.9	15.2	11.6	16.7
Median	98.2	110.7	103.9	106.7	159.4	138.8	143.5	165.1	178.5	248.3	113.5	84.7
Maximum	155.0	986.9	1187.3	1283.6	1822.8	1000.5	842.9	663.1	816.6	318.2	287.9	277.6
St. Dev.	27.9	156.5	241.3	272.9	283.7	203.0	142.0	148.8	142.2	85.4	76.9	65.3

Table 26a – Monthly Statistics for Feather River Flow in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	129.9	140.0	264.3	331.2	358.1	409.8	202.6	229.1	268.8	337.0	239.1	101.5
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	48.3	87.7	61.0	45.0
Median	105.0	101.0	143.5	118.6	234.0	294.9	124.5	110.9	281.8	357.9	259.5	65.8
Maximum	332.6	866.9	1496.9	2206.1	1315.2	1981.4	1127.1	1237.0	689.9	563.4	467.7	302.4
St. Dev.	66.5	117.0	296.8	415.1	343.6	434.1	221.9	259.1	114.3	124.0	140.8	55.0
2003 Baseline												
Average	154.1	134.9	239.6	317.7	344.1	394.1	192.0	222.1	255.7	375.9	283.2	108.8
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	45.5	87.7	61.0	45.0
Median	127.6	101.0	116.9	105.0	186.2	265.8	78.0	100.2	258.9	383.1	331.9	74.2
Maximum	323.8	866.9	1496.9	2206.1	1315.2	1958.1	1127.2	1237.0	690.0	614.9	516.7	341.9
St. Dev.	69.5	111.7	281.6	411.7	348.9	418.5	225.7	259.8	120.1	145.2	153.8	66.9
2003 No Project Alternative A												
Average	152.5	133.4	240.0	317.3	342.1	401.1	191.9	221.5	261.0	370.8	280.6	109.2
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	45.9	87.7	61.0	45.0
Median	120.3	101.0	128.8	105.0	186.2	278.7	80.7	100.2	265.0	372.9	341.4	62.9
Maximum	323.8	866.9	1496.9	2206.1	1315.2	1958.1	1127.2	1237.0	690.0	614.9	514.6	326.8
St. Dev.	69.2	111.8	282.9	408.8	345.9	429.1	225.7	260.0	116.2	142.5	153.9	67.7
2003 No Project Alternative B												
Average	154.1	134.9	239.6	317.7	344.1	394.1	192.0	222.1	255.7	375.9	283.2	108.8
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	45.5	87.7	61.0	45.0
Median	127.6	101.0	116.9	105.0	186.2	265.8	78.0	100.2	258.9	383.1	331.9	74.2
Maximum	323.8	866.9	1496.9	2206.1	1315.2	1958.1	1127.2	1237.0	690.0	614.9	516.7	341.9
St. Dev.	69.5	111.7	281.6	411.7	348.9	418.5	225.7	259.8	120.1	145.2	153.8	66.9
2003 Proposed Project Alternative												
Average	151.4	136.7	239.8	319.7	344.8	403.0	191.7	220.5	257.8	367.8	279.1	109.0
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	45.8	87.7	61.0	45.0
Median	128.8	101.0	129.3	105.0	186.2	280.6	80.2	97.1	256.0	394.3	310.6	62.9
Maximum	323.8	866.9	1496.9	2206.1	1315.2	1972.6	1127.2	1237.0	690.0	614.9	515.8	345.7
St. Dev.	68.2	111.2	280.9	410.9	345.3	432.5	225.6	260.1	115.6	144.0	152.6	67.0

Table 26b - Monthly Statistics for Feather River Flow in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	154.7	128.6	230.1	283.6	321.6	368.1	187.9	220.5	274.6	432.9	290.5	121.5
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	50.9	111.4	46.3	45.0
Median	111.4	101.0	105.0	105.0	100.1	255.4	79.5	104.7	274.4	459.3	332.2	87.4
Maximum	318.8	866.9	1496.9	2206.1	1207.2	1958.1	1129.8	1235.2	691.1	614.9	545.0	311.7
St. Dev.	71.5	104.9	260.1	400.9	339.4	397.5	225.8	261.7	117.8	160.8	157.6	74.1
2020 No Project Alternative A												
Average	154.7	128.6	230.1	283.6	321.6	368.1	187.9	220.5	274.6	432.9	290.5	121.5
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	50.9	111.4	46.3	45.0
Median	111.4	101.0	105.0	105.0	100.1	255.4	79.5	104.7	274.4	459.3	332.2	87.4
Maximum	318.8	866.9	1496.9	2206.1	1207.2	1958.1	1129.8	1235.2	691.1	614.9	545.0	311.7
St. Dev.	71.5	104.9	260.1	400.9	339.4	397.5	225.8	261.7	117.8	160.8	157.6	74.1
2020 No Project Alternative B												
Average	154.7	128.6	230.1	283.6	321.6	368.1	187.9	220.5	274.6	432.9	290.5	121.5
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	50.9	111.4	46.3	45.0
Median	111.4	101.0	105.0	105.0	100.1	255.4	79.5	104.7	274.4	459.3	332.2	87.4
Maximum	318.8	866.9	1496.9	2206.1	1207.2	1958.1	1129.8	1235.2	691.1	614.9	545.0	311.7
St. Dev.	71.5	104.9	260.1	400.9	339.4	397.5	225.8	261.7	117.8	160.8	157.6	74.1
2020 Proposed Project Alternative												
Average	155.7	127.0	229.7	287.2	322.3	369.9	189.5	221.6	276.3	425.8	288.2	120.6
Minimum	55.0	54.0	55.0	55.0	50.0	46.0	45.0	46.0	50.9	111.4	46.4	45.0
Median	129.7	101.0	105.0	105.0	100.1	266.1	81.7	115.0	279.6	446.6	327.6	87.4
Maximum	318.8	866.9	1496.9	2206.1	1207.2	1958.1	1129.8	1235.2	691.1	614.9	547.3	317.6
St. Dev.	71.3	105.3	260.9	403.0	340.1	398.6	226.0	261.8	116.6	160.4	156.7	74.1

Table 27a - Monthly Statistics for Sacramento River Flow into the Delta in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	727.5	944.5	1573.5	2050.7	2236.8	2126.4	1468.1	1220.6	1069.2	1074.4	830.3	784.0
Minimum	467.8	421.8	412.7	385.9	417.1	454.9	447.1	359.4	519.0	557.5	405.5	370.3
Median	637.6	726.9	971.7	1442.1	1909.0	1847.3	972.6	911.3	914.2	1112.0	883.9	722.3
Maximum	2280.2	3833.8	4612.3	4698.7	4356.6	4752.1	4428.9	3853.7	3295.7	1484.4	1313.2	1594.8
St. Dev.	277.5	668.6	1300.2	1432.5	1304.9	1266.7	1096.3	812.7	485.2	205.8	180.5	251.1
2003 Baseline												
Average	751.8	931.4	1542.5	2022.3	2212.9	2100.0	1448.6	1195.5	1042.8	1129.0	910.1	787.4
Minimum	468.6	422.3	409.5	356.2	428.6	440.4	438.1	348.1	500.1	566.1	486.6	354.3
Median	715.4	733.8	965.1	1378.8	1900.7	1813.6	974.1	899.9	886.0	1195.1	960.3	744.4
Maximum	2197.4	3833.8	4612.3	4698.7	4355.4	4752.1	4428.9	3771.0	3295.5	1484.3	1313.1	1594.7
St. Dev.	258.1	645.9	1253.4	1442.9	1298.4	1269.5	1095.7	803.2	489.1	201.8	158.0	242.1
2003 No Project Alternative A												
Average	750.4	934.0	1545.2	2017.9	2210.8	2099.7	1449.0	1194.7	1045.9	1124.0	909.6	784.2
Minimum	469.1	422.6	409.8	354.7	424.1	425.4	438.0	348.1	500.5	577.6	486.9	354.9
Median	709.4	740.5	963.7	1378.3	1886.4	1817.1	1008.8	899.9	885.9	1185.0	959.8	742.9
Maximum	2183.0	3833.8	4612.3	4698.7	4356.6	4752.1	4428.9	3771.1	3295.5	1484.3	1313.1	1594.7
St. Dev.	258.6	644.8	1258.6	1438.9	1298.3	1267.4	1096.3	803.3	488.5	198.6	161.7	243.9
2003 No Project Alternative B												
Average	751.8	931.4	1542.5	2022.3	2212.9	2100.0	1448.6	1195.5	1042.8	1129.0	910.1	787.4
Minimum	468.6	422.3	409.5	356.2	428.6	440.4	438.1	348.1	500.1	566.1	486.6	354.3
Median	715.4	733.8	965.1	1378.8	1900.7	1813.6	974.1	899.9	886.0	1195.1	960.3	744.4
Maximum	2197.4	3833.8	4612.3	4698.7	4355.4	4752.1	4428.9	3771.0	3295.5	1484.3	1313.1	1594.7
St. Dev.	258.1	645.9	1253.4	1442.9	1298.4	1269.5	1095.7	803.2	489.1	201.8	158.0	242.1
2003 Proposed Project Alternative												
Average	748.1	935.8	1546.8	2020.4	2212.3	2100.5	1448.5	1193.3	1045.3	1122.1	908.0	785.7
Minimum	469.3	422.6	409.8	362.4	435.1	437.3	438.1	346.6	502.0	575.4	486.9	355.1
Median	702.3	755.3	960.8	1389.2	1892.5	1825.8	972.5	900.0	885.8	1179.6	957.3	733.3
Maximum	2273.6	3833.8	4612.3	4698.7	4356.8	4752.1	4428.9	3771.1	3295.5	1484.3	1313.1	1594.7
St. Dev.	267.3	644.4	1261.9	1439.0	1297.0	1267.1	1095.8	803.4	487.6	196.3	162.8	243.9

Table 27b - Monthly Statistics for Sacramento River Flow into the Delta in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	751.3	923.6	1524.4	2006.8	2193.4	2096.1	1460.8	1173.9	1028.4	1159.3	891.2	756.4
Minimum	469.9	422.7	409.5	382.6	420.2	440.5	425.9	362.2	493.1	586.2	482.3	356.6
Median	746.2	788.3	1003.2	1311.8	1848.7	1748.3	962.5	861.3	904.7	1231.4	928.3	750.0
Maximum	1984.8	3871.4	4620.1	4708.2	4357.0	4760.4	4427.8	3633.7	3249.1	1599.9	1269.4	1573.7
St. Dev.	226.7	602.7	1205.1	1425.3	1301.3	1270.2	1098.1	783.1	461.9	239.1	195.2	215.0
2020 No Project Alternative A												
Average	751.3	923.6	1524.4	2006.8	2193.4	2096.1	1460.8	1173.9	1028.4	1159.3	891.2	756.4
Minimum	469.9	422.7	409.5	382.6	420.2	440.5	425.9	362.2	493.1	586.2	482.3	356.6
Median	746.2	788.3	1003.2	1311.8	1848.7	1748.3	962.5	861.3	904.7	1231.4	928.3	750.0
Maximum	1984.8	3871.4	4620.1	4708.2	4357.0	4760.4	4427.8	3633.7	3249.1	1599.9	1269.4	1573.7
St. Dev.	226.7	602.7	1205.1	1425.3	1301.3	1270.2	1098.1	783.1	461.9	239.1	195.2	215.0
2020 No Project Alternative B												
Average	751.3	923.6	1524.4	2006.8	2193.4	2096.1	1460.8	1173.9	1028.4	1159.3	891.2	756.4
Minimum	469.9	422.7	409.5	382.6	420.2	440.5	425.9	362.2	493.1	586.2	482.3	356.6
Median	746.2	788.3	1003.2	1311.8	1848.7	1748.3	962.5	861.3	904.7	1231.4	928.3	750.0
Maximum	1984.8	3871.4	4620.1	4708.2	4357.0	4760.4	4427.8	3633.7	3249.1	1599.9	1269.4	1573.7
St. Dev.	226.7	602.7	1205.1	1425.3	1301.3	1270.2	1098.1	783.1	461.9	239.1	195.2	215.0
2020 Proposed Project Alternative												
Average	748.9	922.3	1522.0	2009.0	2195.0	2097.6	1463.2	1175.4	1029.2	1155.4	887.0	756.2
Minimum	469.8	420.6	409.4	382.5	429.1	440.7	426.9	357.5	490.2	585.8	482.5	356.7
Median	742.4	753.1	1003.2	1311.9	1849.7	1748.5	1013.3	860.9	904.7	1232.5	933.1	764.1
Maximum	1979.8	3871.5	4620.2	4708.2	4356.4	4760.4	4427.8	3633.8	3249.7	1582.2	1269.4	1573.7
St. Dev.	224.6	604.9	1206.7	1426.6	1301.1	1273.3	1096.9	783.0	461.1	238.7	193.9	215.6

Table 28a - Monthly Statistics for San Joaquin River Flow at Vernalis in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	186.1	118.7	185.4	272.7	353.3	387.0	361.5	336.3	248.6	140.7	103.1	112.5
Minimum	67.3	73.6	73.2	67.1	67.5	80.3	87.2	75.8	67.4	53.1	41.1	61.2
Median	130.7	102.0	116.5	129.3	192.5	229.3	287.7	275.0	137.3	118.8	111.6	107.1
Maximum	789.1	814.2	1421.2	1545.4	1849.2	2517.5	1520.2	1446.6	2062.0	1097.9	149.7	394.0
St. Dev.	148.7	97.0	223.0	300.1	354.4	425.4	277.6	276.3	338.8	131.3	33.2	48.3
2003 Baseline												
Average	186.2	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.5	140.7	103.2	112.6
Minimum	70.3	75.1	73.1	67.1	67.5	80.4	87.3	76.0	66.5	52.9	41.1	60.9
Median	131.0	102.0	116.5	129.3	192.8	229.3	287.6	275.1	137.7	118.9	111.5	107.2
Maximum	789.1	814.2	1421.2	1545.4	1849.2	2517.5	1520.1	1446.6	2062.0	1097.9	149.7	394.0
St. Dev.	148.4	96.9	223.1	300.1	354.3	425.3	277.6	276.4	338.8	131.3	33.2	48.3
2003 No Project Alternative A												
Average	186.1	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.6	140.7	103.2	112.6
Minimum	67.3	75.4	73.1	67.1	67.5	80.4	87.3	76.0	66.5	53.0	41.1	60.9
Median	130.8	102.0	116.5	129.3	192.8	229.3	287.6	275.1	137.6	118.9	111.6	107.2
Maximum	789.1	814.2	1421.2	1545.4	1849.2	2517.5	1520.1	1446.6	2062.0	1097.9	149.7	394.0
St. Dev.	148.5	96.9	223.1	300.1	354.3	425.3	277.6	276.3	338.8	131.4	33.2	48.3
2003 No Project Alternative B												
Average	186.2	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.5	140.7	103.2	112.6
Minimum	70.3	75.1	73.1	67.1	67.5	80.4	87.3	76.0	66.5	52.9	41.1	60.9
Median	131.0	102.0	116.5	129.3	192.8	229.3	287.6	275.1	137.7	118.9	111.5	107.2
Maximum	789.1	814.2	1421.2	1545.4	1849.2	2517.5	1520.1	1446.6	2062.0	1097.9	149.7	394.0
St. Dev.	148.4	96.9	223.1	300.1	354.3	425.3	277.6	276.4	338.8	131.3	33.2	48.3
2003 Proposed Project Alternative												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.9	52.9	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.5	119.2	111.6	108.0
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.4	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2

Table 28b - Monthly Statistics for San Joaquin River Flow at Vernalis in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.9	52.9	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.5	119.2	111.6	108.0
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.4	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2
2020 No Project Alternative A												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.9	52.9	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.5	119.2	111.6	108.0
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.4	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2
2020 No Project Alternative B												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.9	52.9	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.5	119.2	111.6	108.0
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.4	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2
2020 Proposed Project Alternative												
Average	177.5	118.6	185.3	272.8	353.8	387.0	362.7	342.5	249.3	140.7	104.3	111.4
Minimum	68.5	73.6	73.1	67.1	67.5	79.9	86.3	74.6	65.8	52.8	45.1	61.5
Median	132.9	102.2	117.9	128.0	191.6	228.3	286.0	272.9	136.7	119.2	111.4	108.1
Maximum	762.3	813.3	1420.2	1545.4	1849.2	2521.9	1540.2	1473.0	2066.4	1095.3	151.3	372.4
St. Dev.	136.3	96.8	223.0	299.9	355.6	426.9	282.4	288.1	338.4	131.0	33.1	44.2

Table 29a - Monthly Statistics for Delta Outflow in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	404.6	606.9	1359.8	2285.5	2734.6	2482.9	1607.0	1219.2	740.8	437.3	264.4	292.0
Minimum	202.3	267.8	215.2	276.7	388.1	377.9	351.8	246.0	238.0	246.0	184.5	178.5
Median	270.9	345.5	504.6	1063.0	1564.3	1618.9	953.7	857.8	471.0	399.7	246.0	184.0
Maximum	1801.5	4646.4	9526.2	12847.6	11652.1	15576.5	8409.9	4637.9	4981.6	1818.2	769.5	1508.5
St. Dev.	316.7	741.6	1818.8	2649.1	2616.8	2615.2	1555.1	1048.8	755.8	194.7	67.4	230.1
2003 Baseline												
Average	376.0	592.3	1341.9	2264.2	2684.0	2404.9	1637.0	1289.0	732.8	442.0	276.9	278.5
Minimum	195.0	241.5	276.7	317.4	383.3	376.4	357.3	246.0	238.0	246.0	184.5	178.5
Median	269.7	348.5	463.0	959.4	1600.5	1566.2	962.2	1008.4	478.6	409.0	249.3	195.9
Maximum	1708.4	4791.8	9617.2	13000.7	11646.5	15549.7	8428.4	4623.6	4974.6	1706.0	644.1	1482.4
St. Dev.	289.3	729.7	1785.7	2642.8	2604.0	2564.8	1560.7	1051.2	751.6	185.5	61.4	207.1
2003 No Project Alternative A												
Average	376.2	593.9	1346.1	2264.1	2680.5	2410.4	1639.7	1293.2	734.5	440.9	276.7	278.6
Minimum	195.5	266.8	276.7	318.1	382.6	379.0	357.3	246.0	238.0	246.0	184.5	178.5
Median	263.6	356.1	450.5	983.4	1600.6	1566.3	1010.0	1008.4	486.9	400.1	246.0	192.5
Maximum	1693.6	4793.4	9619.1	13001.1	11692.5	15551.5	8489.6	4631.0	4988.2	1705.6	643.7	1528.9
St. Dev.	290.1	729.7	1790.0	2641.7	2603.6	2580.3	1566.4	1049.4	753.2	184.7	61.0	211.0
2003 No Project Alternative B												
Average	376.0	592.3	1341.9	2264.2	2684.0	2404.9	1637.0	1289.0	732.8	442.0	276.9	278.5
Minimum	195.0	241.5	276.7	317.4	383.3	376.4	357.3	246.0	238.0	246.0	184.5	178.5
Median	269.7	348.5	463.0	959.4	1600.5	1566.2	962.2	1008.4	478.6	409.0	249.3	195.9
Maximum	1708.4	4791.8	9617.2	13000.7	11646.5	15549.7	8428.4	4623.6	4974.6	1706.0	644.1	1482.4
St. Dev.	289.3	729.7	1785.7	2642.8	2604.0	2564.8	1560.7	1051.2	751.6	185.5	61.4	207.1
2003 Proposed Project Alternative												
Average	378.9	594.2	1349.0	2269.1	2684.6	2419.2	1639.0	1293.0	734.7	441.0	276.1	279.4
Minimum	196.1	257.1	276.7	317.2	382.7	378.7	357.3	246.0	238.0	246.0	184.5	178.5
Median	269.4	350.8	465.8	986.8	1600.4	1565.9	1009.6	935.0	486.8	409.5	246.0	196.9
Maximum	1784.2	4793.9	9620.2	13001.2	11700.4	15553.6	8493.1	4674.3	5002.5	1705.6	643.7	1559.3
St. Dev.	297.1	730.0	1790.2	2642.3	2604.3	2586.2	1563.4	1053.9	754.9	184.0	62.3	213.7

Table 29b - Monthly Statistics for Delta Outflow in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	328.0	549.6	1245.6	2184.7	2641.6	2369.7	1631.2	1270.9	694.4	445.1	279.0	240.1
Minimum	192.2	267.8	245.3	325.9	381.6	375.9	350.6	246.0	238.0	246.0	204.9	178.5
Median	268.4	358.4	458.3	865.8	1489.2	1539.0	1008.5	981.8	493.9	399.7	246.6	197.8
Maximum	1374.5	4705.8	9514.7	12950.1	11381.6	15435.4	8032.7	4535.9	4811.9	1561.4	511.6	1301.4
St. Dev.	208.2	666.3	1721.5	2585.7	2578.4	2534.4	1526.0	1021.7	690.6	180.1	52.4	143.4
2020 No Project Alternative A												
Average	328.0	549.6	1245.6	2184.7	2641.6	2369.7	1631.2	1270.9	694.4	445.1	279.0	240.1
Minimum	192.2	267.8	245.3	325.9	381.6	375.9	350.6	246.0	238.0	246.0	204.9	178.5
Median	268.4	358.4	458.3	865.8	1489.2	1539.0	1008.5	981.8	493.9	399.7	246.6	197.8
Maximum	1374.5	4705.8	9514.7	12950.1	11381.6	15435.4	8032.7	4535.9	4811.9	1561.4	511.6	1301.4
St. Dev.	208.2	666.3	1721.5	2585.7	2578.4	2534.4	1526.0	1021.7	690.6	180.1	52.4	143.4
2020 No Project Alternative B												
Average	328.0	549.6	1245.6	2184.7	2641.6	2369.7	1631.2	1270.9	694.4	445.1	279.0	240.1
Minimum	192.2	267.8	245.3	325.9	381.6	375.9	350.6	246.0	238.0	246.0	204.9	178.5
Median	268.4	358.4	458.3	865.8	1489.2	1539.0	1008.5	981.8	493.9	399.7	246.6	197.8
Maximum	1374.5	4705.8	9514.7	12950.1	11381.6	15435.4	8032.7	4535.9	4811.9	1561.4	511.6	1301.4
St. Dev.	208.2	666.3	1721.5	2585.7	2578.4	2534.4	1526.0	1021.7	690.6	180.1	52.4	143.4
2020 Proposed Project Alternative												
Average	326.8	549.7	1248.7	2188.1	2642.4	2372.6	1631.7	1268.1	694.6	444.9	281.0	240.5
Minimum	191.8	267.8	276.7	325.9	383.1	376.4	350.8	246.0	238.0	246.0	203.9	178.5
Median	262.6	358.6	458.6	865.9	1500.7	1509.8	1008.4	988.0	493.2	424.1	247.6	206.2
Maximum	1390.9	4701.8	9518.0	12947.3	11353.6	15448.9	7999.8	4542.2	4827.7	1561.5	511.6	1312.8
St. Dev.	208.8	667.4	1725.7	2588.3	2575.8	2538.4	1523.8	1021.3	692.3	179.6	55.1	144.6

Table 30a - Monthly Statistics for Minimum Required Delta Outflow in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	256.3	287.2	269.2	335.6	748.3	867.9	754.3	689.3	530.7	403.7	254.7	178.5
Minimum	184.5	250.3	215.2	276.7	383.6	365.7	350.5	245.4	238.0	246.0	184.5	178.5
Median	246.0	267.8	276.7	368.9	633.1	701.0	666.0	590.8	455.5	399.7	246.0	178.5
Maximum	404.5	397.0	336.3	368.9	1580.6	1672.3	1438.7	1652.6	1357.4	693.2	336.4	178.5
St. Dev.	37.4	30.1	24.3	44.6	342.4	354.7	237.0	339.6	245.0	103.1	28.6	0.0
2003 Baseline												
Average	253.3	299.7	289.1	349.4	739.6	857.6	759.7	686.6	520.3	404.2	270.6	178.5
Minimum	184.5	221.8	215.2	276.7	381.9	364.5	349.8	239.2	238.0	246.0	184.5	178.5
Median	246.0	290.4	276.7	368.9	633.1	701.0	668.8	582.6	447.6	399.7	246.0	178.5
Maximum	388.8	413.9	406.9	552.0	1580.6	1672.0	1452.3	1647.5	1317.9	730.2	384.9	178.5
St. Dev.	36.5	40.2	40.9	48.4	341.5	345.3	244.5	341.2	246.5	100.5	43.2	0.0
2003 No Project Alternative A												
Average	252.9	299.6	289.5	348.6	739.4	857.7	759.8	686.2	520.0	404.4	270.2	178.5
Minimum	184.5	215.2	215.2	276.7	381.6	364.4	349.8	239.2	238.0	246.0	184.5	178.5
Median	246.0	289.8	276.7	368.9	633.1	701.0	668.6	581.3	445.9	399.7	246.0	178.5
Maximum	372.9	414.3	421.6	467.8	1580.6	1672.0	1464.7	1648.1	1318.0	725.3	385.7	178.5
St. Dev.	36.1	37.7	40.8	44.9	340.4	344.9	245.4	341.2	246.6	101.0	42.8	0.0
2003 No Project Alternative B												
Average	253.3	299.7	289.1	349.4	739.6	857.6	759.7	686.6	520.3	404.2	270.6	178.5
Minimum	184.5	221.8	215.2	276.7	381.9	364.5	349.8	239.2	238.0	246.0	184.5	178.5
Median	246.0	290.4	276.7	368.9	633.1	701.0	668.8	582.6	447.6	399.7	246.0	178.5
Maximum	388.8	413.9	406.9	552.0	1580.6	1672.0	1452.3	1647.5	1317.9	730.2	384.9	178.5
St. Dev.	36.5	40.2	40.9	48.4	341.5	345.3	244.5	341.2	246.5	100.5	43.2	0.0
2003 Proposed Project Alternative												
Average	253.6	298.1	289.8	348.5	738.5	857.5	758.7	686.1	519.5	404.6	269.9	178.5
Minimum	184.5	223.9	215.2	276.7	381.7	364.1	349.8	239.3	238.0	246.0	184.5	178.5
Median	246.0	292.4	276.7	368.9	633.1	701.0	668.5	580.6	447.6	399.7	246.0	178.5
Maximum	398.2	409.6	421.7	521.9	1580.6	1672.0	1463.3	1646.5	1318.0	721.7	388.8	178.5
St. Dev.	35.9	35.6	40.2	46.6	340.0	345.3	245.0	341.0	246.7	100.9	44.0	0.0

Table 30b - Monthly Statistics for Minimum Required Delta Outflow in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	249.6	311.8	301.6	358.2	750.1	865.0	763.0	687.2	524.1	408.8	275.2	178.5
Minimum	184.5	267.8	215.2	276.7	380.5	361.7	350.6	239.1	238.0	246.0	204.9	178.5
Median	246.0	299.0	276.7	368.9	633.1	701.0	670.3	582.2	444.8	399.7	246.0	178.5
Maximum	353.9	498.6	459.1	500.6	1580.6	1671.7	1433.9	1616.5	1336.7	741.0	393.2	178.5
St. Dev.	35.8	50.9	53.4	43.1	355.8	350.3	247.2	340.8	249.7	107.5	45.1	0.0
2020 No Project Alternative A												
Average	249.6	311.8	301.6	358.2	750.1	865.0	763.0	687.2	524.1	408.8	275.2	178.5
Minimum	184.5	267.8	215.2	276.7	380.5	361.7	350.6	239.1	238.0	246.0	204.9	178.5
Median	246.0	299.0	276.7	368.9	633.1	701.0	670.3	582.2	444.8	399.7	246.0	178.5
Maximum	353.9	498.6	459.1	500.6	1580.6	1671.7	1433.9	1616.5	1336.7	741.0	393.2	178.5
St. Dev.	35.8	50.9	53.4	43.1	355.8	350.3	247.2	340.8	249.7	107.5	45.1	0.0
2020 No Project Alternative B												
Average	249.6	311.8	301.6	358.2	750.1	865.0	763.0	687.2	524.1	408.8	275.2	178.5
Minimum	184.5	267.8	215.2	276.7	380.5	361.7	350.6	239.1	238.0	246.0	204.9	178.5
Median	246.0	299.0	276.7	368.9	633.1	701.0	670.3	582.2	444.8	399.7	246.0	178.5
Maximum	353.9	498.6	459.1	500.6	1580.6	1671.7	1433.9	1616.5	1336.7	741.0	393.2	178.5
St. Dev.	35.8	50.9	53.4	43.1	355.8	350.3	247.2	340.8	249.7	107.5	45.1	0.0
2020 Proposed Project Alternative												
Average	248.7	312.4	302.3	358.8	749.9	864.8	764.6	686.3	524.1	408.6	277.5	178.5
Minimum	184.5	239.2	215.2	276.7	380.1	361.9	350.8	239.1	238.0	246.0	203.9	178.5
Median	246.0	304.4	276.7	368.9	633.1	701.0	670.2	583.9	443.5	399.7	246.0	178.5
Maximum	357.6	474.3	455.5	511.5	1580.6	1671.9	1435.7	1616.7	1336.7	738.8	393.3	178.5
St. Dev.	33.0	52.0	52.2	43.9	355.3	350.0	246.8	341.4	249.8	107.1	48.1	0.0

Table 31a - Monthly Statistics for SWP Banks Pumping in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	203.1	220.3	312.2	352.1	289.1	275.6	178.5	168.1	205.3	227.7	245.2	267.8
Minimum	55.7	17.9	64.9	69.4	16.7	18.4	17.9	18.4	17.9	18.4	18.4	56.1
Median	178.0	201.6	319.5	318.3	311.1	325.6	185.6	151.7	198.2	255.3	277.5	267.4
Maximum	410.7	397.5	472.1	522.6	485.3	464.9	312.6	379.8	397.5	410.7	410.7	397.5
St. Dev.	99.1	121.9	112.6	112.5	124.1	115.7	85.5	94.3	110.7	128.7	134.2	96.3
2003 Baseline												
Average	233.6	217.3	316.3	361.4	316.9	311.4	142.0	91.3	189.0	260.4	276.3	268.8
Minimum	52.2	17.9	59.3	49.2	17.3	18.4	17.9	18.4	17.9	0.0	0.0	50.6
Median	240.8	187.2	336.1	411.6	340.1	355.2	142.4	69.2	184.4	292.8	343.5	271.8
Maximum	410.7	397.5	447.1	497.6	485.3	464.9	302.7	326.0	397.5	410.7	410.7	397.5
St. Dev.	102.2	125.8	106.2	113.6	132.7	137.3	62.6	63.8	112.6	144.2	137.8	99.4
2003 No Project Alternative A												
Average	231.3	215.1	313.7	358.4	319.1	312.2	141.7	87.7	192.2	253.5	275.8	268.2
Minimum	66.7	17.9	61.7	49.2	17.3	10.5	17.9	18.4	17.9	0.0	0.0	50.7
Median	224.1	185.9	329.8	384.8	339.0	357.3	142.4	69.2	184.8	280.5	330.0	274.0
Maximum	410.7	397.5	447.1	497.6	485.3	464.9	296.6	326.0	397.5	410.7	410.7	397.5
St. Dev.	102.6	127.0	106.0	114.0	133.2	136.7	62.3	63.2	110.1	142.8	138.2	99.9
2003 No Project Alternative B												
Average	233.6	217.3	316.3	361.4	316.9	311.4	142.0	91.3	189.0	260.4	276.3	268.8
Minimum	52.2	17.9	59.3	49.2	17.3	18.4	17.9	18.4	17.9	0.0	0.0	50.6
Median	240.8	187.2	336.1	411.6	340.1	355.2	142.4	69.2	184.4	292.8	343.5	271.8
Maximum	410.7	397.5	447.1	497.6	485.3	464.9	302.7	326.0	397.5	410.7	410.7	397.5
St. Dev.	102.2	125.8	106.2	113.6	132.7	137.3	62.6	63.8	112.6	144.2	137.8	99.4
2003 Proposed Project Alternative												
Average	230.7	217.7	311.2	356.4	316.0	310.4	140.3	85.7	189.8	249.6	272.9	265.5
Minimum	63.4	17.9	79.0	49.2	17.3	18.4	17.9	18.4	17.9	0.0	0.0	50.6
Median	220.7	193.3	329.0	383.6	340.0	349.0	142.3	69.2	171.8	307.2	319.7	270.2
Maximum	410.7	397.5	447.1	497.6	485.3	464.9	295.0	326.0	397.5	410.7	410.7	397.5
St. Dev.	101.3	124.7	106.4	113.5	131.0	135.2	61.8	60.5	110.4	144.5	137.4	101.4

Table 31b - Monthly Statistics for SWP Banks Pumping in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	271.6	240.9	377.5	396.0	323.8	338.1	154.9	92.9	215.0	290.2	261.0	290.3
Minimum	65.9	17.9	49.2	51.5	17.2	18.4	17.9	18.4	17.9	18.4	18.4	53.1
Median	279.7	200.1	405.0	481.2	347.5	399.4	144.3	69.2	192.4	321.6	324.3	303.6
Maximum	522.6	505.8	497.6	497.6	488.9	522.6	378.5	332.6	505.8	491.9	450.4	476.0
St. Dev.	130.3	149.8	127.0	124.7	136.6	155.6	76.8	75.4	135.9	154.6	156.1	118.3
2020 No Project Alternative A												
Average	271.6	240.9	377.5	396.0	323.8	338.1	154.9	92.9	215.0	290.2	261.0	290.3
Minimum	65.9	17.9	49.2	51.5	17.2	18.4	17.9	18.4	17.9	18.4	18.4	53.1
Median	279.7	200.1	405.0	481.2	347.5	399.4	144.3	69.2	192.4	321.6	324.3	303.6
Maximum	522.6	505.8	497.6	497.6	488.9	522.6	378.5	332.6	505.8	491.9	450.4	476.0
St. Dev.	130.3	149.8	127.0	124.7	136.6	155.6	76.8	75.4	135.9	154.6	156.1	118.3
2020 No Project Alternative B												
Average	271.6	240.9	377.5	396.0	323.8	338.1	154.9	92.9	215.0	290.2	261.0	290.3
Minimum	65.9	17.9	49.2	51.5	17.2	18.4	17.9	18.4	17.9	18.4	18.4	53.1
Median	279.7	200.1	405.0	481.2	347.5	399.4	144.3	69.2	192.4	321.6	324.3	303.6
Maximum	522.6	505.8	497.6	497.6	488.9	522.6	378.5	332.6	505.8	491.9	450.4	476.0
St. Dev.	130.3	149.8	127.0	124.7	136.6	155.6	76.8	75.4	135.9	154.6	156.1	118.3
2020 Proposed Project Alternative												
Average	273.5	238.4	373.0	396.0	323.2	338.4	155.6	96.1	216.9	283.1	259.3	289.0
Minimum	69.0	17.9	43.4	51.5	17.2	18.4	17.9	18.4	17.9	18.4	18.4	53.3
Median	276.7	197.4	387.7	458.2	357.1	390.5	144.4	69.2	193.7	312.8	329.5	297.7
Maximum	522.6	505.8	497.6	497.6	488.9	522.6	378.5	332.6	505.8	491.9	447.1	476.0
St. Dev.	128.6	151.4	127.6	123.9	138.5	155.0	75.9	77.9	133.8	154.5	155.6	118.3

Table 32a - Monthly Statistics for CVP Banks Pumping in the 1994 and 2003 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	8.0	1.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	48.8	20.0	8.6
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.2	3.2	0.0
Maximum	128.0	56.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	128.0	128.0	95.3
St. Dev.	23.6	9.3	1.6	0.0	0.0	0.0	0.0	0.0	0.0	36.3	28.6	20.4
2003 Baseline												
Average	22.6	12.7	3.5	3.3	4.8	7.4	0.0	0.0	0.0	35.9	29.7	22.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.3	16.1	0.0
Maximum	141.8	115.5	84.8	77.9	104.4	79.9	0.0	0.0	0.0	159.3	174.6	127.3
St. Dev.	39.5	29.3	13.4	13.7	16.2	18.1	0.0	0.0	0.0	38.9	40.9	32.2
2003 No Project Alternative A												
Average	22.1	12.2	2.4	3.9	4.5	7.1	0.0	0.0	0.0	38.5	29.0	18.8
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.8	18.9	0.0
Maximum	128.0	119.4	93.7	78.3	104.4	83.1	0.0	0.0	0.0	166.8	164.3	139.2
St. Dev.	38.7	29.8	12.6	14.4	15.4	18.7	0.0	0.0	0.0	40.0	37.0	29.3
2003 No Project Alternative B												
Average	22.6	12.7	3.5	3.3	4.8	7.4	0.0	0.0	0.0	35.9	29.7	22.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.3	16.1	0.0
Maximum	141.8	115.5	84.8	77.9	104.4	79.9	0.0	0.0	0.0	159.3	174.6	127.3
St. Dev.	39.5	29.3	13.4	13.7	16.2	18.1	0.0	0.0	0.0	38.9	40.9	32.2
2003 Proposed Project Alternative												
Average	21.1	11.7	2.4	4.3	4.8	5.4	0.0	0.0	0.0	39.7	29.1	19.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	16.2	0.0
Maximum	127.8	119.6	98.4	78.4	104.4	87.2	0.0	0.0	0.0	173.7	166.3	136.2
St. Dev.	37.7	29.3	12.8	15.4	16.0	16.0	0.0	0.0	0.0	41.7	38.1	28.7

Table 32b - Monthly Statistics for CVP Banks Pumping in the 2020 Scenarios (TAF/month)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	25.1	18.1	3.7	0.4	2.6	4.4	0.0	0.0	0.0	32.8	40.9	14.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	25.5	0.0
Maximum	124.5	118.2	74.0	16.8	68.7	77.9	0.0	0.0	0.0	131.4	239.2	93.3
St. Dev.	34.2	34.3	12.6	2.3	10.6	15.4	0.0	0.0	0.0	33.9	52.3	22.0
2020 No Project Alternative A												
Average	25.1	18.1	3.7	0.4	2.6	4.4	0.0	0.0	0.0	32.8	40.9	14.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	25.5	0.0
Maximum	124.5	118.2	74.0	16.8	68.7	77.9	0.0	0.0	0.0	131.4	239.2	93.3
St. Dev.	34.2	34.3	12.6	2.3	10.6	15.4	0.0	0.0	0.0	33.9	52.3	22.0
2020 No Project Alternative B												
Average	25.1	18.1	3.7	0.4	2.6	4.4	0.0	0.0	0.0	32.8	40.9	14.5
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	25.5	0.0
Maximum	124.5	118.2	74.0	16.8	68.7	77.9	0.0	0.0	0.0	131.4	239.2	93.3
St. Dev.	34.2	34.3	12.6	2.3	10.6	15.4	0.0	0.0	0.0	33.9	52.3	22.0
2020 Proposed Project Alternative												
Average	24.5	18.6	3.6	0.7	1.8	4.5	0.0	0.0	0.0	35.0	38.8	15.6
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	25.5	0.0
Maximum	124.5	115.9	73.8	25.5	46.7	80.1	0.0	0.0	0.0	146.1	241.8	85.0
St. Dev.	32.9	33.5	12.5	3.9	8.1	15.8	0.0	0.0	0.0	35.5	52.0	21.8

Table 33a - Monthly Statistics for Average X2 Position in the 1994 and 2003 Scenarios (km)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	84.2	85.8	84.2	81.4	77.0	71.3	66.1	65.6	68.0	70.9	75.2	79.3
Minimum	69.7	67.3	66.8	57.7	49.5	49.2	46.7	42.1	48.5	52.1	52.4	60.5
Median	84.1	87.9	86.2	84.0	80.3	73.8	66.6	66.7	69.4	72.0	76.7	79.3
Maximum	88.0	89.5	89.2	86.2	87.7	86.2	82.5	82.4	81.3	85.0	85.2	85.5
St. Dev.	2.4	4.7	5.1	5.7	9.2	10.8	9.9	9.3	8.5	8.3	7.3	4.4
2003 Baseline												
Average	83.8	85.8	84.7	81.6	77.0	71.3	66.3	65.9	67.9	70.3	75.1	79.2
Minimum	71.2	68.0	66.4	57.4	49.3	49.0	46.5	42.1	48.5	52.1	52.4	61.0
Median	83.6	87.6	86.6	83.6	80.9	74.5	66.7	66.9	69.4	70.5	76.1	79.3
Maximum	87.5	89.5	89.4	87.0	85.8	84.6	82.2	82.3	81.3	84.9	85.3	85.5
St. Dev.	2.1	4.2	4.7	5.4	8.9	10.5	9.8	9.2	8.4	8.2	7.4	4.4
2003 No Project Alternative A												
Average	83.8	85.9	84.7	81.6	76.9	71.3	66.3	65.9	67.9	70.3	75.1	79.2
Minimum	71.2	67.7	66.4	57.4	49.3	48.9	46.5	42.1	48.5	52.1	52.4	60.9
Median	83.5	87.7	86.6	83.8	80.9	74.1	66.7	66.9	69.3	70.5	76.1	79.3
Maximum	87.5	89.5	89.5	86.2	85.8	84.4	82.1	82.1	81.3	84.9	85.4	85.5
St. Dev.	2.1	4.3	4.7	5.4	8.9	10.5	9.8	9.2	8.4	8.2	7.4	4.4
2003 No Project Alternative B												
Average	83.8	85.8	84.7	81.6	77.0	71.3	66.3	65.9	67.9	70.3	75.1	79.2
Minimum	71.2	68.0	66.4	57.4	49.3	49.0	46.5	42.1	48.5	52.1	52.4	61.0
Median	83.6	87.6	86.6	83.6	80.9	74.5	66.7	66.9	69.4	70.5	76.1	79.3
Maximum	87.5	89.5	89.4	87.0	85.8	84.6	82.2	82.3	81.3	84.9	85.3	85.5
St. Dev.	2.1	4.2	4.7	5.4	8.9	10.5	9.8	9.2	8.4	8.2	7.4	4.4
2003 Proposed Project Alternative												
Average	83.8	85.9	84.6	81.6	76.9	71.2	66.2	65.8	67.9	70.3	75.1	79.2
Minimum	71.2	67.6	66.3	57.3	49.3	48.9	46.5	42.1	48.5	52.0	52.3	60.9
Median	83.6	87.7	86.6	83.5	80.9	74.4	66.7	66.9	69.3	70.5	76.2	79.3
Maximum	87.5	89.5	89.4	86.6	85.8	84.5	82.1	82.2	81.3	84.5	85.3	85.5
St. Dev.	2.1	4.3	4.7	5.4	8.9	10.5	9.8	9.2	8.4	8.2	7.4	4.3

Table 33b - Monthly Statistics for Average X2 Position in the 2020 Scenarios (km)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	83.7	86.4	85.5	82.2	77.7	71.8	66.6	66.1	68.0	70.4	75.3	79.2
Minimum	73.2	69.6	68.3	58.1	49.7	50.0	46.7	42.2	48.8	52.3	52.7	61.7
Median	83.6	87.5	86.3	83.8	81.5	75.5	67.2	66.9	69.2	71.1	76.0	79.4
Maximum	87.2	89.4	89.6	85.7	86.4	84.3	82.1	82.3	81.3	85.0	84.9	85.5
St. Dev.	1.9	3.2	3.6	4.8	8.6	10.3	9.7	9.1	8.4	8.1	7.0	4.3
2020 No Project Alternative A												
Average	83.7	86.4	85.5	82.2	77.7	71.8	66.6	66.1	68.0	70.4	75.3	79.2
Minimum	73.2	69.6	68.3	58.1	49.7	50.0	46.7	42.2	48.8	52.3	52.7	61.7
Median	83.6	87.5	86.3	83.8	81.5	75.5	67.2	66.9	69.2	71.1	76.0	79.4
Maximum	87.2	89.4	89.6	85.7	86.4	84.3	82.1	82.3	81.3	85.0	84.9	85.5
St. Dev.	1.9	3.2	3.6	4.8	8.6	10.3	9.7	9.1	8.4	8.1	7.0	4.3
2020 No Project Alternative B												
Average	83.7	86.4	85.5	82.2	77.7	71.8	66.6	66.1	68.0	70.4	75.3	79.2
Minimum	73.2	69.6	68.3	58.1	49.7	50.0	46.7	42.2	48.8	52.3	52.7	61.7
Median	83.6	87.5	86.3	83.8	81.5	75.5	67.2	66.9	69.2	71.1	76.0	79.4
Maximum	87.2	89.4	89.6	85.7	86.4	84.3	82.1	82.3	81.3	85.0	84.9	85.5
St. Dev.	1.9	3.2	3.6	4.8	8.6	10.3	9.7	9.1	8.4	8.1	7.0	4.3
2020 Proposed Project Alternative												
Average	83.7	86.4	85.5	82.2	77.7	71.8	66.6	66.1	68.0	70.4	75.3	79.2
Minimum	73.2	69.5	68.1	58.1	49.6	49.9	46.7	42.2	48.9	52.3	52.7	61.7
Median	83.6	87.3	86.5	83.8	81.5	75.5	67.2	67.3	69.2	70.7	76.0	79.4
Maximum	87.5	89.5	89.7	85.8	85.8	84.6	82.2	82.3	81.3	85.0	84.9	85.5
St. Dev.	1.9	3.2	3.6	4.8	8.6	10.3	9.7	9.2	8.4	8.2	7.0	4.3

Table 34a - Monthly Statistics for Export/Import Ratio in the 1994 and 2003 Scenarios

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1994 Baseline												
Average	0.50	0.45	0.42	0.36	0.24	0.22	0.19	0.19	0.28	0.39	0.50	0.58
Minimum	0.20	0.07	0.03	0.04	0.04	0.02	0.05	0.07	0.07	0.08	0.10	0.23
Median	0.50	0.47	0.50	0.35	0.22	0.22	0.21	0.18	0.31	0.45	0.56	0.63
Maximum	0.65	0.65	0.63	0.65	0.45	0.35	0.32	0.34	0.35	0.52	0.62	0.65
St. Dev.	0.10	0.13	0.18	0.20	0.13	0.10	0.07	0.06	0.08	0.12	0.14	0.09
2003 Baseline												
Average	0.53	0.45	0.41	0.35	0.25	0.24	0.17	0.12	0.27	0.38	0.49	0.58
Minimum	0.14	0.04	0.03	0.03	0.02	0.02	0.05	0.03	0.07	0.07	0.09	0.24
Median	0.54	0.48	0.48	0.40	0.25	0.23	0.19	0.11	0.29	0.44	0.56	0.63
Maximum	0.65	0.65	0.64	0.63	0.45	0.35	0.26	0.27	0.35	0.52	0.64	0.65
St. Dev.	0.10	0.13	0.17	0.18	0.13	0.10	0.06	0.05	0.08	0.13	0.15	0.09
2003 No Project Alternative A												
Average	0.53	0.45	0.41	0.35	0.25	0.24	0.17	0.12	0.27	0.38	0.49	0.58
Minimum	0.14	0.04	0.02	0.03	0.02	0.02	0.05	0.03	0.07	0.07	0.09	0.22
Median	0.53	0.48	0.48	0.39	0.24	0.24	0.19	0.11	0.30	0.44	0.56	0.63
Maximum	0.65	0.65	0.62	0.60	0.45	0.35	0.26	0.28	0.35	0.52	0.63	0.65
St. Dev.	0.10	0.14	0.17	0.18	0.13	0.10	0.06	0.05	0.07	0.13	0.15	0.09
2003 No Project Alternative B												
Average	0.53	0.45	0.41	0.35	0.25	0.24	0.17	0.12	0.27	0.38	0.49	0.58
Minimum	0.14	0.04	0.03	0.03	0.02	0.02	0.05	0.03	0.07	0.07	0.09	0.24
Median	0.54	0.48	0.48	0.40	0.25	0.23	0.19	0.11	0.29	0.44	0.56	0.63
Maximum	0.65	0.65	0.64	0.63	0.45	0.35	0.26	0.27	0.35	0.52	0.64	0.65
St. Dev.	0.10	0.13	0.17	0.18	0.13	0.10	0.06	0.05	0.08	0.13	0.15	0.09
2003 Proposed Project Alternative												
Average	0.53	0.45	0.41	0.35	0.24	0.23	0.17	0.12	0.27	0.38	0.49	0.57
Minimum	0.14	0.04	0.02	0.03	0.02	0.02	0.05	0.03	0.06	0.07	0.09	0.20
Median	0.54	0.48	0.48	0.39	0.24	0.24	0.19	0.11	0.30	0.44	0.56	0.62
Maximum	0.65	0.65	0.62	0.60	0.45	0.35	0.26	0.28	0.35	0.52	0.64	0.65
St. Dev.	0.10	0.13	0.17	0.18	0.13	0.10	0.06	0.05	0.08	0.13	0.15	0.09

Table 34b - Monthly Statistics for Export/Import Ratio in the 2020 Scenarios

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2020 Baseline												
Average	0.56	0.47	0.45	0.37	0.26	0.24	0.17	0.12	0.27	0.38	0.47	0.60
Minimum	0.26	0.07	0.04	0.03	0.03	0.03	0.06	0.03	0.09	0.09	0.09	0.31
Median	0.57	0.49	0.52	0.44	0.25	0.26	0.19	0.11	0.30	0.41	0.54	0.65
Maximum	0.65	0.65	0.65	0.61	0.45	0.35	0.26	0.27	0.35	0.55	0.65	0.65
St. Dev.	0.08	0.14	0.17	0.19	0.13	0.10	0.05	0.05	0.08	0.13	0.18	0.08
2020 No Project Alternative A												
Average	0.56	0.47	0.45	0.37	0.26	0.24	0.17	0.12	0.27	0.38	0.47	0.60
Minimum	0.26	0.07	0.04	0.03	0.03	0.03	0.06	0.03	0.09	0.09	0.09	0.31
Median	0.57	0.49	0.52	0.44	0.25	0.26	0.19	0.11	0.30	0.41	0.54	0.65
Maximum	0.65	0.65	0.65	0.61	0.45	0.35	0.26	0.27	0.35	0.55	0.65	0.65
St. Dev.	0.08	0.14	0.17	0.19	0.13	0.10	0.05	0.05	0.08	0.13	0.18	0.08
2020 No Project Alternative B												
Average	0.56	0.47	0.45	0.37	0.26	0.24	0.17	0.12	0.27	0.38	0.47	0.60
Minimum	0.26	0.07	0.04	0.03	0.03	0.03	0.06	0.03	0.09	0.09	0.09	0.31
Median	0.57	0.49	0.52	0.44	0.25	0.26	0.19	0.11	0.30	0.41	0.54	0.65
Maximum	0.65	0.65	0.65	0.61	0.45	0.35	0.26	0.27	0.35	0.55	0.65	0.65
St. Dev.	0.08	0.14	0.17	0.19	0.13	0.10	0.05	0.05	0.08	0.13	0.18	0.08
2020 Proposed Project Alternative												
Average	0.56	0.47	0.45	0.37	0.25	0.24	0.17	0.12	0.28	0.38	0.47	0.60
Minimum	0.25	0.07	0.04	0.03	0.03	0.03	0.06	0.03	0.09	0.08	0.08	0.31
Median	0.58	0.50	0.52	0.45	0.26	0.26	0.19	0.11	0.31	0.42	0.54	0.65
Maximum	0.65	0.65	0.65	0.61	0.45	0.35	0.26	0.25	0.35	0.55	0.65	0.65
St. Dev.	0.08	0.14	0.17	0.18	0.13	0.10	0.05	0.05	0.08	0.13	0.18	0.08

3.5. Reservoir Storage Levels

Figures 20a through 20c show the annual carryover storage levels at the end of December in Lake Oroville. Figures 21a through 21c show the same information in the SWP portion of San Luis Reservoir in each scenario. In Lake Oroville, each of the scenarios have similar storage patterns, with the Baseline, Proposed Project and No Project scenarios being very similar in both 2003 and 2020. In San Luis Reservoir, there is more variation between the scenarios in 2003 but the values in 2020 are similar. In both reservoirs there are many years in which the 1994 Baseline has greater carryover storage levels than at the later levels of development, and in many years there are higher carryover storage levels at the 2003 level of development scenarios than in the 2020 level of development scenarios.

Figure 22a shows the average monthly storage in the SWP portion of San Luis Reservoir in each of the 2003 scenarios. Figure 22b shows the same information for the 2020 scenarios. The monthly patterns at each level of development are similar in each of the different scenarios, except that San Luis storage is a little bit higher in most months in the Proposed Project than in the Baseline and No Project scenarios.

In addition, as discussed above the SWP San Luis monthly storage values from the CALSIM II model were adjusted to account for the change in monthly delivery patterns between the different No Project scenarios. As the data in the figures show, these differences had only a minor effect on San Luis storage results.

Figure 20a - End-of-December Carryover Storage Values in Lake Oroville at the 1994 Level of Development

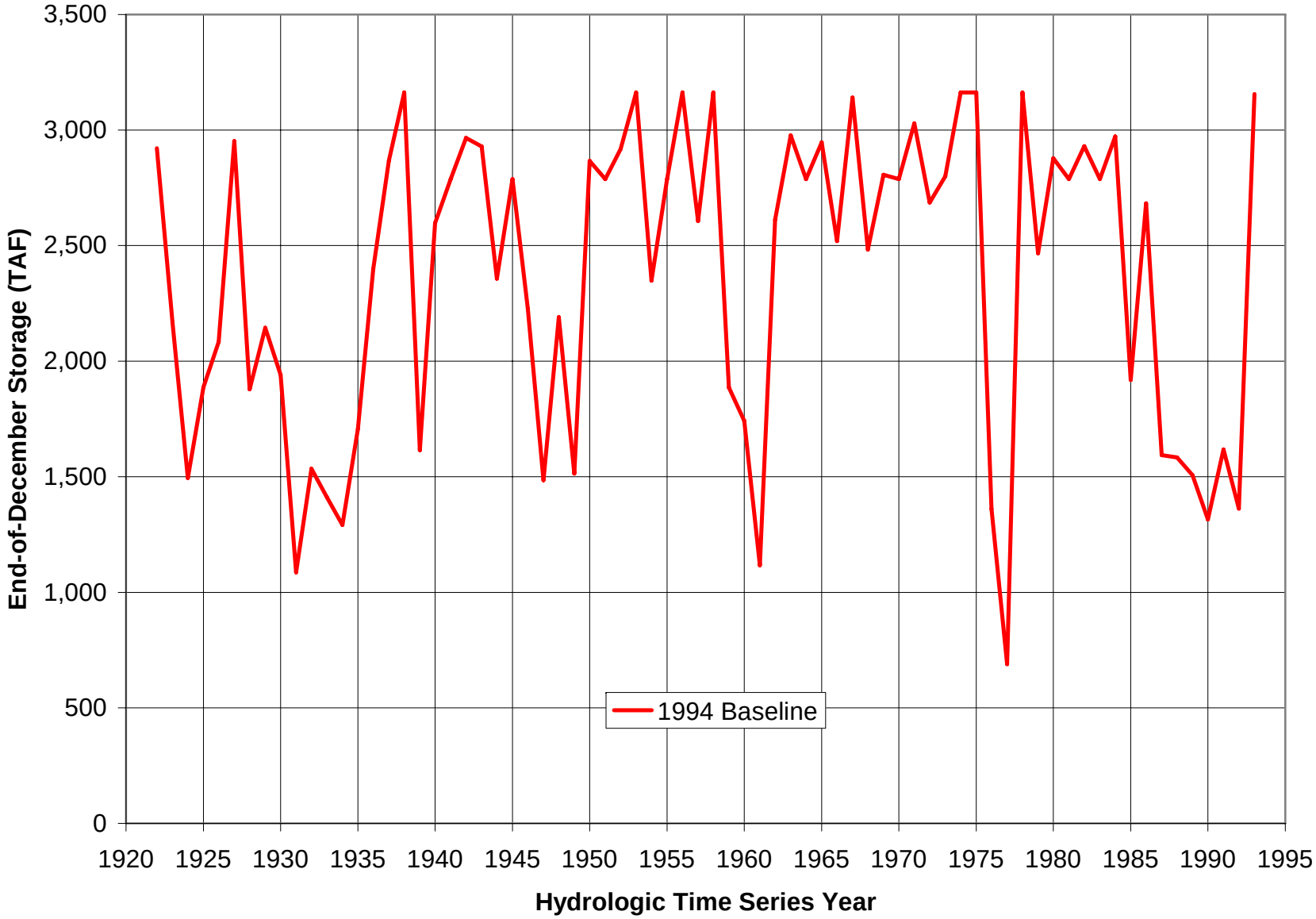


Figure 20b - End-of-December Carryover Storage Values in Lake Oroville at the 2003 Level of Development

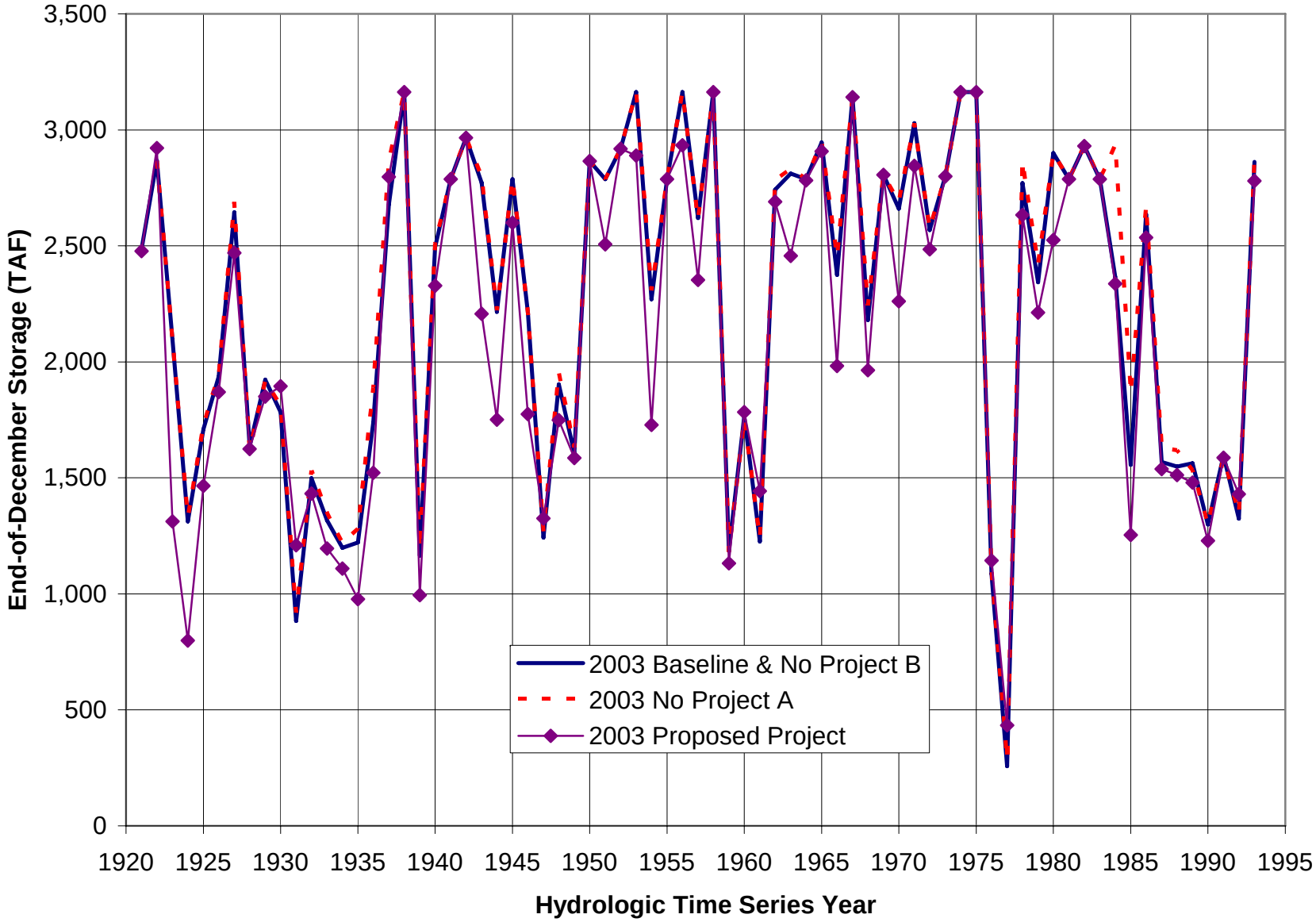


Figure 20c - End-of-December Carryover Storage Values in Lake Oroville at the 2020 Level of Development

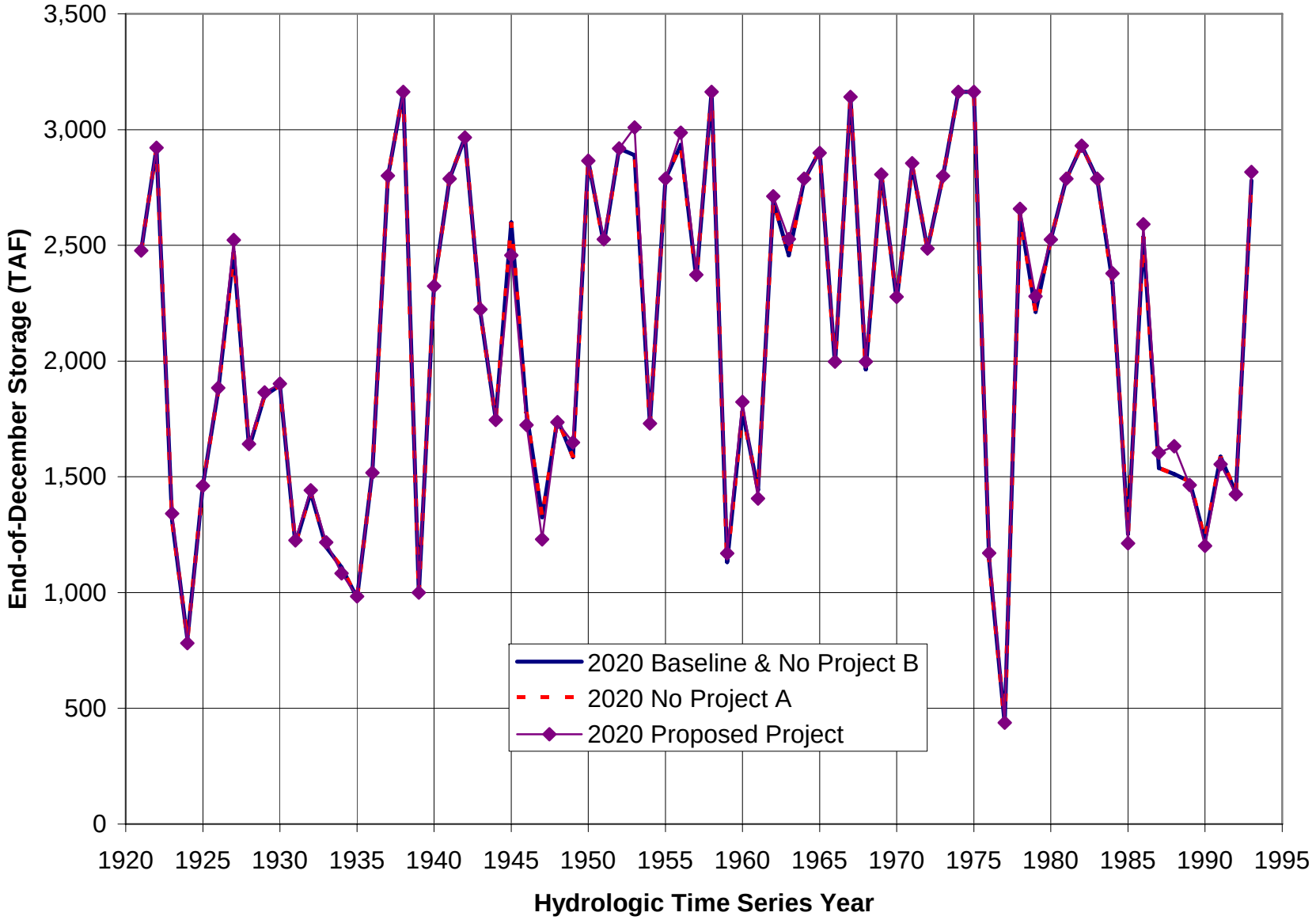


Figure 21a - End-of-December Carryover Storage Values in SWP Portion of San Luis Reservoir at the 1994 Level of Development

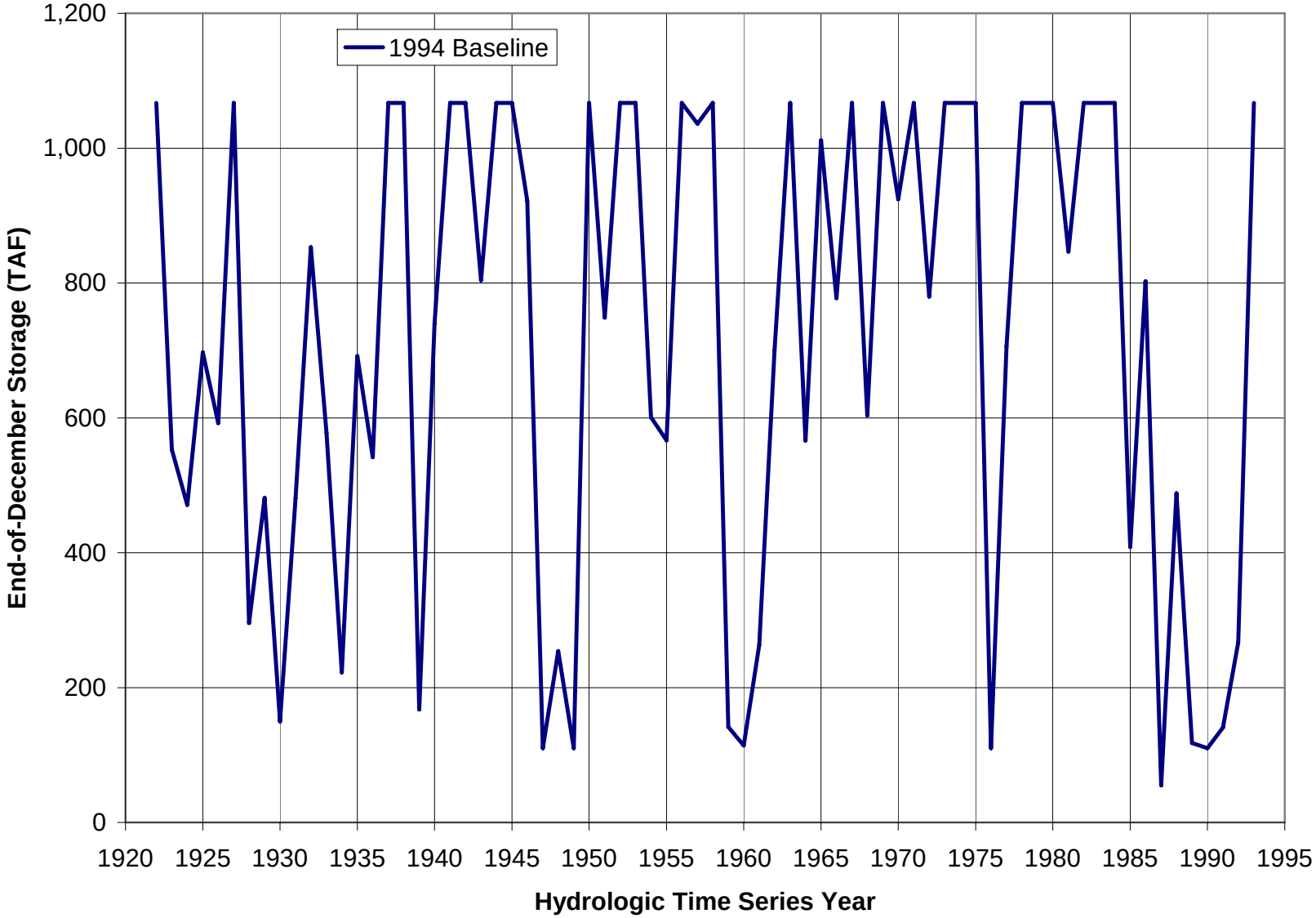


Figure 21b - End-of-December Carryover Storage Values in SWP Portion of San Luis Reservoir at the 2003 Level of Development

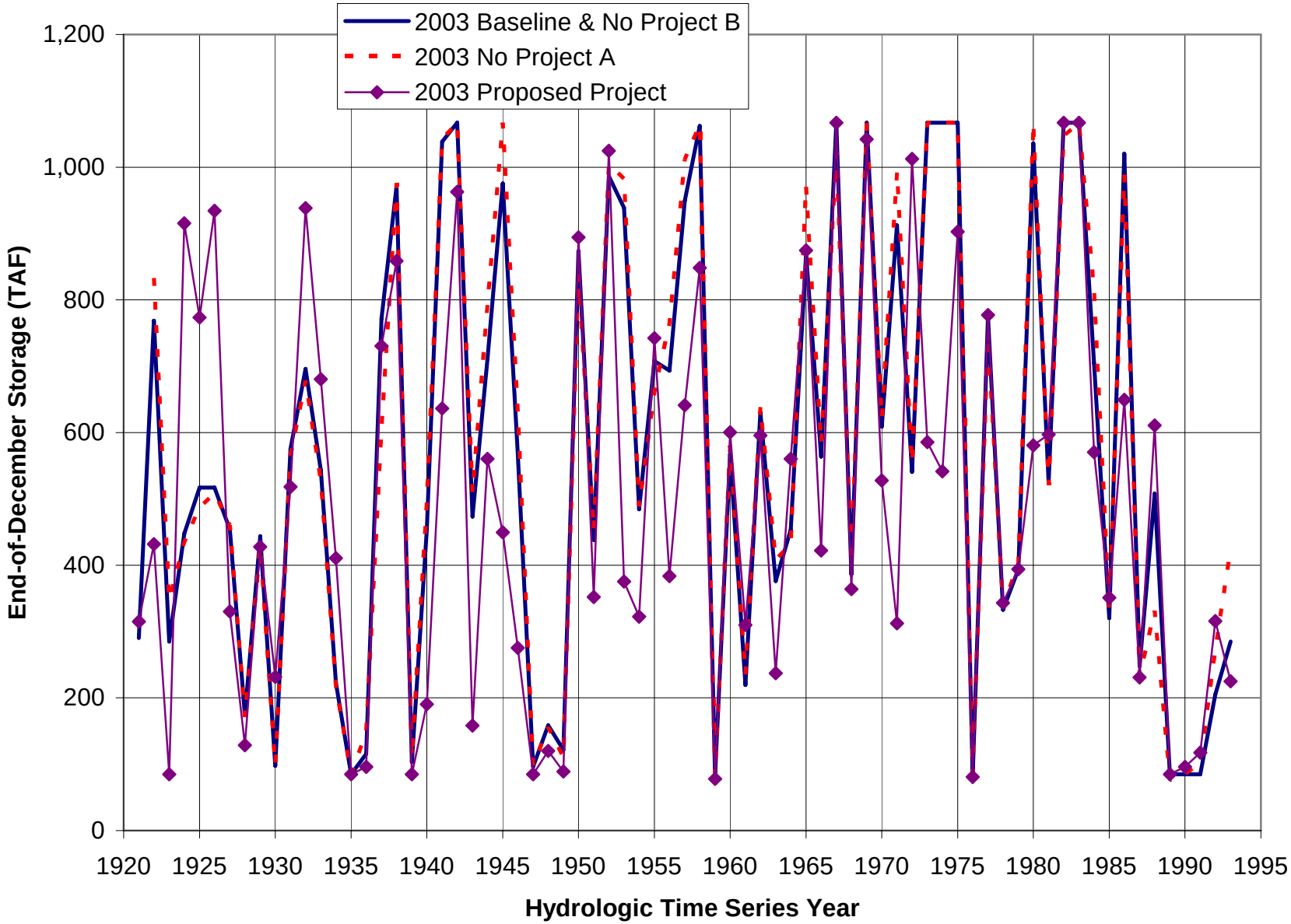


Figure 21c - End-of-December Carryover Storage Values in SWP Portion of San Luis Reservoir at the 2020 Level of Development

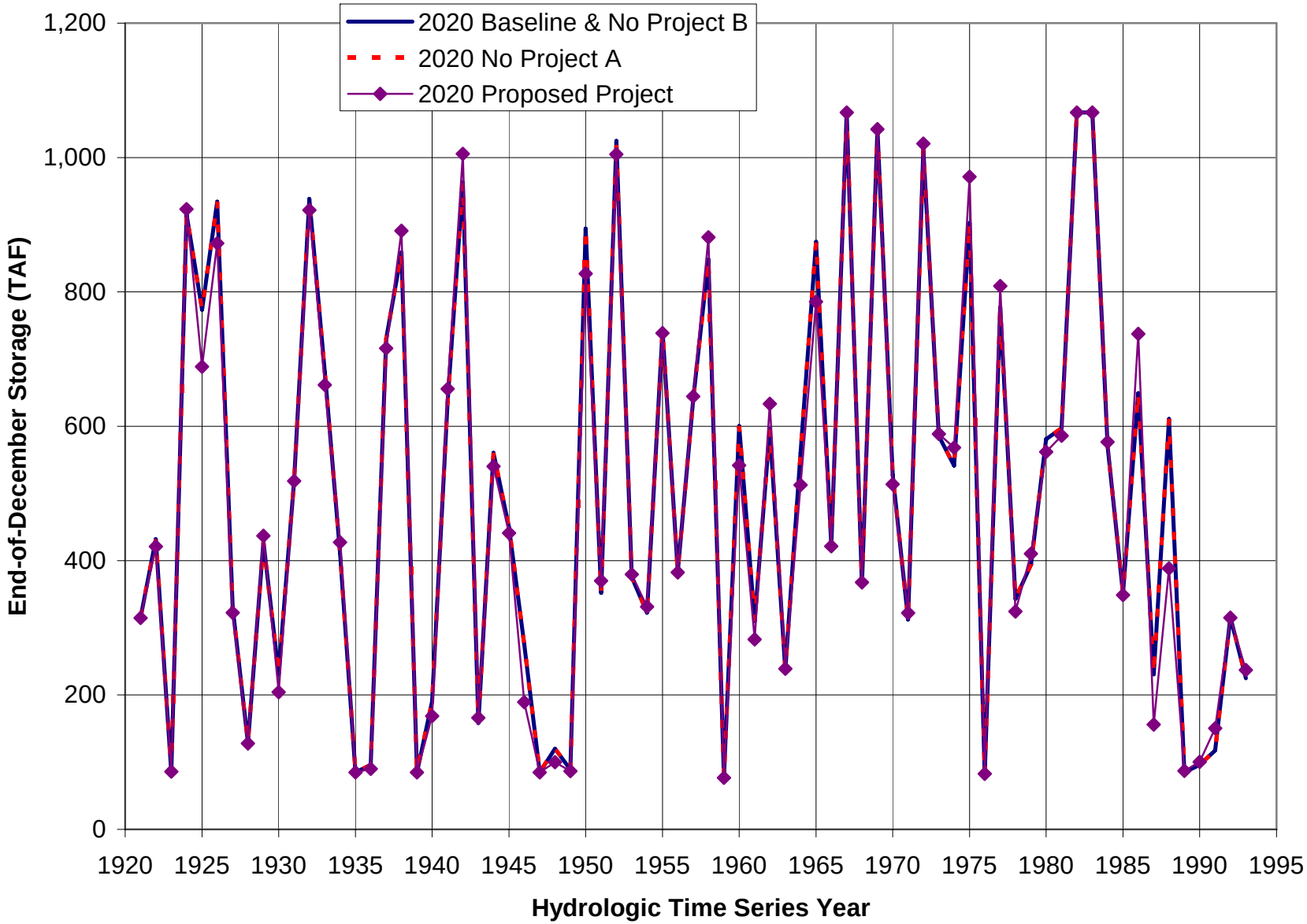


Figure 22a - Average Monthly Storage Values in SWP Portion of San Luis Reservoir at the 2003 Level of Development

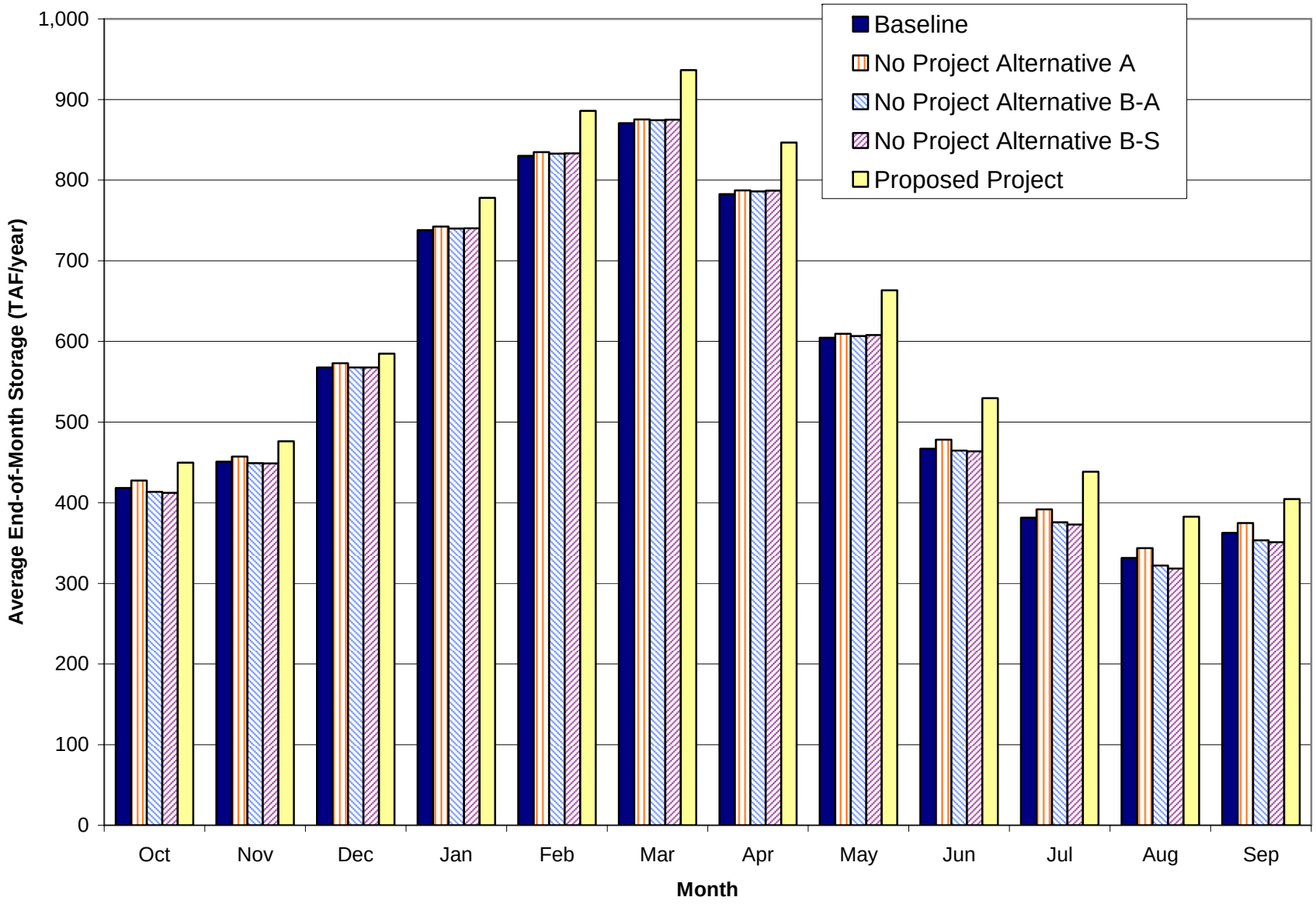
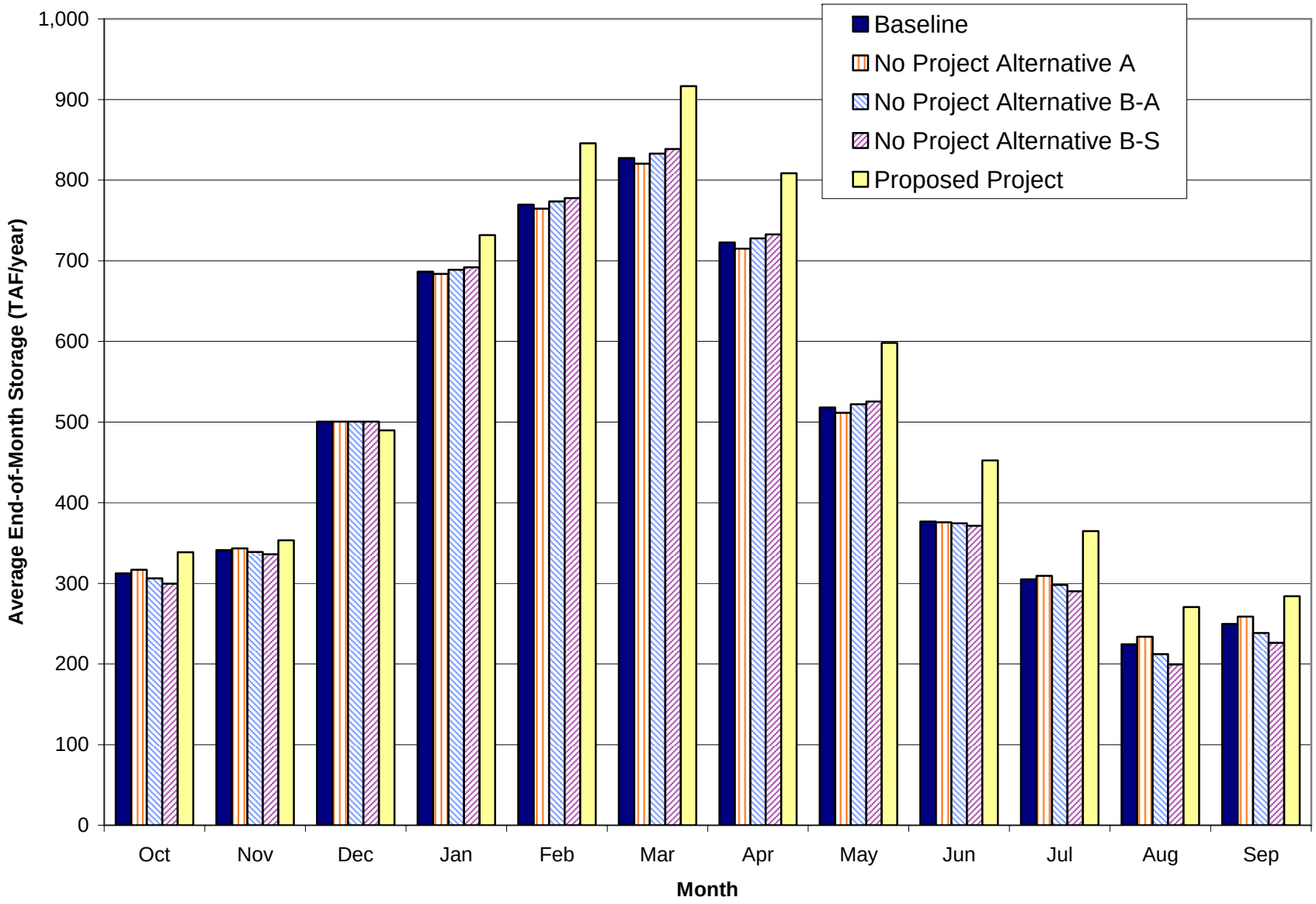


Figure 22b - Average Monthly Storage Values in SWP Portion of San Luis Reservoir at the 2020 Level of Development



3.6. Kern Fan Element Storage Operations

Scenarios were developed for the 2003 and 2020 No Project Alternatives A, B-A, and B-S that incorporate a SWP-owned groundwater banking facility in the Kern Fan Element (KFE). Section 3.1 on SWP deliveries report the scheduled and unscheduled deliveries that occurred under each Alternative with and without the KFE facility in place. This section describes the operations of the banking facility itself.

Table 35 shows the average annual recharge and extraction quantities in each scenario in each water year type. In the 2003 scenarios about 8.6 TAF per year is recharged into KFE, with extractions of about 7.5 TAF per year. In the 2020 scenarios 14.6 to 16.4 TAF is recharged into KFE and 13.0 – 14.6 TAF per year is extracted. In all scenarios, most recharge occurs during wet and above normal years and all of the extraction occurs during dry and critical years.

Table 35 – Kern Fan Element Storage Facility Recharge and Extraction (TAF/year)

	2003 No Project A	**2003 No Project B**	**2020 No Project A**	**2020 No Project B**
Recharge				
All Years	8.6	8.6	16.4	14.6
Wet Years	12.7	13.1	26.8	22.4
Above Normal Years	15.2	15.2	23.8	23.8
Below Normal Years	8.7	8.1	17.9	15.5
Dry Years	5.1	5.1	8.4	8.4
Critical Years	0.0	0.0	0.0	0.0
Extraction				
All Years	7.5	7.5	14.6	13.0
Wet Years	0.0	0.0	0.0	0.0
Above Normal Years	0.0	0.0	0.0	0.0
Below Normal Years	0.0	0.0	0.0	0.0
Dry Years	6.6	6.6	24.5	16.9
Critical Years	37.3	37.1	57.6	57.6

Figures 23a through 23b show the annual extraction and recharge amounts that occur in each water year in each scenario. Figures 24a through 24b show the KFE storage in each month of the simulation. In all scenarios, the KFE storage facility is filled to capacity for much of the period of simulation and then reduced as extractions occur during dry periods.

Figure 23a – Annual Extraction and Recharge in KFE Storage in 2003 No Project Alternative A

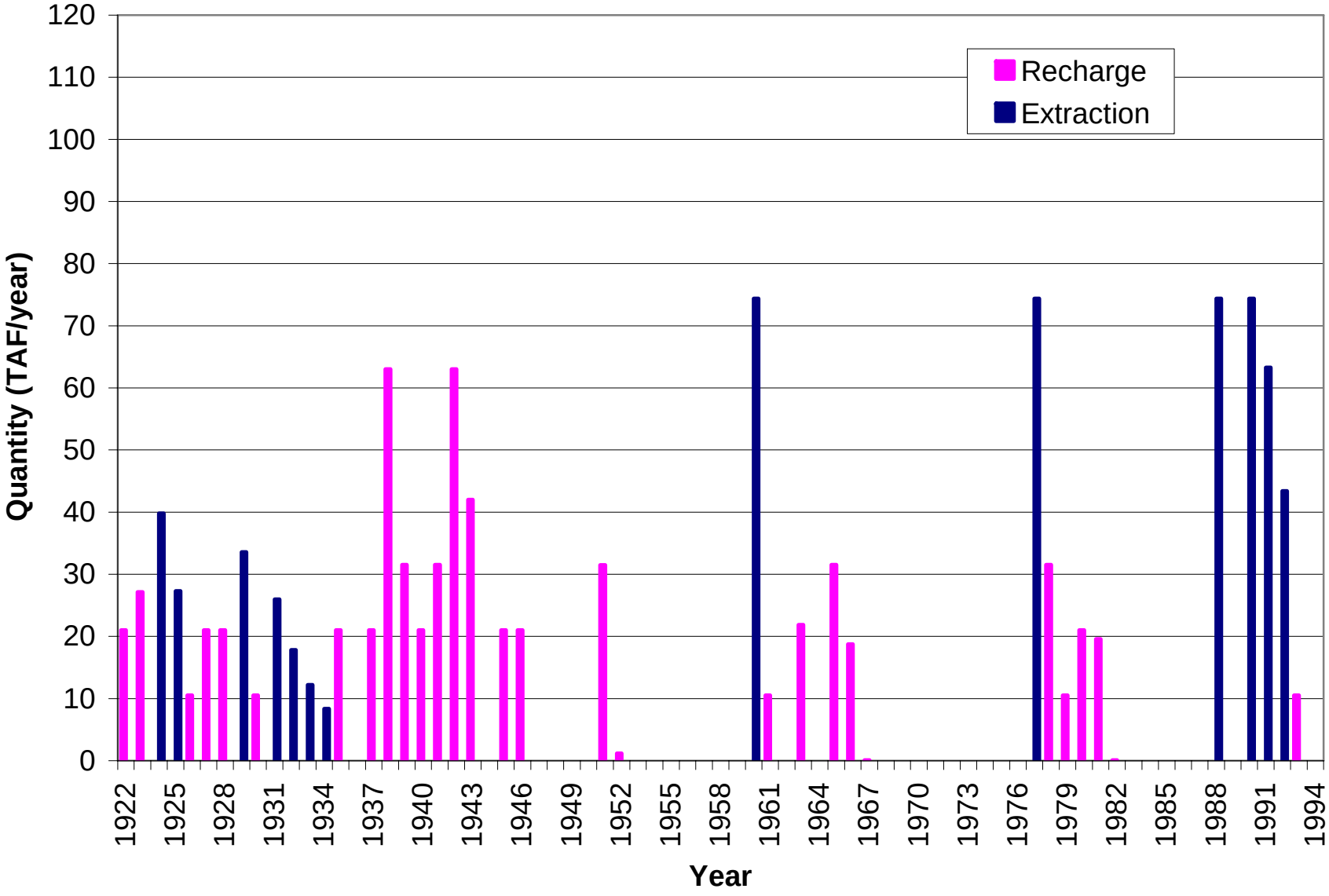


Figure 23b – Annual Extraction and Recharge in KFE Storage in 2003 No Project Alternative B

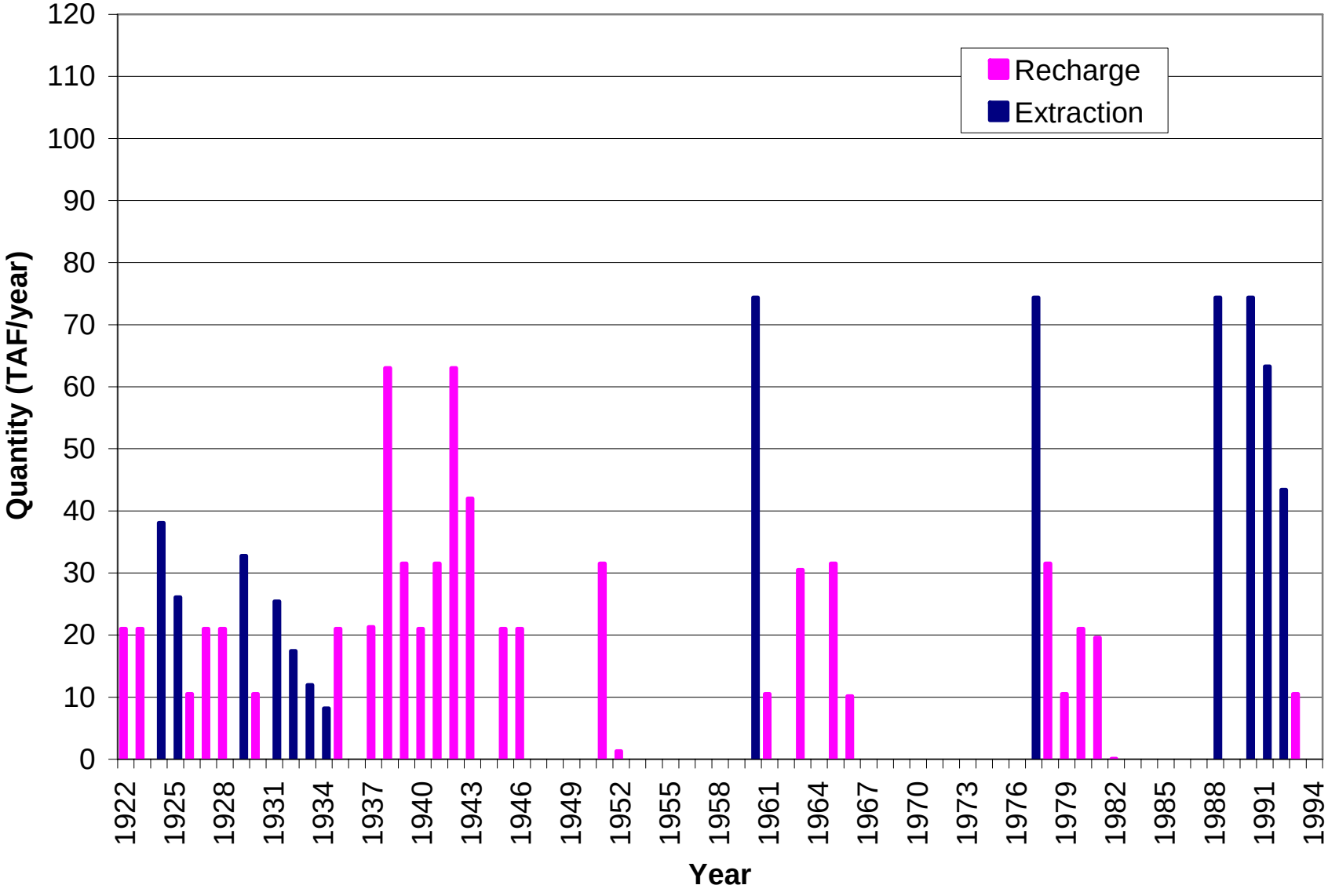


Figure 23c – Annual Extraction and Recharge in KFE Storage in 2020 No Project Alternative A

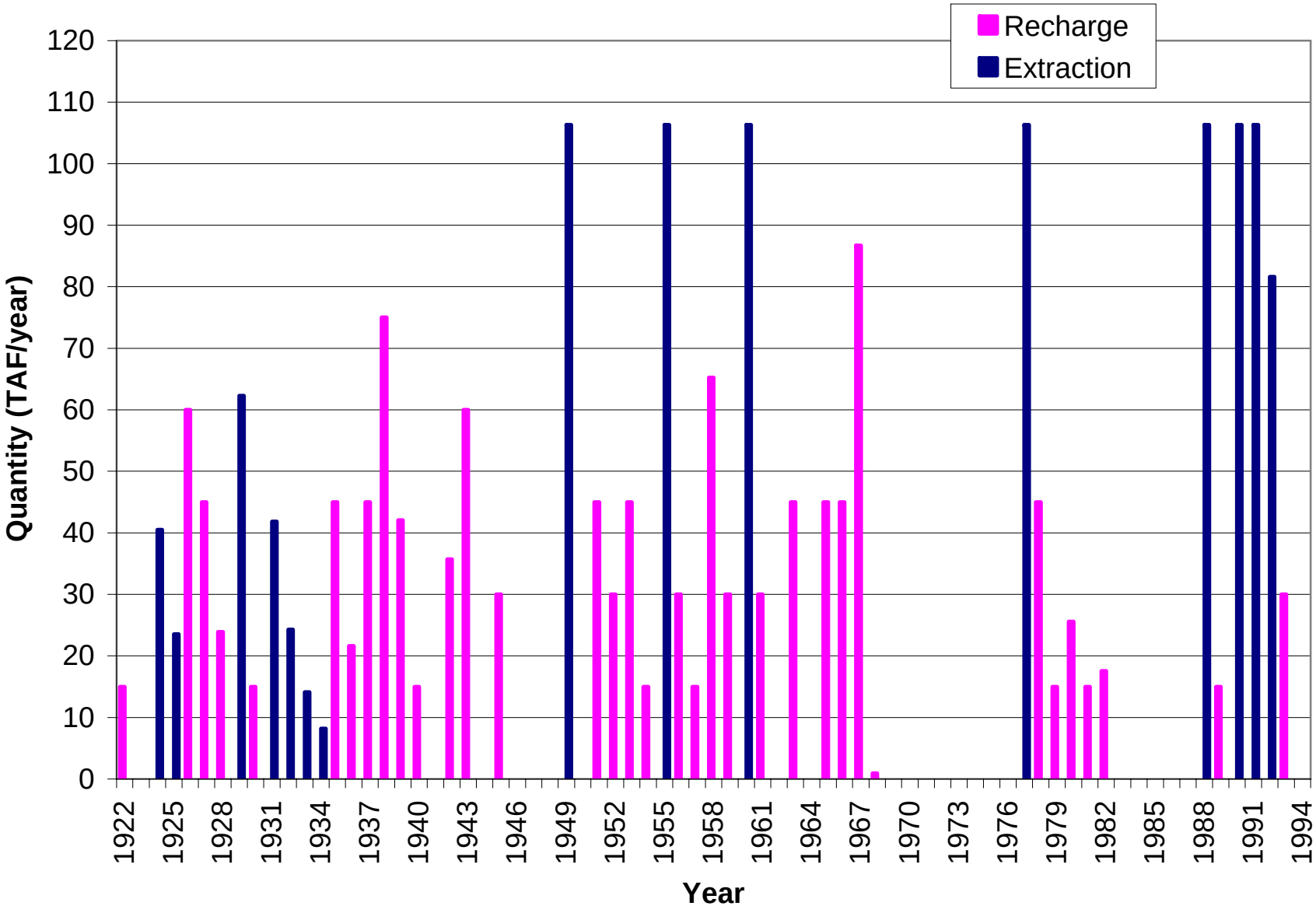


Figure 23d – Annual Extraction and Recharge in KFE Storage in 2020 No Project Alternative B

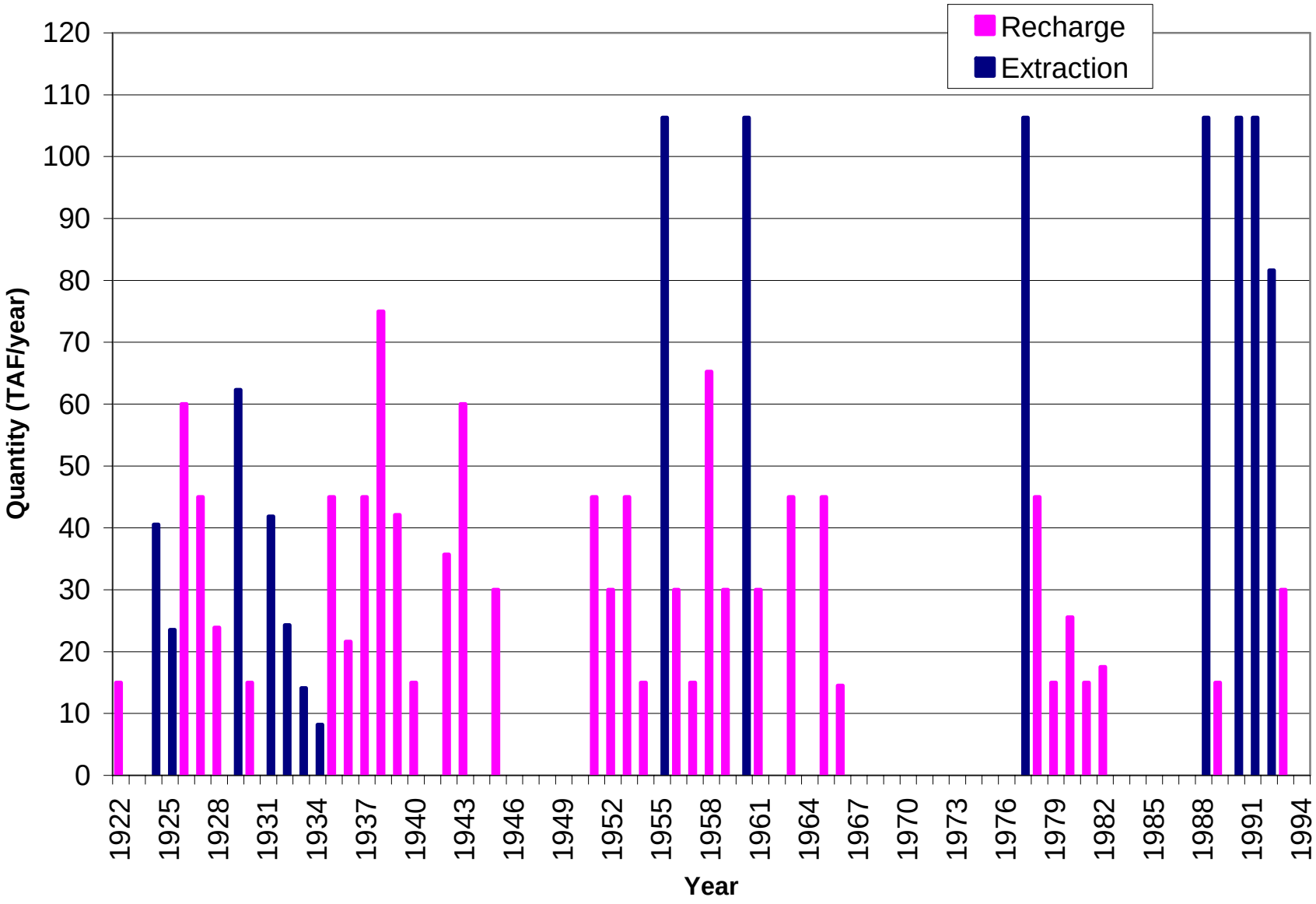


Figure 24a – Monthly Storage in the Kern Fan Element in 2003 No Project Alternative A

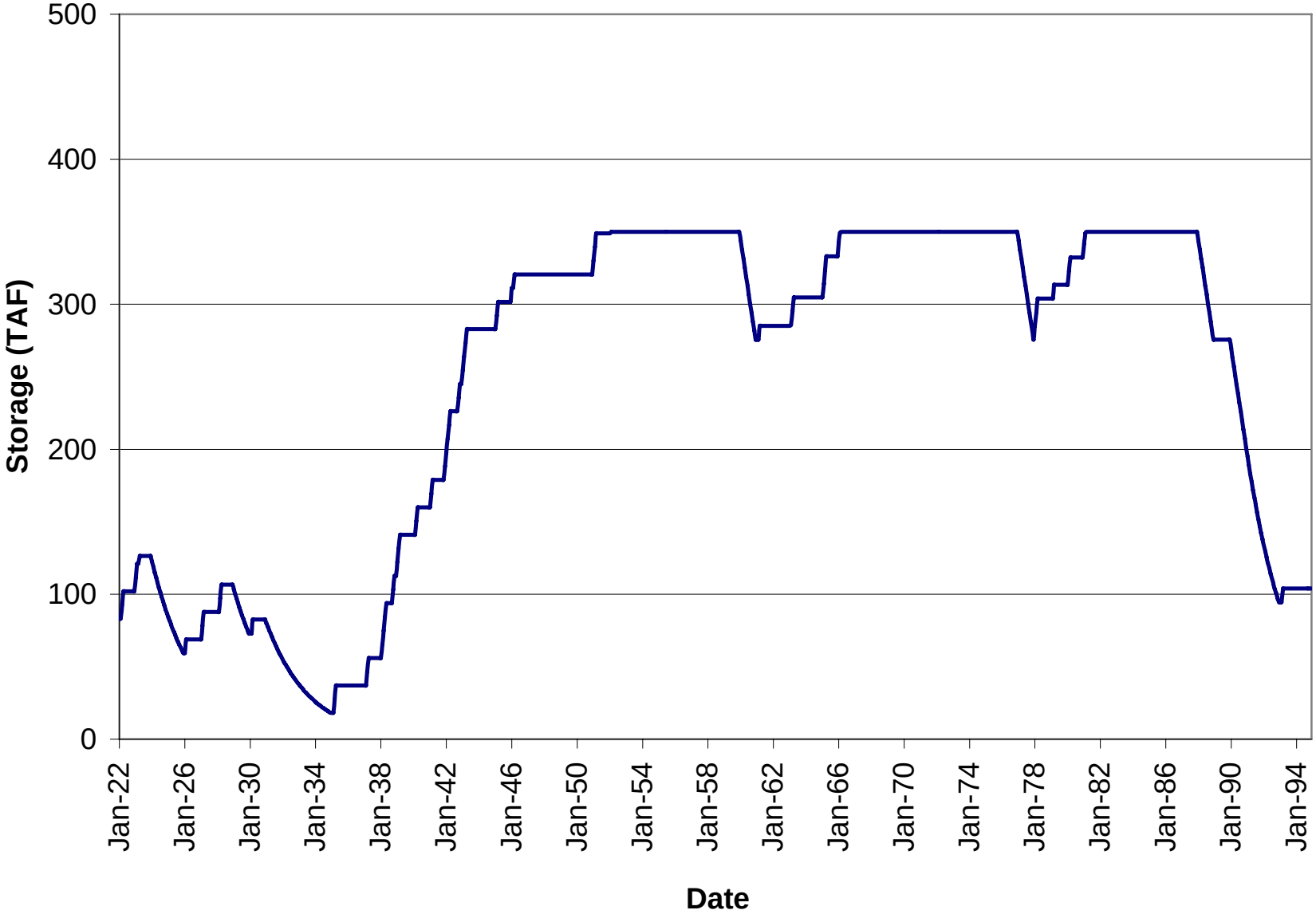


Figure 24b – Monthly Storage in the Kern Fan Element in 2003 No Project Alternative B

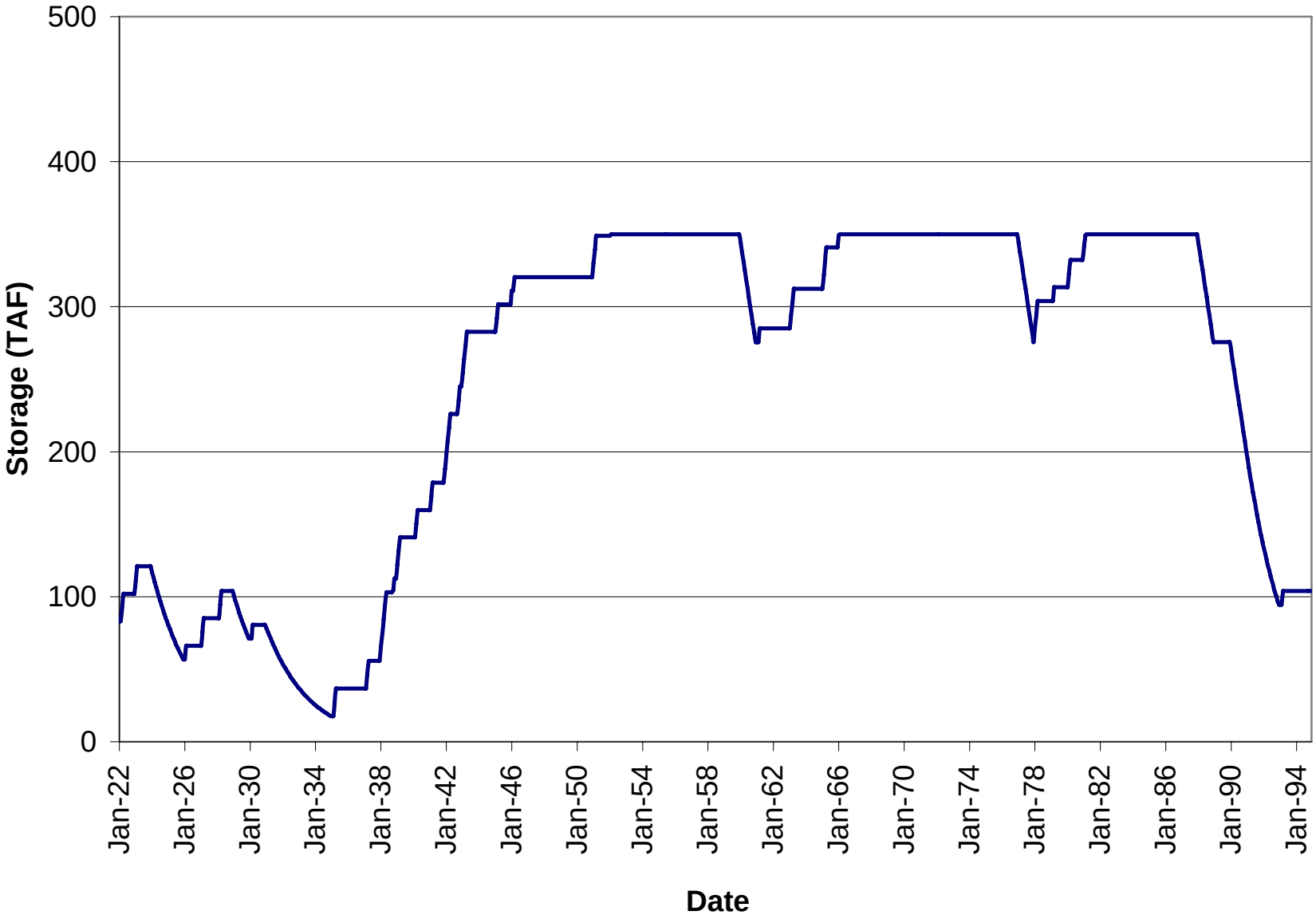


Figure 24c – Monthly Storage in the Kern Fan Element in 2020 No Project Alternative A

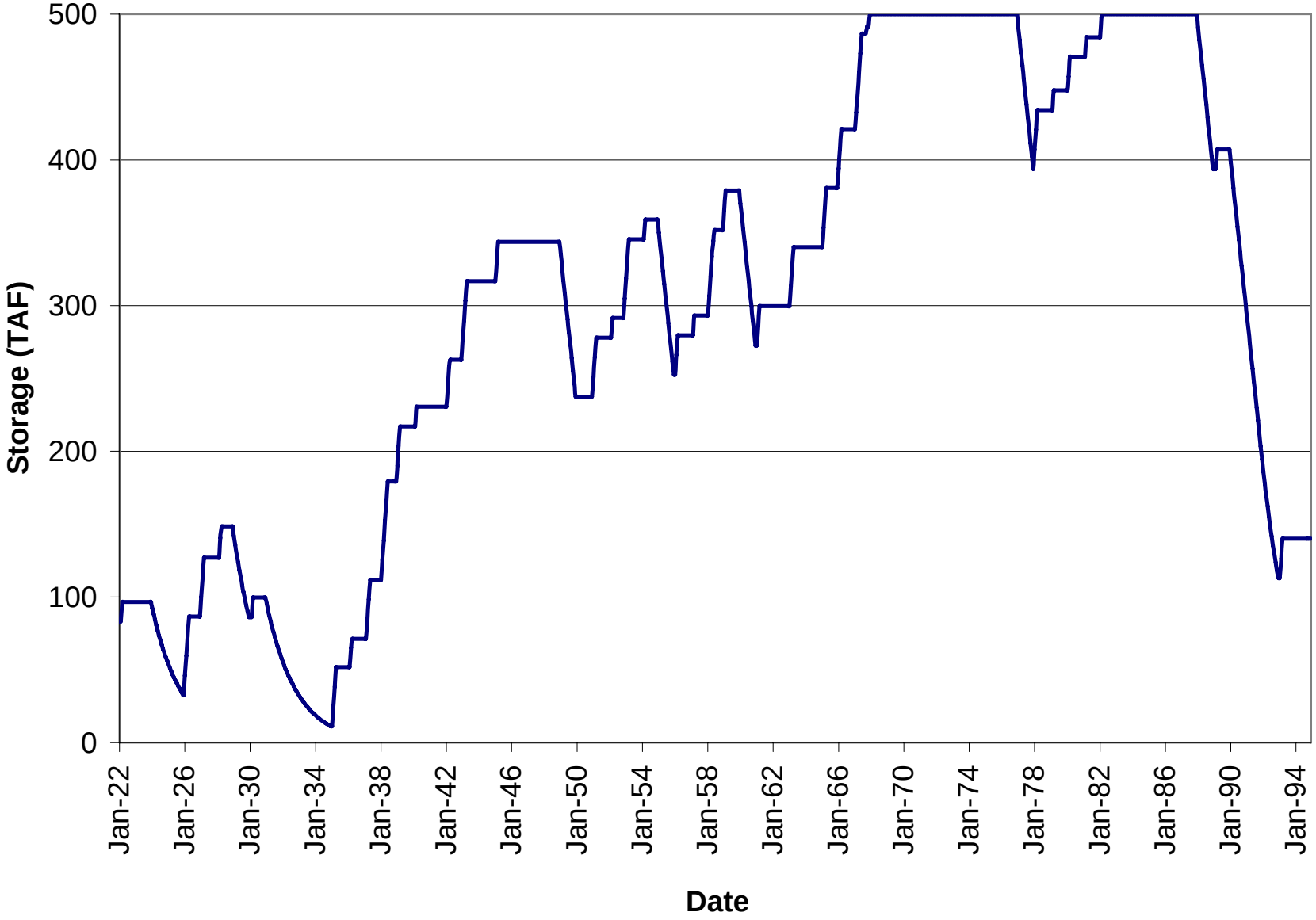
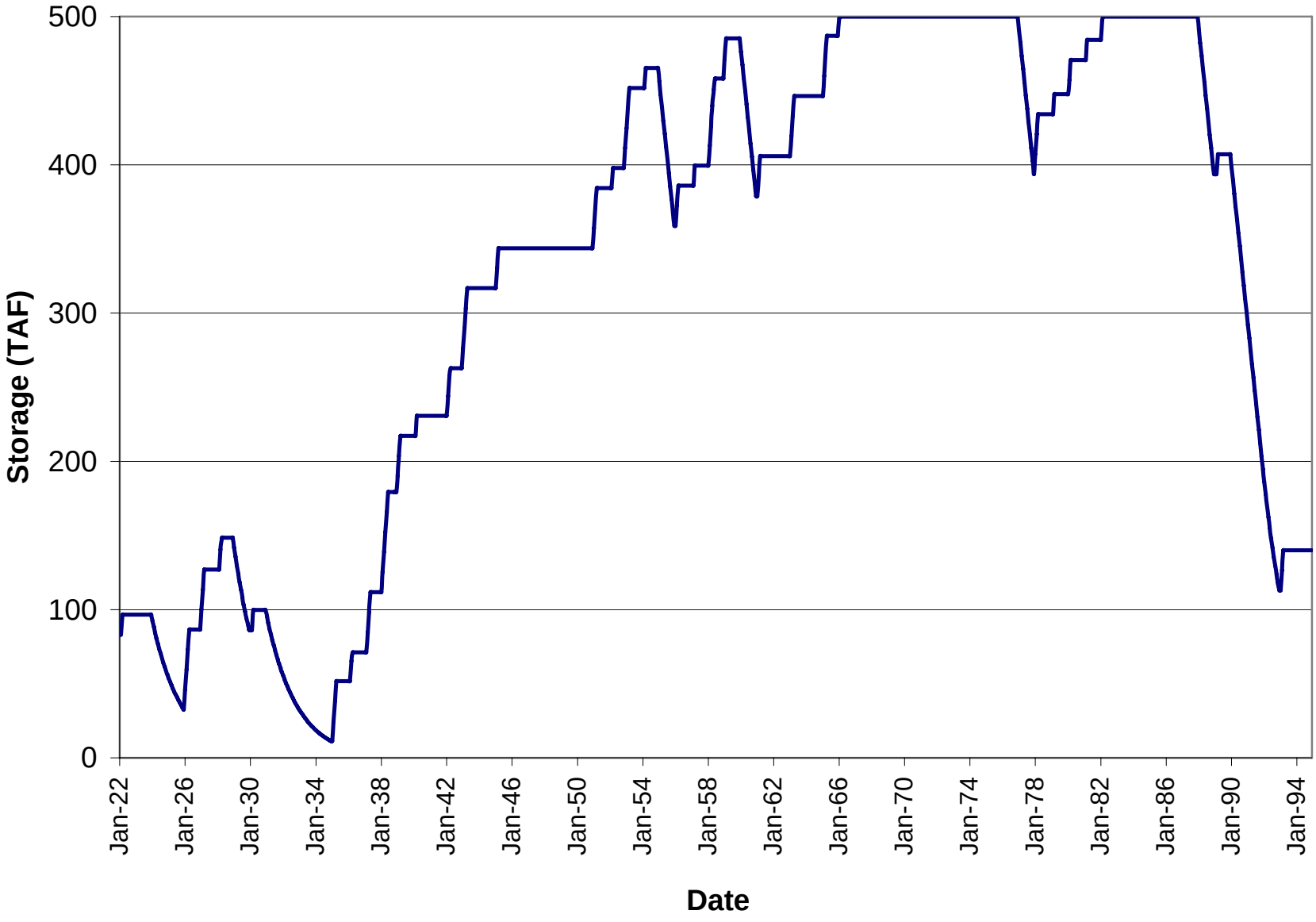


Figure 24d – Monthly Storage in the Kern Fan Element in 2020 No Project Alternative B



4.0. Limitations

For the Monterey Plus EIR, the CALSIM II model was used to simulate overall SWP and CVP operations and the resulting flows in the Delta and in upstream rivers in each alternative. However, because the most significant differences in assumptions between the different alternatives is in the allocation rules for SWP deliveries, the system-wide SWP Table A and Article 21 delivery results from CALSIM II have been post-processed using Excel spreadsheets to determine the deliveries to each contractor in each alternative. With this approach the deliveries to individual contractors are determined according to each alternative's allocation rules but total SWP deliveries for each year are unchanged from the CALSIM II model results.

The CALSIM II model is the best available tool for long-term planning of the SWP, CVP, and the Delta in an integrated manner. However, in its current state of development it has several limitations, some of which were identified in *A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California* (Close et al. 2003). The following are some of the more significant limitations of the CALSIM II model:

- The CALSIM II model simulates at a monthly time step that does not reflect daily variations in flows and climatic conditions. However, monthly results still yield useful insights into the differences between alternatives (USBR 2004).

- Because the operations of the CVPIA (b)(2) and EWA respond to real-time hydrology and fish movements the program operations do not follow a pattern that can be predicted in a monthly model; thus CALSIM II cannot completely represent the operations of these programs. Because the model is set up to run each step of the 3406(b)(2) on an annual basis and because the WQCP and Endangered Species Act actions are set on a priority basis that can trigger actions using 3406(b)(2) water or EWA assets, the model will exceed the dedicated amount of 3406(b)(2) that is available. In addition, the 3406(b)(2) and EWA operations in CALSIM II do not fully account for the potential weighting of assets versus cost or the dynamic influence of biological factors on the timing of actions. The monthly time step of CALSIM II also requires day-weighted monthly averaging to simulate VAMP actions, export reductions, and X2-based operations, which can cause the amount of water needed for these actions to be either an under- or over-estimated (USBR 2004).

- Because CALSIM II uses fixed rules and guidelines, operations might not reflect how the SWP and CVP would operate during extended drought periods. The allocation process utilizes storage-delivery curves to determine annual allocation amounts based on storage conditions and inflow to project reservoirs but does not include project inflow from contributing streams. This curve-based approach may cause some variation in results between studies that would be closer with a more robust approach to the allocation process (USBR 2004).

There are the following additional limitations specific to the modeling approach employed in this analysis:

- Under the pre-Monterey Amendment allocation rules, agricultural Table A amounts receive an initial cut in SWP deliveries in years when 100% Table A allocation cannot be achieved by an amount up to 50% of their Table A amounts in any one year or a total of 100% of their Table A amounts over any seven year period. While these allocation rules were implemented in the analysis, there was no way to fully implement the seven year rule in the first six years of the analysis, which could cause an underestimate of agricultural deliveries in these years in the No Project Alternatives. For this reason, the first six years of data have been removed in the reporting of SWP deliveries in this appendix.

- For the 1994 and 2003 scenarios a constant annual Table A demand was used for every M&I contractor other than MWDSC. In reality, these contractors have demands for Table A water that may differ by year type and other local conditions. However, because of the limited amount of data available to quantify their demands at each level of development and because their demands are relatively much smaller than that of KCWA and MWDSC, the Monterey Plus EIR Modeling Subcommittee determined that assuming a constant Table A demand for each of these contractors was an acceptable simplification.

- In the real-world operation of the State Water Project, contractors may request their full Table A amounts and then only take a portion of their allocated amount. This means that their "request" may differ from their actual "demand". However, while the SWP operators may not know what the demand actually is, in the CALSIM II model and in the post-processing spreadsheets it is assumed that the actual demands are known at the beginning of the contract year. This approach may result in a minor over-estimation of SWP project deliveries in the 1994 and 2003 scenarios.

- The Monterey Amendment includes a provision for a Turnback Pool, by which contractors who do not utilize their entire Table A allocation can sell unused allocation to other contractors. However, the Turnback Pool is not represented in the CALSIM II model, nor is data available to adequately quantify this operation, and thus there was no way to fully represent it in the post-processing spreadsheets. This means that the delivery patterns shown for the Proposed Project scenarios may be somewhat different than they would be if the Turnback Pool were fully represented.

- In this analysis, the monthly storage pattern in San Luis Reservoir and the monthly delivery pattern to SWP contractors are operated dynamically in the CALSIM II model and then are post-processed to match the allocation assumptions of each alternative. This approach results in only a minor change in San Luis Reservoir operation in most years, but it does not allow for a dynamic operation of the reservoir, which likely results in some minor inefficiencies in the operation of the Project.

- For the 1994 scenario, there is no available data set for the 1994 level of development for many parts of the system, including Sacramento and San Joaquin River hydrology and CVP demands. In order to analyze this scenario it has been assumed that these components of the state water system are the same as in the 2003 alternatives.

For the Monterey Plus EIR, the effects of these limitations have been minimized because the model and post-processing results have been presented in "comparative" mode as opposed to

"absolute" or "predictive" mode. In "absolute" applications the model is run once to predict a future outcome and errors or assumptions in formulation, system representation, data, operational criteria and other model inputs all contribute to total error or uncertainty in model results. In "comparative" applications the model is run two or more times, once to represent a baseline condition and additional times with specific changes in inputs to assess the changes in the outcome due to the input changes. In comparative mode, only the difference between two simulations is of importance – the errors and uncertainties that exist in both simulations are largely removed (or significantly reduced) when measuring the change between simulations.

5.0. References

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Monterey Plus EIR

Attachment to
Analysis of Hydrology and SWP Deliveries in each Alternative Using CALSIM II and Associated Post-Processing Routines

8/22/2007

This document is an attachment to the appendix *Analysis of Hydrology and SWP Deliveries in each Alternative Using CALSIM II and Associated Post-Processing Routines* (May 30, 2006). The appendix describes the approach, assumptions and results of CALSIM II modeling and associated post-processing that was performed in support of the Monterey Plus EIR. The modeling assisted analysis of some of the Monterey Amendment's impacts on the State Water Project (SWP) and other areas. The analysis included evaluation of a 1994 Baseline and 2003 and 2020 evaluations of a Baseline, the Proposed Project and multiple No Project Alternatives that reflect different interpretations of the pre-Monterey contracts.

This attachment describes the assumptions and results of additional scenarios at the 2003 and 2020 levels of development have been developed since the release of the May 30, 3006 appendix. For each of these additional scenarios the SWP deliveries to each contractor have been post-processed using the same process used previously. The attachment reports the resulting SWP scheduled and unscheduled deliveries to each contractor.

Additional Scenarios

The following additional scenarios have been analyzed at both the 2003 and 2020 levels of development for the following alternatives.

- No Project Alternative 1
- No Project Alternative 2
- No Project Alternative 3
- No Project Alternative 4

A revised version of the Proposed Project has also been analyzed at the 2020 level of development.

No Project Alternatives 1, 3, and 4 have been analyzed both with and without a hypothetical SWP groundwater banking facility in the Kern Fan Element (KFE). No Project Alternative 2 does not include a state-owned groundwater banking facility in the KFE.

In addition, for No Project Alternative 1 and revised Proposed Project at the 2020 level of development additional scenarios were developed to analyze SWP deliveries under climate change conditions.

Changes in Assumptions for Additional Scenarios

With the exception of the changes described below, the revised Proposed Project scenarios utilize all of the same assumptions as the original Proposed Project scenarios; the No Project Alternative 1 and No Project Alternative 2 scenarios utilize all of the same assumptions as the original Baseline and No Project A scenarios; the No Project Alternative 3 scenarios utilize all of the same assumptions as the original Alternative B-A scenarios; and the No Project Alternative 4 scenarios utilize all of the same assumptions as the original Alternative B-S scenarios.

The additional scenarios incorporate the following changes in assumptions relative to the original scenarios.

- For all of the 2020 scenarios, Banks Pumping Plant has been operated at the 1994 operating capacity of 6,680 cfs.
- The assumed Table A transfers have been revised from the original scenarios. The assumed Table A transfers included in the additional scenarios are shown in Table A-1. Table A-2 shows the resulting Table A amounts for each contractor in each scenario.
- The No Project Alternative 2 scenarios include the Table A relinquishments that are shown in Table 4 of the May 30, 2006 appendix.

CALSIM II Simulations Used for Post-Processing Analysis

2003 Scenarios

SWP deliveries for the additional 2003 scenarios were post-processed from the same CALSIM II simulations that were used for the original scenarios. The No Project Alternative 1, 3 and 4 scenarios were post-processed using data from the Baseline CALSIM II simulation. The No Project Alternative 2 scenario was post-processed using data from the Proposed Project CALSIM II simulation.

At the 2003 level of development, the Proposed Project scenario is unchanged from the original scenario contained in the May 30, 2006 appendix. However, Table A amounts and SWP delivery results from the original scenario are shown in this attachment for comparison purposes.

2020 Scenarios

Updated versions of the 2020 Baseline and 2020 Proposed Project CALSIM II simulations were performed. The assumptions and input data for these scenarios were the same as the original CALSIM II simulations except that the operation of Banks Pumping Plant was changed to a capacity of 6,680 cfs. The No Project Alternative 1, 3 and 4 scenarios were post-processed using data from the updated Baseline CALSIM II simulation. No Project Alternative 2 and the revised Proposed Project scenario was post-processed using data from the updated Proposed Project CALSIM II simulation.

Analysis of Climate Change Scenarios

For the climate change scenarios, the annual scheduled deliveries used as an input into the post-processing spreadsheets were modified using SWP delivery data from the GFDL B1 and Base

scenarios contained in *Progress on Incorporating Climate Change into Management of California's Water Resources* (DWR, July 2006). The Table A deliveries from the Monterey Plus EIR CALSIM II simulations were adjusted by multiplying each year's value by a factor equal to the ratio of the Table A delivery in the GFDL B1 scenario divided by the Base scenario. Post-processing of the SWP deliveries was then performed using this revised time series.

Unscheduled deliveries were not modified to account for climate change because the average annual unscheduled deliveries in the GFDL B1 scenario were very close to that in the Base scenario.

SWP Delivery Results for the Additional Scenarios

Average annual scheduled and unscheduled deliveries to each contractor in each of the additional scenarios in all years, wet years, above normal years, below normal years, dry years, and critical years are shown in revised versions of Tables A-3a-f, A-4a-f, A-5a-f, and A-6a-f.

Table A-1 - Table A Transfers (acre-feet)

Transferor	Transferee	No Project Alternative 1	No Project Alternative 2	No Project Alternative 3	No Project Alternative 4	Proposed Project	Applicable Levels of Development
Kern County WA	Mojave WA	0	25,000	0	0	25,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	7,000	0	0	7,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	15,000	0	0	15,000[1]	2003, 2020
Kern County WA	Castaic Lake WA	0	41,000	0	0	41,000[1]	2003, 2020
Kern County WA	Palmdale WD	0	4,000	0	0	4,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	10,000	0	0	10,000[1]	2003, 2020
Kern County WA	Alameda Co., Zone 7	0	2,219	0	0	2,219[1]	2003, 2020
Kern County WA	Napa Co.	0	4,025	0	0	4,025[1]	2003, 2020
Kern County WA	Solano County WA	0	5,756	0	0	5,756[1]	2003, 2020
Kern County WA	Coachella VWD	0	0	0	0	12,000[1]	2020
Kern County WA	Desert WA	0	0	0	0	4,000[1]	2020
Tulare Lake Basin WSD	AVEK WA	3,000	3,000	3,000	3,000	3,000	2003, 2020
Tulare Lake Basin WSD	Dudley Ridge WD	3,973	3,973	3,973	3,973	3,973	2003, 2020
Tulare Lake Basin WSD	Alameda Co., Zone 7	400	400	400	400	400	2003, 2020
Tulare Lake Basin WSD	County of Kings	5,000	5,000	5,000	5,000	5,000	2003, 2020
Tulare Lake Basin WSD	Coachella VWD	9,900	9,900	9,900	9,900	9,900	2003, 2020
MWDSC	Coachella VWD	88,100	88,100	88,100	88,100	88,100	2020
MWDSC	Desert WA	11,900	11,900	11,900	11,900	11,900	2020

Notes:

(1) This Table A transfer is a component of the Monterey Amendment Article 53 KCWA commitment of 130 TAF of Table A transfers

Table A-2 - Table A Amounts in the Additional Scenarios (acre-feet)

SWP CONTRACTOR	2003 No Project 1	2020 No Project 1	2003 No Project 2	2020 No Project 2	2003 No Project 3 & 4	2020 No Project 3 & 4	2003 Proposed Project	2020 Proposed Project
County of Butte	3,500	27,500	3,500	27,500	1,594	12,388	3,500	27,500
Plumas County FC&WCD	1,690	2,700	1,690	2,700	770	1,216	1,690	2,700
City of Yuba City	9,600	9,600	9,600	9,600	4,372	4,325	9,600	9,600
Napa County FC&WCD	17,450	24,900	21,475	28,925	7,947	11,217	21,475	28,925
Solano County WA	41,000	42,000	46,756	47,756	18,672	18,920	46,756	47,756
Alameda Co. FC&WCD, Zone 7	46,400	46,400	80,619	80,619	21,132	20,902	80,619	80,619
Alameda County WD	42,000	42,000	42,000	42,000	19,128	18,920	42,000	42,000
Santa Clara Valley WD	100,000	100,000	100,000	100,000	45,543	45,048	100,000	100,000
Oak Flat WD	5,700	5,700	5,700	5,700	2,596	2,568	5,700	5,700
County of Kings	9,000	9,000	9,000	9,000	4,099	4,054	9,000	9,000
Dudley Ridge WD	61,673	61,673	57,343	57,343	28,087	27,783	57,343	57,343
Empire West Side ID	3,000	3,000	3,000	3,000	1,366	1,351	3,000	3,000
Kern County Water Agency (M&I)	134,600	134,600	134,600	134,600	61,300	60,635	134,600	134,600
Kern County Water Agency (Agric.)	1,018,800	1,018,800	864,130	864,130	463,987	458,953	864,130	848,130
Tulare Lake Basin WSD	96,227	96,227	96,227	96,227	43,824	43,349	96,227	96,227
San Luis Obispo Co. FC&WCD	25,000	25,000	25,000	25,000	11,386	11,262	25,000	25,000
Santa Barbara Co. FC&WCD	45,486	45,486	45,486	45,486	20,715	20,491	45,486	45,486
Antelope Valley-East Kern WA	141,400	141,400	141,400	141,400	64,397	63,698	141,400	141,400
Castaic Lake WA (31A)	12,700	12,700	12,700	12,700	5,784	5,721	12,700	12,700
Castaic Lake WA	41,500	41,500	82,500	82,500	18,900	18,695	82,500	82,500
Coachella Valley WD	33,000	121,100	33,000	121,100	15,029	54,554	33,000	133,100
Crestline-Lake Arrowhead WA	5,800	5,800	5,800	5,800	2,641	2,613	5,800	5,800
Desert WA	38,100	50,000	38,100	50,000	17,352	22,524	38,100	54,000
Littlerock Creek ID	2,300	2,300	2,300	2,300	1,047	1,036	2,300	2,300
Mojave WA	50,800	50,800	75,800	75,800	23,136	22,885	75,800	75,800
Metropolitan WDSC	2,011,500	1,911,500	2,011,500	1,911,500	916,088	861,100	2,011,500	1,911,500
Palmdale WD	17,300	17,300	21,300	21,300	7,879	7,793	21,300	21,300
San Bernardino Valley MWD	102,600	102,600	102,600	102,600	46,727	46,220	102,600	102,600
San Gabriel Valley MWD	28,800	28,800	28,800	28,800	13,116	12,974	28,800	28,800
San Gorgonio Pass WA	5,000	17,300	5,000	17,300	2,277	7,793	5,000	17,300
Ventura County FCD	20,000	20,000	20,000	20,000	9,109	9,010	20,000	20,000
Total Agriculture	1,207,100	1,207,100	1,048,100	1,048,100	549,744	543,779	1,048,100	1,032,100
Total M&I	2,964,826	3,010,586	3,078,826	3,124,586	1,350,256	1,356,221	3,078,826	3,140,586
Total	4,171,926	4,217,686	4,126,926	4,172,686	1,900,000	1,900,000	4,126,926	4,172,686

Table A-3a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.5	6.5	6.5	6.4	6.4	7.2	7.2	6.4
Solano	34.2	34.3	34.3	33.3	33.4	30.5	30.6	34.3
Zone 7	41.1	41.2	57.7	38.7	38.8	37.5	37.6	59.3
Alameda	31.9	32.0	31.9	30.8	30.9	29.9	30.0	31.3
Santa Clara	76.6	76.8	76.8	74.0	74.2	71.8	72.0	75.3
Oak Flat	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.7
Kings	7.0	7.0	7.2	7.4	7.4	7.6	7.6	7.3
Dudley Ridge	47.2	47.3	45.2	50.3	50.4	51.7	51.8	46.8
Empire W.S.	2.3	2.3	2.4	2.4	2.4	2.5	2.5	2.4
KCWA (M&I)	119.4	119.8	120.1	112.3	112.6	108.6	108.8	117.8
KCWA (Agric.)	778.3	779.5	677.5	829.0	830.7	852.9	854.9	705.7
Tulare	73.0	73.1	75.3	77.8	78.0	81.6	81.9	78.6
SLO	4.3	4.3	4.3	4.2	4.2	4.2	4.2	4.2
Santa Barbara	25.2	25.3	25.2	25.1	25.2	24.5	24.6	24.9
AVEK	61.8	62.1	61.9	61.5	61.8	61.4	61.6	61.3
Castaic (Agric.)	9.7	9.7	10.0	10.3	10.4	10.6	10.7	10.4
Castaic (M&I)	36.8	36.9	59.0	34.6	34.7	33.5	33.5	61.1
Coachella	17.5	17.5	17.5	16.9	17.0	16.7	16.7	17.8
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8
Desert	28.3	28.4	28.4	27.5	27.5	27.0	27.1	27.8
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.0	13.1	13.0	13.0	13.1	13.0	13.1	13.0
MWDSC	1,310.1	1,314.3	1,315.3	1,269.9	1,273.7	1,253.5	1,257.1	1,284.6
Palmdale	13.5	13.5	13.5	13.0	13.0	12.5	12.6	13.5
San Bernardino	64.4	64.6	64.5	63.3	63.5	63.1	63.3	63.5
San Gabriel	16.8	16.9	16.8	16.6	16.6	16.5	16.6	16.6
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Total Agriculture	921.8	923.2	822.1	981.9	983.9	1,011.7	1,014.1	855.9
Total M&I	1,908.3	1,914.3	1,953.6	1,848.2	1,853.6	1,818.4	1,823.5	1,919.7
Total	2,830.1	2,837.5	2,775.7	2,830.1	2,837.5	2,830.1	2,837.5	2,775.7

Table A-3b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.6	37.6	35.9	35.9	37.7
Zone 7	46.4	46.4	66.5	45.7	45.7	44.9	44.9	66.5
Alameda	35.2	35.2	35.2	35.0	35.0	34.3	34.3	35.2
Santa Clara	84.7	84.7	84.7	84.1	84.1	82.5	82.5	84.7
Oak Flat	5.3	5.3	5.4	5.3	5.3	5.3	5.3	5.3
Kings	8.6	8.6	8.8	8.7	8.7	8.7	8.7	8.4
Dudley Ridge	57.0	57.0	53.9	57.7	57.7	58.1	58.1	53.4
Empire W.S.	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
KCWA (M&I)	134.6	134.6	134.6	132.6	132.6	130.2	130.2	134.6
KCWA (Agric.)	938.5	938.5	804.2	949.3	949.3	956.7	956.7	805.0
Tulare	87.3	87.3	89.3	88.4	88.4	90.7	90.7	89.6
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.0	26.0	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.4	64.4	64.9
Castaic (Agric.)	11.7	11.7	12.0	11.8	11.8	11.9	11.9	11.8
Castaic (M&I)	41.5	41.5	68.6	40.9	40.9	40.1	40.1	68.6
Coachella	19.3	19.3	19.3	19.2	19.2	18.9	18.9	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	31.0	31.0	30.6	30.6	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,272.5	1,272.5	1,272.5	1,264.4	1,264.4	1,263.6	1,263.6	1,272.5
Palmdale	14.9	14.9	14.9	14.8	14.8	14.5	14.5	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.3	69.3	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.0	18.0	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,111.2	1,111.2	976.4	1,124.0	1,124.0	1,134.3	1,134.3	976.3
Total M&I	1,928.4	1,928.4	1,975.6	1,915.6	1,915.6	1,905.4	1,905.4	1,975.7
Total	3,039.7	3,039.7	2,952.0	3,039.6	3,039.6	3,039.7	3,039.6	2,952.0

Table A-3c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.7	37.7	36.7	36.7	37.7
Zone 7	46.4	46.4	66.5	46.0	46.0	45.6	45.6	66.5
Alameda	35.2	35.2	35.2	35.2	35.2	35.2	35.2	35.2
Santa Clara	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7
Oak Flat	5.4	5.4	5.5	5.4	5.4	5.5	5.5	5.4
Kings	8.7	8.7	8.8	8.8	8.8	8.8	8.8	8.6
Dudley Ridge	58.7	58.7	54.9	59.0	59.0	59.1	59.1	54.5
Empire W.S.	2.8	2.8	2.9	2.9	2.9	2.9	2.9	2.9
KCWA (M&I)	134.6	134.6	134.6	133.5	133.5	132.2	132.2	134.6
KCWA (Agric.)	966.1	966.1	820.3	971.5	971.5	974.3	974.3	821.0
Tulare	90.3	90.3	91.1	90.8	90.8	92.2	92.2	91.4
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	12.0	12.0	12.2	12.1	12.1	12.1	12.1	12.1
Castaic (M&I)	41.5	41.5	68.6	41.2	41.2	40.8	40.8	68.6
Coachella	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,537.7	1,537.7	1,537.7	1,533.0	1,533.0	1,531.1	1,531.1	1,537.6
Palmdale	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,144.0	1,144.0	995.6	1,150.5	1,150.5	1,154.8	1,154.8	995.7
Total M&I	2,193.7	2,193.7	2,240.9	2,187.2	2,187.2	2,183.0	2,183.0	2,240.8
Total	3,337.8	3,337.8	3,236.5	3,337.8	3,337.8	3,337.8	3,337.8	3,236.5

Table A-3d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.8	6.8	7.6	7.6	6.8
Solano	37.7	37.7	37.7	37.7	37.7	34.3	34.3	37.7
Zone 7	46.4	46.4	65.3	43.2	43.2	42.0	42.0	66.5
Alameda	35.2	35.2	35.2	34.7	34.7	33.8	33.8	35.2
Santa Clara	84.7	84.7	84.7	83.3	83.3	81.1	81.1	84.7
Oak Flat	5.1	5.1	5.4	5.5	5.5	5.7	5.7	5.4
Kings	8.1	8.1	8.5	8.7	8.7	8.9	8.9	8.6
Dudley Ridge	55.7	55.7	53.9	59.2	59.2	61.4	61.4	54.5
Empire W.S.	2.7	2.7	2.8	2.9	2.9	3.0	3.0	2.9
KCWA (M&I)	134.6	134.6	134.6	125.4	125.4	121.5	121.5	134.6
KCWA (Agric.)	919.5	919.5	812.1	978.1	978.1	1,015.5	1,015.5	821.8
Tulare	86.8	86.8	90.4	92.3	92.3	96.0	96.0	91.5
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.3	26.3	26.2	26.2	26.3
AVEK	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Castaic (Agric.)	11.5	11.5	11.9	12.2	12.2	12.7	12.7	12.1
Castaic (M&I)	41.5	41.5	67.1	38.7	38.7	37.4	37.4	68.6
Coachella	19.3	19.3	19.3	19.0	19.0	18.9	18.9	19.3
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	31.2	31.2	31.2	30.9	30.9	30.6	30.6	31.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,606.5	1,606.5	1,606.5	1,554.9	1,554.9	1,523.8	1,523.8	1,592.1
Palmdale	14.9	14.9	14.9	14.6	14.6	14.2	14.2	14.9
San Bernardino	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8
San Gabriel	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	1,089.4	1,089.4	985.0	1,158.9	1,158.9	1,203.2	1,203.2	996.7
Total M&I	2,262.5	2,262.5	2,307.1	2,193.0	2,193.0	2,148.6	2,148.6	2,295.3
Total	3,351.9	3,351.9	3,292.1	3,351.8	3,351.8	3,351.9	3,351.9	3,292.1

Table A-3e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	6.8	6.8	6.8	6.6	6.6	7.5	7.5	6.7
Solano	36.5	36.7	36.6	32.6	32.6	27.5	27.5	35.7
Zone 7	42.1	42.2	56.8	36.1	36.1	33.4	33.4	60.2
Alameda	33.7	33.8	33.8	29.9	30.0	27.9	27.9	31.8
Santa Clara	80.9	81.2	81.3	71.7	71.8	66.7	66.7	76.3
Oak Flat	3.8	3.8	3.9	4.6	4.6	4.7	4.7	4.5
Kings	6.0	6.0	6.2	7.3	7.3	7.7	7.8	7.1
Dudley Ridge	41.2	41.3	39.6	50.0	50.2	53.2	53.5	45.4
Empire W.S.	2.0	2.0	2.1	2.4	2.4	2.6	2.6	2.4
KCWA (M&I)	122.4	122.8	124.8	104.6	104.8	96.6	96.6	116.5
KCWA (Agric.)	681.1	682.8	596.7	826.7	829.4	880.0	883.9	684.3
Tulare	64.3	64.5	66.4	78.1	78.3	85.9	86.4	76.2
SLO	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Santa Barbara	26.3	26.3	26.3	26.1	26.1	23.9	23.9	26.0
AVEK	64.9	64.9	64.9	63.9	64.0	63.8	63.9	64.0
Castaic (Agric.)	8.5	8.5	8.8	10.3	10.3	11.0	11.0	10.1
Castaic (M&I)	37.7	37.9	57.2	32.3	32.3	29.8	29.8	62.0
Coachella	18.5	18.5	18.6	16.4	16.5	15.8	15.8	18.6
Crestline	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Desert	30.0	30.1	30.1	26.8	26.8	25.7	25.8	28.3
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
MWDSC	1,365.6	1,368.8	1,378.0	1,254.1	1,256.6	1,217.9	1,219.4	1,286.5
Palmdale	14.2	14.2	14.3	12.5	12.5	11.6	11.6	14.0
San Bernardino	68.9	69.1	68.8	63.8	63.9	63.6	63.7	66.0
San Gabriel	18.0	18.0	17.9	16.9	17.0	16.9	16.9	17.3
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total Agriculture	807.0	809.0	723.7	979.5	982.6	1,045.2	1,049.8	830.0
Total M&I	1,991.3	1,996.0	2,040.8	1,818.9	1,822.3	1,753.2	1,755.1	1,934.5
Total	2,798.4	2,804.9	2,764.5	2,798.3	2,804.9	2,798.4	2,804.9	2,764.5

Table A-3f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project
Napa	4.7	4.9	4.8	4.5	4.5	5.5	5.6	4.4
Solano	17.8	18.3	18.1	17.8	18.5	15.2	15.7	19.3
Zone 7	19.9	20.4	26.5	18.1	18.5	17.2	17.7	30.5
Alameda	16.8	17.3	17.0	16.4	16.8	15.6	16.1	16.0
Santa Clara	40.1	41.3	40.7	39.0	40.0	37.2	38.2	38.3
Oak Flat	1.6	1.7	1.8	1.8	1.8	1.9	1.9	2.1
Kings	2.5	2.6	2.9	2.7	2.8	2.9	2.9	3.3
Dudley Ridge	17.5	17.9	18.2	19.3	19.7	20.4	20.8	21.3
Empire W.S.	0.9	0.9	1.0	0.9	1.0	1.0	1.0	1.1
KCWA (M&I)	57.8	59.3	58.6	52.5	53.9	49.9	51.3	55.3
KCWA (Agric.)	289.9	295.2	274.1	320.4	327.5	338.4	345.5	321.0
Tulare	27.4	27.9	30.5	30.4	31.2	34.1	34.9	35.7
SLO	3.5	3.6	3.6	3.5	3.5	3.5	3.5	3.3
Santa Barbara	19.5	20.2	19.9	19.3	20.0	18.8	19.5	18.4
AVEK	46.0	47.6	46.8	45.5	46.9	45.6	47.0	44.2
Castaic (Agric.)	3.6	3.7	4.0	4.0	4.1	4.2	4.3	4.7
Castaic (M&I)	17.8	18.3	26.6	16.2	16.6	15.4	15.8	31.4
Coachella	9.2	9.5	9.4	9.0	9.2	8.9	9.1	11.1
Crestline	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6
Desert	15.1	15.5	15.3	14.8	15.2	14.5	14.9	14.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	12.2	12.4	12.2	12.1	12.3	12.1	12.3	12.3
MWDSC	771.5	792.7	787.2	748.1	767.8	734.2	753.9	733.9
Palmdale	7.0	7.2	7.1	6.7	6.9	6.4	6.6	7.6
San Bernardino	38.1	39.2	38.7	37.7	38.7	37.7	38.8	36.2
San Gabriel	10.4	10.7	10.6	10.3	10.6	10.3	10.6	9.9
San Gorgonio	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Ventura	4.6	4.7	4.6	4.6	4.7	4.6	4.7	4.6
Total Agriculture	343.5	349.7	332.4	379.6	388.0	402.9	411.3	389.3
Total M&I	1,113.9	1,144.8	1,149.5	1,077.7	1,106.5	1,054.4	1,083.2	1,092.6
Total	1,457.3	1,494.5	1,481.9	1,457.3	1,494.5	1,457.4	1,494.5	1,481.9

Table A-4a - Average Annual Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	20.1	20.2	23.0	19.4	19.4	17.5	17.6	22.5	18.2	18.3	20.1
Solano	33.9	34.1	38.0	32.7	32.8	29.3	29.4	37.1	30.7	30.8	33.2
Zone 7	37.5	37.6	61.2	36.1	36.2	32.5	32.6	62.6	33.8	34.0	56.0
Alameda	33.9	34.1	34.1	32.7	32.8	29.6	29.7	32.6	30.7	30.8	29.2
Santa Clara	80.8	81.1	81.2	77.8	78.1	70.5	70.8	77.7	73.0	73.3	69.5
Oak Flat	3.8	3.8	3.8	4.2	4.2	4.7	4.7	4.3	3.3	3.3	3.9
Kings	6.1	6.1	6.1	6.8	6.8	7.5	7.5	6.8	5.3	5.3	6.1
Dudley Ridge	41.2	41.3	38.5	45.7	45.9	50.9	51.1	43.4	35.8	36.0	38.8
Empire W.S.	2.0	2.0	2.0	2.2	2.2	2.5	2.5	2.3	1.7	1.7	2.0
KCWA (M&I)	108.8	109.2	109.3	104.7	105.1	93.8	94.2	104.5	98.3	98.7	93.5
KCWA (Agric.)	679.0	681.9	577.0	754.5	757.6	839.2	842.4	642.2	590.0	593.0	574.5
Tulare	63.7	64.0	64.2	70.8	71.1	78.8	79.1	72.9	55.3	55.6	65.2
SLO	20.2	20.3	20.3	19.4	19.5	17.4	17.5	19.4	18.3	18.3	17.4
Santa Barbara	36.8	36.9	36.9	35.4	35.5	31.7	31.8	35.3	33.2	33.4	31.6
AVEK	113.9	114.4	114.5	109.9	110.3	109.4	109.8	109.8	102.8	103.3	98.2
Castaic (Agric.)	8.5	8.5	8.5	9.4	9.4	10.5	10.5	9.6	7.4	7.4	8.6
Castaic (M&I)	33.5	33.7	62.0	32.3	32.4	28.9	29.0	64.1	30.3	30.4	57.3
Coachella	96.7	97.0	97.1	94.0	94.4	94.2	94.6	103.4	87.1	87.5	92.5
Crestline	4.7	4.7	4.7	4.5	4.5	4.0	4.1	4.5	4.2	4.3	4.0
Desert	40.4	40.6	40.6	38.9	39.0	38.6	38.7	41.9	36.5	36.7	37.5
Littlerock	1.9	1.9	1.9	1.8	1.8	1.6	1.6	1.8	1.7	1.7	1.6
Mojave	41.1	41.2	58.5	39.5	39.7	43.0	43.2	58.9	37.1	37.3	52.7
MWDSC	1,545.0	1,551.1	1,552.2	1,486.6	1,492.0	1,418.3	1,423.8	1,484.3	1,395.7	1,401.9	1,327.8
Palmdale	14.0	14.0	16.8	13.5	13.5	12.1	12.1	16.5	12.6	12.7	14.8
San Bernardino	82.9	83.3	83.3	79.8	80.1	86.9	87.2	79.7	74.9	75.2	71.3
San Gabriel	23.3	23.4	23.4	22.4	22.5	24.4	24.5	22.4	21.0	21.1	20.0
San Gorgonio	14.0	14.0	14.0	13.5	13.5	12.1	12.1	13.4	12.6	12.7	12.0
Ventura	16.2	16.2	16.2	15.6	15.6	13.9	14.0	15.5	14.6	14.7	13.9
Total Agriculture	804.3	807.7	700.1	893.6	897.4	994.0	997.8	781.5	698.9	702.4	699.1
Total M&I	2,399.5	2,408.9	2,489.3	2,310.2	2,318.6	2,209.8	2,218.2	2,407.8	2,167.3	2,177.0	2,154.0
Total	3,203.8	3,216.6	3,189.3	3,203.8	3,216.0	3,203.8	3,216.0	3,189.3	2,866.2	2,879.4	2,853.0

Table A-4b - Wet Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	24.4	24.4	28.3	24.2	24.2	23.6	23.6	28.1	23.6	23.6	26.8
Solano	41.2	41.2	46.7	40.8	40.8	39.7	39.7	46.4	39.7	39.7	44.3
Zone 7	45.5	45.5	78.0	45.1	45.1	43.9	43.9	78.2	43.9	43.9	74.8
Alameda	41.2	41.2	41.2	40.8	40.8	39.8	39.8	40.8	39.7	39.7	39.0
Santa Clara	98.2	98.2	98.2	97.1	97.1	94.7	94.7	97.1	94.6	94.6	92.8
Oak Flat	5.1	5.1	5.2	5.3	5.3	5.4	5.4	5.3	4.8	4.8	5.0
Kings	8.3	8.3	8.4	8.6	8.6	8.8	8.8	8.3	7.8	7.8	7.9
Dudley Ridge	55.8	55.8	51.8	57.4	57.4	58.9	58.9	53.0	52.1	52.1	50.6
Empire W.S.	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.8	2.5	2.5	2.6
KCWA (M&I)	132.1	132.1	132.1	130.7	130.7	127.1	127.1	130.6	127.4	127.4	124.9
KCWA (Agric.)	919.7	919.7	774.9	945.6	945.6	969.7	969.7	784.5	857.9	857.9	748.2
Tulare	85.9	85.9	86.1	88.3	88.3	90.5	90.5	89.0	80.0	80.0	84.9
SLO	24.5	24.5	24.5	24.3	24.3	23.6	23.6	24.3	23.7	23.7	23.2
Santa Barbara	44.6	44.6	44.6	44.2	44.2	42.9	42.9	44.1	43.0	43.0	42.2
AVEK	138.7	138.7	138.7	137.3	137.3	137.5	137.5	137.2	133.6	133.6	131.2
Castaic (Agric.)	11.5	11.5	11.5	11.8	11.8	12.1	12.1	11.7	10.7	10.7	11.2
Castaic (M&I)	40.7	40.7	79.6	40.3	40.3	39.2	39.2	80.1	39.3	39.3	76.5
Coachella	118.5	118.5	118.5	117.6	117.6	118.0	118.0	129.2	114.0	114.0	123.5
Crestline	5.7	5.7	5.7	5.6	5.6	5.5	5.5	5.6	5.5	5.5	5.4
Desert	49.1	49.1	49.1	48.6	48.6	48.6	48.6	52.4	47.3	47.3	50.1
Littlerock	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1
Mojave	49.9	49.9	73.6	49.3	49.3	50.8	50.8	73.6	48.1	48.1	70.3
MWDSC	1,876.3	1,876.3	1,876.3	1,856.2	1,856.2	1,836.6	1,836.6	1,855.2	1,808.8	1,808.8	1,773.4
Palmdale	17.0	17.0	20.8	16.8	16.8	16.3	16.3	20.7	16.4	16.4	19.8
San Bernardino	100.7	100.7	100.7	99.6	99.6	102.6	102.6	99.6	97.1	97.1	95.2
San Gabriel	28.3	28.3	28.3	28.0	28.0	28.8	28.8	28.0	27.3	27.3	26.7
San Gorgonio	17.0	17.0	17.0	16.8	16.8	16.3	16.3	16.8	16.4	16.4	16.1
Ventura	19.6	19.6	19.6	19.4	19.4	18.9	18.9	19.4	18.9	18.9	18.6
Total Agriculture	1,089.1	1,089.1	940.5	1,119.7	1,119.7	1,148.3	1,148.3	954.6	1,015.9	1,015.9	910.5
Total M&I	2,915.5	2,915.5	3,023.6	2,884.9	2,884.9	2,856.4	2,856.4	3,009.5	2,810.3	2,810.3	2,876.8
Total	4,004.6	4,004.6	3,964.1	4,004.6	4,004.6	4,004.6	4,004.6	3,964.1	3,826.2	3,826.2	3,787.3

Table A-4c - Above Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	24.3	24.3	27.9	23.5	23.5	22.2	22.2	27.4	22.3	22.3	24.7
Solano	41.0	41.0	46.0	39.6	39.6	37.2	37.2	45.2	37.6	37.6	40.8
Zone 7	45.2	45.2	75.1	43.8	43.8	41.2	41.2	76.3	41.5	41.5	68.9
Alameda	41.0	41.0	41.0	39.6	39.6	37.5	37.5	39.7	37.6	37.6	35.9
Santa Clara	97.5	97.5	97.6	94.4	94.4	89.2	89.2	94.6	89.5	89.5	85.4
Oak Flat	4.7	4.7	4.8	5.2	5.2	5.5	5.5	5.1	4.1	4.1	4.7
Kings	7.6	7.6	7.7	8.3	8.3	8.8	8.8	8.1	6.7	6.7	7.4
Dudley Ridge	51.2	51.2	47.8	55.9	55.9	59.2	59.2	51.8	44.6	44.6	47.4
Empire W.S.	2.5	2.5	2.5	2.7	2.7	2.9	2.9	2.7	2.2	2.2	2.5
KCWA (M&I)	131.3	131.3	131.4	127.0	127.0	119.3	119.3	127.3	120.5	120.5	115.0
KCWA (Agric.)	842.6	842.6	714.8	920.6	920.6	975.1	975.1	766.1	734.8	734.8	701.2
Tulare	78.7	78.7	79.4	86.0	86.0	91.1	91.1	86.9	68.6	68.6	79.6
SLO	24.4	24.4	24.4	23.6	23.6	22.2	22.2	23.6	22.4	22.4	21.4
Santa Barbara	44.4	44.4	44.4	42.9	42.9	40.3	40.3	43.0	40.7	40.7	38.9
AVEK	137.6	137.6	137.7	133.4	133.4	133.5	133.5	133.7	126.2	126.2	120.8
Castaic (Agric.)	10.5	10.5	10.6	11.5	11.5	12.2	12.2	11.5	9.2	9.2	10.5
Castaic (M&I)	40.5	40.5	76.3	39.2	39.2	36.8	36.8	78.0	37.2	37.2	70.5
Coachella	117.0	117.0	117.2	114.3	114.3	114.8	114.8	125.9	107.1	107.1	113.7
Crestline	5.7	5.7	5.7	5.5	5.5	5.1	5.1	5.5	5.2	5.2	5.0
Desert	48.8	48.8	48.8	47.2	47.2	47.2	47.2	51.1	44.8	44.8	46.1
Littlerock	2.2	2.2	2.2	2.2	2.2	2.1	2.0	2.2	2.1	2.1	2.0
Mojave	49.5	49.5	71.4	47.9	47.9	50.8	50.8	71.7	45.5	45.5	64.8
MWDSC	1,864.0	1,864.0	1,865.5	1,803.6	1,803.6	1,759.4	1,759.4	1,808.0	1,711.6	1,711.6	1,632.9
Palmdale	16.9	16.9	20.4	16.3	16.3	15.3	15.3	20.1	15.5	15.5	18.2
San Bernardino	100.1	100.1	100.1	96.8	96.8	102.6	102.6	97.0	91.9	91.9	87.6
San Gabriel	28.1	28.1	28.1	27.2	27.2	28.8	28.8	27.2	25.8	25.8	24.6
San Gorgonio	16.9	16.9	16.9	16.3	16.3	15.3	15.3	16.4	15.5	15.5	14.8
Ventura	19.5	19.5	19.5	18.9	18.9	17.7	17.7	18.9	17.9	17.9	17.1
Total Agriculture	997.8	997.8	867.6	1,090.2	1,090.2	1,154.8	1,154.8	932.2	870.2	870.2	853.3
Total M&I	2,895.5	2,895.5	2,997.5	2,803.1	2,803.1	2,738.6	2,738.6	2,932.9	2,658.3	2,658.3	2,648.9
Total	3,893.4	3,893.4	3,865.1	3,893.4	3,893.4	3,893.4	3,893.4	3,865.1	3,528.4	3,528.4	3,502.2

Table A-4d - Below Normal Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	22.4	22.4	25.7	21.2	21.2	18.0	18.0	24.9	19.7	19.8	21.7
Solano	37.8	37.8	42.4	35.7	35.7	29.9	29.9	41.1	33.3	33.3	35.8
Zone 7	41.7	41.7	67.5	39.5	39.5	33.2	33.2	69.4	36.7	36.8	60.4
Alameda	37.8	37.8	38.1	35.7	35.7	30.4	30.4	36.2	33.3	33.3	31.5
Santa Clara	90.1	90.1	90.8	85.1	85.1	72.5	72.5	86.1	79.2	79.4	75.0
Oak Flat	4.2	4.2	4.2	4.8	4.8	5.6	5.6	4.9	3.5	3.5	4.3
Kings	6.6	6.6	6.7	7.7	7.7	8.9	8.9	7.8	5.5	5.6	6.7
Dudley Ridge	45.0	45.0	42.7	52.5	52.5	61.1	61.1	49.4	37.9	38.0	43.0
Empire W.S.	2.2	2.2	2.2	2.6	2.6	3.0	3.0	2.6	1.8	1.9	2.2
KCWA (M&I)	121.3	121.3	122.2	114.5	114.5	95.7	95.7	115.9	106.6	106.9	100.9
KCWA (Agric.)	742.7	742.7	643.4	866.6	866.6	1,008.7	1,008.7	730.6	626.5	628.3	635.7
Tulare	70.1	70.1	71.6	81.9	81.9	95.3	95.3	82.9	59.2	59.3	72.1
SLO	22.5	22.5	22.7	21.3	21.3	17.8	17.8	21.5	19.8	19.8	18.7
Santa Barbara	41.0	41.0	41.3	38.7	38.7	32.3	32.3	39.2	36.0	36.1	34.1
AVEK	126.9	126.9	127.9	120.3	120.3	119.7	119.7	121.8	111.5	111.7	106.0
Castaic (Agric.)	9.3	9.3	9.5	10.8	10.8	12.6	12.6	10.9	7.8	7.8	9.5
Castaic (M&I)	37.4	37.4	68.2	35.3	35.3	29.5	29.5	71.1	32.9	32.9	61.8
Coachella	107.4	107.4	108.3	103.0	103.0	103.6	103.6	114.6	94.2	94.4	99.8
Crestline	5.2	5.2	5.3	4.9	4.9	4.1	4.1	5.0	4.6	4.6	4.3
Desert	45.0	45.0	45.4	42.5	42.5	42.2	42.2	46.5	39.6	39.7	40.5
Littlerock	2.1	2.1	2.1	2.0	2.0	1.6	1.6	2.0	1.8	1.8	1.7
Mojave	45.8	45.8	64.7	43.2	43.2	49.6	49.6	65.3	40.2	40.3	56.8
MWDSC	1,722.0	1,722.0	1,735.2	1,626.0	1,626.0	1,511.4	1,511.4	1,646.5	1,514.1	1,517.5	1,432.7
Palmdale	15.6	15.6	18.7	14.7	14.7	12.3	12.3	18.3	13.7	13.7	16.0
San Bernardino	92.4	92.4	93.1	87.3	87.3	100.2	100.2	88.4	81.3	81.4	76.9
San Gabriel	25.9	25.9	26.1	24.5	24.5	28.1	28.1	24.8	22.8	22.9	21.6
San Gorgonio	15.6	15.6	15.7	14.7	14.7	12.3	12.3	14.9	13.7	13.7	13.0
Ventura	18.0	18.0	18.2	17.0	17.0	14.2	14.2	17.2	15.8	15.9	15.0
Total Agriculture	879.9	879.9	780.4	1,026.8	1,026.8	1,195.1	1,195.1	889.0	742.3	744.5	773.6
Total M&I	2,674.0	2,674.0	2,779.6	2,527.1	2,527.1	2,358.8	2,358.8	2,670.9	2,350.8	2,356.0	2,324.1
Total	3,553.9	3,553.9	3,560.0	3,553.9	3,553.9	3,553.9	3,553.9	3,560.0	3,093.1	3,100.5	3,097.7

Table A-4e - Dry Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	18.0	18.1	20.2	16.7	16.8	13.5	13.5	19.3	15.3	15.5	16.3
Solano	30.3	30.5	33.4	28.2	28.3	22.2	22.3	31.8	25.8	26.1	26.9
Zone 7	33.4	33.6	51.3	31.2	31.3	24.7	24.8	53.8	28.4	28.8	45.3
Alameda	30.3	30.5	30.5	28.2	28.3	22.8	22.8	28.0	25.8	26.1	23.6
Santa Clara	72.2	72.7	72.7	67.2	67.4	54.2	54.4	66.7	61.5	62.2	56.2
Oak Flat	2.9	3.0	2.9	3.6	3.7	4.4	4.5	3.8	2.4	2.4	3.2
Kings	4.6	4.7	4.7	5.7	5.8	7.2	7.2	6.0	3.7	3.8	5.1
Dudley Ridge	31.8	32.0	29.6	39.2	39.7	49.0	49.5	38.2	25.7	26.1	32.2
Empire W.S.	1.5	1.6	1.6	1.9	1.9	2.4	2.4	2.0	1.2	1.3	1.7
KCWA (M&I)	97.1	97.8	97.8	90.5	90.7	71.1	71.3	89.8	82.8	83.8	75.7
KCWA (Agric.)	525.0	529.2	446.6	646.9	655.9	809.5	818.5	565.6	424.1	431.8	476.9
Tulare	49.6	50.0	49.7	61.1	62.0	76.5	77.3	64.2	40.1	40.8	54.1
SLO	18.0	18.2	18.2	16.8	16.9	13.2	13.2	16.7	15.4	15.6	14.1
Santa Barbara	32.8	33.1	33.0	30.6	30.7	24.0	24.1	30.3	28.0	28.3	25.6
AVEK	101.4	102.1	102.1	95.0	95.2	93.0	93.3	94.3	86.3	87.4	79.5
Castaic (Agric.)	6.5	6.6	6.6	8.1	8.2	10.1	10.2	8.5	5.3	5.4	7.1
Castaic (M&I)	30.0	30.2	51.3	27.9	28.0	21.9	22.0	55.0	25.5	25.8	46.4
Coachella	85.4	86.0	85.9	81.1	81.3	80.7	81.0	88.8	72.5	73.4	74.8
Crestline	4.2	4.2	4.2	3.9	3.9	3.1	3.1	3.9	3.6	3.6	3.3
Desert	36.1	36.3	36.3	33.6	33.7	32.7	32.8	36.0	30.7	31.1	30.4
Littlerock	1.7	1.7	1.7	1.5	1.6	1.2	1.2	1.5	1.4	1.4	1.3
Mojave	36.7	36.9	49.8	34.2	34.2	39.7	39.8	50.6	31.2	31.6	42.6
MWDSC	1,379.6	1,389.1	1,388.7	1,285.3	1,288.7	1,154.9	1,158.3	1,274.8	1,175.2	1,189.7	1,074.8
Palmdale	12.5	12.6	14.6	11.6	11.7	9.1	9.2	14.2	10.6	10.8	12.0
San Bernardino	74.1	74.6	74.5	69.0	69.2	80.2	80.4	68.4	63.1	63.9	57.7
San Gabriel	20.8	20.9	20.9	19.4	19.4	22.5	22.6	19.2	17.7	17.9	16.2
San Gorgonio	12.5	12.6	12.6	11.6	11.7	9.1	9.2	11.5	10.6	10.8	9.7
Ventura	14.4	14.5	14.5	13.4	13.5	10.6	10.6	13.3	12.3	12.4	11.2
Total Agriculture	622.0	627.0	541.7	766.4	777.1	959.0	969.7	688.3	502.4	511.6	580.3
Total M&I	2,141.4	2,156.1	2,214.4	1,997.0	2,002.5	1,804.5	1,809.9	2,067.9	1,823.8	1,846.3	1,743.5
Total	2,763.4	2,783.1	2,756.2	2,763.4	2,779.6	2,763.4	2,779.6	2,756.2	2,326.2	2,357.9	2,323.8

Table A-4f - Critical Years: Annual Average Scheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	8.9	9.2	10.0	8.4	8.8	7.3	7.7	9.4	6.9	7.1	7.1
Solano	15.0	15.6	16.6	14.2	14.8	12.2	12.8	15.5	11.6	11.9	11.6
Zone 7	16.5	17.1	24.5	15.7	16.4	13.5	14.2	26.2	12.7	13.1	19.7
Alameda	15.0	15.6	15.3	14.2	14.8	12.4	13.0	13.6	11.6	11.9	10.2
Santa Clara	35.7	37.0	36.5	33.8	35.3	29.5	31.0	32.4	27.6	28.4	24.4
Oak Flat	1.3	1.3	1.3	1.5	1.6	1.8	1.8	1.8	0.9	0.9	1.4
Kings	2.0	2.1	2.0	2.4	2.5	2.9	3.0	2.9	1.3	1.4	2.2
Dudley Ridge	13.8	14.6	12.7	16.7	17.1	19.9	20.4	18.6	9.2	9.6	14.0
Empire W.S.	0.7	0.7	0.7	0.8	0.8	1.0	1.0	1.0	0.4	0.5	0.7
KCWA (M&I)	48.1	49.8	49.2	45.5	47.6	39.1	41.1	43.7	37.1	38.2	32.8
KCWA (Agric.)	228.6	240.6	191.6	275.3	283.1	328.5	336.2	275.2	152.7	159.0	206.8
Tulare	21.6	22.7	21.3	26.0	26.7	31.0	31.8	31.2	14.4	15.0	23.5
SLO	8.9	9.3	9.1	8.5	8.8	7.3	7.6	8.1	6.9	7.1	6.1
Santa Barbara	16.2	16.8	16.6	15.4	16.1	13.2	13.9	14.8	12.5	12.9	11.1
AVEK	50.1	52.0	51.2	47.6	49.7	47.0	49.1	45.9	38.6	39.7	34.5
Castaic (Agric.)	2.8	3.0	2.8	3.4	3.5	4.1	4.2	4.1	1.9	2.0	3.1
Castaic (M&I)	14.8	15.4	24.3	14.0	14.7	12.1	12.7	26.8	11.4	11.8	20.1
Coachella	41.9	43.5	42.8	40.3	42.0	40.2	42.0	43.2	32.1	33.1	32.5
Crestline	2.1	2.1	2.1	2.0	2.0	1.7	1.8	1.9	1.6	1.6	1.4
Desert	17.9	18.5	18.3	16.9	17.7	16.6	17.4	17.5	13.8	14.2	13.2
Littlerock	0.8	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.7	0.6
Mojave	18.1	18.8	24.1	17.2	17.9	19.1	19.8	24.6	14.0	14.4	18.5
MWDSC	682.8	707.8	698.3	646.6	675.4	603.9	632.7	620.2	526.8	542.1	466.0
Palmdale	6.2	6.4	7.2	5.9	6.1	5.0	5.3	6.9	4.8	4.9	5.2
San Bernardino	36.6	38.0	37.5	34.7	36.3	38.5	40.1	33.3	28.3	29.1	25.0
San Gabriel	10.3	10.7	10.5	9.7	10.2	10.8	11.2	9.3	7.9	8.2	7.0
San Gorgonio	6.2	6.4	6.3	5.9	6.1	5.0	5.3	5.6	4.8	4.9	4.2
Ventura	7.1	7.4	7.3	6.8	7.1	5.8	6.1	6.5	5.5	5.7	4.9
Total Agriculture	270.8	285.0	232.4	326.2	335.4	389.2	398.3	334.9	180.9	188.4	251.6
Total M&I	1,059.4	1,098.3	1,108.6	1,004.0	1,048.7	941.0	985.7	1,006.1	817.1	840.8	756.0
Total	1,330.2	1,383.4	1,341.0	1,330.2	1,384.1	1,330.2	1,384.0	1,341.0	998.0	1,029.2	1,007.6

Table A-5a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	1.0	0.8	1.0	1.0	0.8	1.0	0.8	1.7
Solano	1.0	0.9	1.2	1.0	0.9	1.0	0.9	2.1
Zone 7	1.1	1.1	1.3	1.1	1.1	1.1	1.1	2.2
Alameda	1.4	1.3	1.6	1.4	1.3	1.4	1.3	2.1
Santa Clara	5.1	4.7	5.7	5.1	4.7	5.1	4.7	7.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.2	2.1	2.3	2.2	2.1	2.2	2.1	2.2
Empire W.S.	1.6	1.5	1.8	1.6	1.5	1.6	1.5	1.0
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	101.2	99.1	107.3	101.2	99.1	101.2	99.1	81.8
Tulare	26.7	25.6	30.1	26.7	25.6	26.7	25.6	16.7
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.7	1.7	1.8	1.7	1.7	1.7	1.7	2.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	1.0	0.9	1.3	1.0	0.9	1.0	0.9	2.2
Coachella	3.0	2.8	3.2	3.0	2.8	3.0	2.8	2.7
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	6.9	6.2	7.2	6.9	6.2	6.9	6.2	5.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	119.8	116.4	128.1	119.8	116.4	119.8	116.4	164.0
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	131.7	128.4	141.6	131.7	128.4	131.7	128.4	101.6
Total M&I	142.0	136.8	152.4	142.0	136.8	142.0	136.8	192.3
Total	273.8	265.2	294.0	273.8	265.2	273.8	265.2	294.0

Table A-5b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	2.1	1.7	2.2	2.1	1.7	2.1	1.7	3.1
Solano	2.3	1.9	2.6	2.3	1.9	2.3	1.9	4.2
Zone 7	2.4	2.3	2.7	2.4	2.3	2.4	2.3	4.3
Alameda	2.9	2.8	3.3	2.9	2.8	2.9	2.8	4.1
Santa Clara	10.6	9.9	12.0	10.6	9.9	10.6	9.9	13.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	4.3	4.2	4.5	4.3	4.2	4.3	4.2	4.3
Empire W.S.	3.3	3.1	3.5	3.3	3.1	3.3	3.1	1.9
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	200.3	196.5	212.4	200.3	196.5	200.3	196.5	152.0
Tulare	53.9	52.3	61.0	53.9	52.3	53.9	52.3	31.9
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	3.5	3.4	3.7	3.5	3.4	3.5	3.4	4.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	2.3	1.9	2.9	2.3	1.9	2.3	1.9	4.4
Coachella	6.3	5.8	6.5	6.3	5.8	6.3	5.8	4.6
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	14.3	13.1	14.7	14.3	13.1	14.3	13.1	11.1
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	215.1	211.5	216.6	215.1	211.5	215.1	211.5	304.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	261.8	256.3	281.4	261.8	256.3	261.8	256.3	190.0
Total M&I	261.7	254.2	267.2	261.7	254.2	261.7	254.2	358.5
Total	523.5	510.5	548.5	523.5	510.5	523.5	510.5	548.5

Table A-5c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.7	0.5	0.7	0.7	0.5	0.7	0.5	1.8
Solano	0.7	0.5	0.7	0.7	0.5	0.7	0.5	2.2
Zone 7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	2.3
Alameda	1.1	1.0	1.3	1.1	1.0	1.1	1.0	2.2
Santa Clara	3.6	3.2	4.4	3.6	3.2	3.6	3.2	7.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	2.4	2.3	2.5	2.4	2.3	2.4	2.3	2.3
Empire W.S.	1.5	1.2	2.0	1.5	1.2	1.5	1.2	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	104.4	101.2	112.2	104.4	101.2	104.4	101.2	86.5
Tulare	24.9	22.5	30.6	24.9	22.5	24.9	22.5	15.1
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.7	0.5	0.7	0.7	0.5	0.7	0.5	2.4
Coachella	2.9	2.5	3.1	2.9	2.5	2.9	2.5	3.0
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	5.8	4.9	6.9	5.8	4.9	5.8	4.9	5.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	110.9	104.0	140.7	110.9	104.0	110.9	104.0	173.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	133.3	127.2	147.3	133.3	127.2	133.3	127.2	104.7
Total M&I	128.6	119.5	160.9	128.6	119.5	128.6	119.5	203.4
Total	261.9	246.7	308.1	261.9	246.7	261.9	246.7	308.1

Table A-5d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.7	0.6	0.8	0.7	0.6	0.7	0.6	1.3
Solano	0.8	0.7	0.9	0.8	0.7	0.8	0.7	1.4
Zone 7	0.9	0.8	1.2	0.9	0.8	0.9	0.8	1.5
Alameda	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.4
Santa Clara	3.9	3.6	4.3	3.9	3.6	3.9	3.6	5.4
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Empire W.S.	1.2	1.2	1.3	1.2	1.2	1.2	1.2	0.8
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	71.1	68.8	72.8	71.1	68.8	71.1	68.8	65.1
Tulare	18.7	18.4	19.9	18.7	18.4	18.7	18.4	14.0
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.2	1.1	1.4	1.2	1.1	1.2	1.1	1.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.8	0.7	1.0	0.8	0.7	0.8	0.7	1.5
Coachella	2.1	2.0	2.2	2.1	2.0	2.1	2.0	2.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	5.1	4.7	5.4	5.1	4.7	5.1	4.7	4.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	108.8	104.6	119.6	108.8	104.6	108.8	104.6	130.6
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	92.5	89.8	95.5	92.5	89.8	92.5	89.8	81.4
Total M&I	125.2	119.8	137.8	125.2	119.8	125.2	119.8	151.9
Total	217.8	209.5	233.3	217.7	209.5	217.7	209.5	233.3

Table A-5e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.8
Solano	0.4	0.3	0.4	0.4	0.3	0.4	0.3	1.0
Zone 7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.1
Alameda	0.6	0.6	0.6	0.6	0.6	0.6	0.6	1.0
Santa Clara	2.2	2.0	2.2	2.2	2.0	2.2	2.0	3.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.1
Empire W.S.	0.8	0.7	0.8	0.8	0.7	0.8	0.7	0.4
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	47.8	47.3	52.3	47.8	47.3	47.8	47.3	40.7
Tulare	12.8	11.8	13.6	12.8	11.8	12.8	11.8	7.6
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.8	0.7	0.8	0.8	0.7	0.8	0.7	1.1
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.3	0.4	0.4	0.3	0.4	0.3	1.1
Coachella	1.3	1.1	1.3	1.3	1.1	1.3	1.1	1.5
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.8	2.3	2.9	2.8	2.3	2.8	2.3	2.7
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	66.1	63.7	68.2	66.1	63.7	66.1	63.7	81.7
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	62.4	60.9	67.8	62.4	60.9	62.4	60.9	49.7
Total M&I	75.4	71.8	77.6	75.4	71.8	75.4	71.8	95.7
Total	137.8	132.7	145.4	137.8	132.7	137.8	132.7	145.4

Table A-5f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2003 Scenarios

SWP CONTRACTOR	2003 No Project 1 without KFE	2003 No Project 1 with KFE	2003 No Project 2	2003 No Project 3 without KFE	2003 No Project 3 with KFE	2003 No Project 4 without KFE	2003 No Project 4 with KFE	2003 Proposed Project (revised)
Napa	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.4
Solano	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5
Zone 7	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.5
Alameda	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.5
Santa Clara	1.2	1.2	1.5	1.2	1.2	1.2	1.2	1.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.3
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	21.8	21.8	23.3	21.8	21.8	21.8	21.8	22.2
Tulare	5.8	5.8	6.9	5.8	5.8	5.8	5.8	5.3
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.5
Coachella	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.9
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	1.5	1.5	1.7	1.5	1.5	1.5	1.5	1.9
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	34.9	34.9	43.0	34.9	34.9	34.9	34.9	44.4
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	28.5	28.5	31.1	28.5	28.5	28.5	28.5	28.2
Total M&I	40.1	40.1	49.1	40.1	40.1	40.1	40.1	51.9
Total	68.6	68.6	80.1	68.6	68.6	68.6	68.6	80.1

Table A-6a - Average Annual Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.9	0.1	0.1	0.9
Solano	0.2	0.1	0.2	0.2	0.1	0.2	0.1	1.0	0.2	0.1	1.0
Zone 7	0.3	0.2	0.3	0.3	0.2	0.3	0.2	1.0	0.3	0.2	1.0
Alameda	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.9	0.5	0.4	0.9
Santa Clara	1.5	1.1	1.5	1.5	1.2	1.5	1.2	3.3	1.5	1.2	3.3
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.1	1.0	1.0	1.1	1.0	1.1	1.0	1.0	1.1	1.0	1.0
Empire W.S.	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.2	0.7	0.6	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	48.1	44.3	46.8	48.1	44.3	48.1	44.3	36.1	48.1	44.3	36.1
Tulare	11.8	10.3	12.0	11.8	10.4	11.8	10.4	4.9	11.8	10.3	4.9
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.6	0.7	0.6	0.7	0.6	1.0	0.7	0.6	1.0
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.2	0.1	0.2	0.2	0.1	0.2	0.1	1.0	0.2	0.1	1.0
Coachella	1.3	1.1	1.2	1.3	1.1	1.3	1.1	2.0	1.3	1.1	2.0
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	2.1	2.3	2.4	2.1	2.4	2.1	2.4	2.4	2.2	2.4
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	52.1	44.0	51.2	52.1	44.3	52.1	44.3	62.9	52.1	44.3	62.9
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	61.6	56.2	60.5	61.6	56.3	61.6	56.3	42.2	61.6	56.2	42.2
Total M&I	59.2	49.8	58.2	59.2	50.2	59.2	50.2	76.5	59.2	50.2	76.5
Total	120.8	106.0	118.7	120.8	106.5	120.8	106.5	118.7	120.8	106.4	118.7

Table A-6b - Wet Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.0	0.1	0.0	1.5	0.1	0.0	1.5
Solano	0.1	0.0	0.1	0.1	0.0	0.1	0.0	1.6	0.1	0.0	1.6
Zone 7	0.3	0.1	0.4	0.3	0.1	0.3	0.1	1.7	0.3	0.1	1.7
Alameda	0.7	0.6	0.7	0.7	0.6	0.7	0.6	1.6	0.7	0.6	1.6
Santa Clara	2.1	1.5	2.2	2.1	1.5	2.1	1.5	5.6	2.1	1.5	5.6
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.7	1.8	1.7	1.7
Empire W.S.	1.2	1.0	1.2	1.2	1.0	1.2	1.0	0.2	1.2	1.0	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	79.4	72.6	78.0	79.4	72.6	79.4	72.6	59.9	79.4	72.6	59.9
Tulare	19.6	16.6	19.6	19.6	17.0	19.6	17.0	6.4	19.6	16.6	6.4
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	1.0	0.9	1.0	1.0	0.9	1.0	0.9	1.8	1.0	0.9	1.8
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.1	0.0	0.2	0.1	0.0	0.1	0.0	1.7	0.1	0.0	1.7
Coachella	1.9	1.7	1.9	1.9	1.7	1.9	1.7	3.4	1.9	1.7	3.4
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	3.6	3.4	3.5	3.6	3.4	3.6	3.4	3.6	3.6	3.4	3.6
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	80.4	65.1	80.3	80.4	65.7	80.4	65.7	100.3	80.4	65.1	100.3
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	102.0	91.9	100.5	102.0	92.4	102.0	92.4	68.2	102.0	91.9	68.2
Total M&I	90.4	73.4	90.4	90.4	74.0	90.4	74.0	122.7	90.4	73.4	122.7
Total	192.3	165.3	190.9	192.3	166.3	192.3	166.3	190.9	192.3	165.3	190.9

Table A-6c - Above Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1
Solano	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2
Zone 7	0.1	0.0	0.1	0.1	0.0	0.1	0.0	1.3	0.1	0.0	1.3
Alameda	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.2	0.4	0.4	1.2
Santa Clara	1.3	0.9	1.2	1.3	0.9	1.3	0.9	4.0	1.3	0.9	4.0
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.3	1.2	1.3	1.3	1.2	1.3	1.2	1.3	1.3	1.2	1.3
Empire W.S.	1.0	0.7	1.1	1.0	0.7	1.0	0.7	0.1	1.0	0.7	0.1
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	61.8	58.7	61.4	61.8	58.7	61.8	58.7	40.5	61.8	58.7	40.5
Tulare	15.5	12.1	16.7	15.5	12.1	15.5	12.1	3.8	15.5	12.1	3.8
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.7	0.7	0.6	0.7	0.6	1.3	0.7	0.6	1.3
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	1.3
Coachella	1.4	1.2	1.3	1.4	1.2	1.4	1.2	2.5	1.4	1.2	2.5
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	1.9	2.3	2.4	1.9	2.4	1.9	2.2	2.4	1.9	2.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	56.6	45.2	53.2	56.6	45.2	56.6	45.2	77.8	56.6	45.2	77.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	79.5	72.6	80.4	79.5	72.6	79.5	72.6	45.7	79.5	72.6	45.7
Total M&I	63.0	50.3	59.1	63.0	50.3	63.0	50.3	93.9	63.0	50.3	93.9
Total	142.5	123.0	139.6	142.5	123.0	142.5	123.0	139.6	142.5	123.0	139.6

Table A-6d - Below Normal Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.8	0.1	0.0	0.8
Solano	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.9	0.2	0.0	0.9
Zone 7	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.9	0.3	0.2	0.9
Alameda	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.8	0.4	0.3	0.8
Santa Clara	1.4	0.9	1.3	1.4	0.9	1.4	0.9	3.1	1.4	0.9	3.1
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	1.0	0.9	0.9	1.0	0.9	1.0	0.9	0.9	1.0	0.9	0.9
Empire W.S.	0.6	0.5	0.6	0.6	0.5	0.6	0.5	0.2	0.6	0.5	0.2
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	41.4	36.0	41.4	41.4	36.0	41.4	36.0	34.0	41.4	36.0	34.0
Tulare	9.6	8.9	10.1	9.6	8.9	9.6	8.9	4.6	9.6	8.9	4.6
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.7	0.6	0.6	0.7	0.6	0.7	0.6	0.9	0.7	0.6	0.9
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.2	0.0	0.2	0.2	0.0	0.2	0.0	0.9	0.2	0.0	0.9
Coachella	1.2	1.0	1.1	1.2	1.0	1.2	1.0	1.8	1.2	1.0	1.8
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.4	1.8	2.2	2.4	1.8	2.4	1.8	2.2	2.4	1.8	2.2
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	44.2	36.9	45.2	44.2	36.9	44.2	36.9	52.8	44.2	36.9	52.8
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	52.5	46.3	53.1	52.5	46.3	52.5	46.3	39.6	52.5	46.3	39.6
Total M&I	51.1	41.7	51.7	51.1	41.7	51.1	41.7	65.2	51.1	41.7	65.2
Total	103.6	88.0	104.8	103.6	88.0	103.6	88.0	104.8	103.6	88.0	104.8

Table A-6e - Dry Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

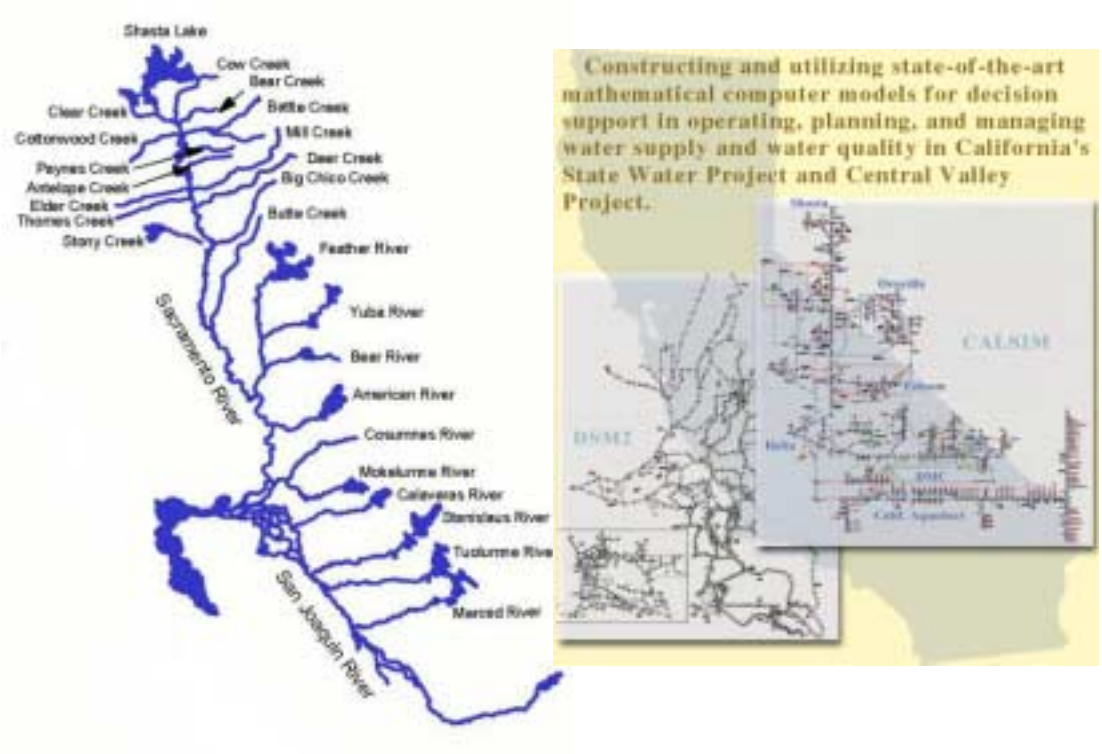
SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3
Solano	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3
Zone 7	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.4
Alameda	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3
Santa Clara	0.7	0.5	0.7	0.7	0.6	0.7	0.6	1.0	0.7	0.7	1.0
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.4	0.4	0.5	0.4	0.5	0.4	0.4	0.5	0.4	0.4
Empire W.S.	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	20.6	19.3	16.7	20.6	19.3	20.6	19.3	11.8	20.6	19.3	11.8
Tulare	4.1	4.0	3.8	4.1	4.0	4.1	4.0	2.5	4.1	4.0	2.5
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.4
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.4
Coachella	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.7	0.6	0.6	0.7
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	1.0	0.7	0.8	1.0	0.8	1.0	0.8	1.0	1.0	0.9	1.0
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	21.3	18.5	18.7	21.3	19.1	21.3	19.1	23.3	21.3	19.8	23.3
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	25.5	23.9	21.1	25.5	23.9	25.5	23.9	14.7	25.5	23.9	14.7
Total M&I	24.7	20.9	21.6	24.7	22.0	24.7	22.0	28.0	24.7	23.0	28.0
Total	50.2	44.8	42.7	50.2	45.9	50.2	45.9	42.7	50.2	47.0	42.7

Table A-6f - Critical Years: Annual Average Unscheduled Deliveries (TAF/year) to each Contractor in the Additional 2020 Scenarios

SWP CONTRACTOR	2020 No Project 1 without KFE	2020 No Project 1 with KFE	2020 No Project 2	2020 No Project 3 without KFE	2020 No Project 3 with KFE	2020 No Project 4 without KFE	2020 No Project 4 with KFE	2020 Proposed Project (revised)	2020 No Project 1 without KFE, with Climate Change	2020 No Project 1 with KFE, with Climate Change	2020 Proposed Project (revised) with Climate Change
Napa	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Solano	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Zone 7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Alameda	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Santa Clara	1.8	1.8	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Oak Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dudley Ridge	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Empire W.S.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.4
KCWA (M&I)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KCWA (Agric.)	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7
Tulare	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.5	6.8	6.8	6.5
SLO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Barbara	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVEK	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Castaic (Agric.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Castaic (M&I)	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5
Coachella	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Crestline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Desert	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.3	2.1	2.1	2.3
Littlerock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mojave	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MWDSC	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.5	45.4	45.4	45.5
Palmdale	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Bernardino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gabriel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
San Gorgonio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventura	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Agriculture	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.0	30.5	30.5	30.0
Total M&I	52.8	52.8	52.8	52.8	52.8	52.8	52.8	53.2	52.8	52.8	53.2
Total	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2	83.2

G. CALSIM II PEER REVIEW REPORT AND THE DEPARTMENT'S RESPONSE

A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California



Submitted to the

California Bay Delta Authority Science Program
Association of Bay Governments
Oakland, California

by

A. Close, W.M. Haneman, J.W. Labadie, D.P. Loucks (Chair), J.R. Lund, D.C. McKinney, and J.R. Stedinger

December 4, 2003

Executive Summary

1. Summary

The central all-encompassing question put to the panel is whether the CALFED program has adopted an appropriate approach to modeling the CVP-SWP-Central Valley system. Is the general CALSIM modeling approach appropriate for predicting the performance of the general facilities and for use in allocation planning, assessing water supply reliabilities and for carrying out operational studies? We believe the use of an optimization engine for simulating the hydrology and for making allocation decisions is an appropriate approach and is in fact the approach many serious efforts of this kind are using. It is a substantial improvement of the previous modeling approaches and provides a basis for consensus among federal and state interests. The modeling approach addresses many of the complexities of the CVP-SWP system and its water management decisions.

There exists a common tension between those who wish for greater detail and those who want less detail from the model. This argues for a more comprehensive, modular and flexible approach than is now available. In this report we suggest some ways this might be accomplished in the future. We also propose some management procedures that could be considered to improve model and model application quality control and documentation. The openness and availability of the model is admirable and very important given the numerous stakeholders who have interests in the management and allocation of water in the state. To increase the public's confidence in the many components and features of CALSIM II, we suggest that these components of CALSIM be subjected to careful technical peer review by appropriate experts and stakeholders.

2. Background

The California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) have developed a computer model called CALSIM II that simulates much of the water resources infrastructure in the Central Valley of California and the Delta region. This infrastructure is referred to as the CVP-SWP system. In particular CALSIM II provides quantitative hydrologic-based information to those responsible for planning, managing and operating the State Water Project (SWP) and the federal Central Valley Project (CVP). As the official model of those projects, CALSIM II is the default system model for any inter-regional or statewide analysis of water in the Central Valley of California.

CALSIM II has a central role in the analysis of many CVP-SWP and related issues, some of which require capabilities beyond those included in the model. California needs a large-scale relatively versatile inter-regional operations planning model and CALSIM II currently serves that purpose reasonably well. As the primary State and Federal-sponsored model available for water operations and planning, CALSIM II is critical to the study of many technical and policy issues related to water supply reliability, environmental management and performance, water demands, economics, hydrology and climate, and regulatory compliance.

CALSIM II is a particular application of the California Water Resources Simulation Model called CALSIM. It uses a mixed integer linear programming model solver to route water through a network over time. Currently it uses monthly time steps. Policies and priorities are implemented through the use of user-defined weights applied to the flows in the system (represented by arcs of the network). Simulation cycles at different temporal scales allow for successive implementation of constraints. The model can simulate the operation of relatively complex environmental water accounts and state and federal environmental regulations. In our judgment CALSIM II represents a very impressive modeling effort on the part of all those involved with its development and application.

The CALFED Science Program commissioned this external review panel (Appendix D) to 1) provide an independent analysis and evaluation of the strengths and weaknesses of CALSIM and CALSIM II, and 2) to offer suggestions on the appropriate uses of these modeling tools, on ways their use might complement or be complemented by other models, and on further development, quality assurance, and use in major water systems operations and planning in California.

The panel received background documents (Appendix B), including a survey by the University of California at Davis of stakeholder responses to questions about CALSIM II. We subsequently met for one and a half days in Sacramento for discussions and presentations (Appendix A) by CALFED, DWR and USBR staff. The discussions concluded with a summary presentation by the panel outlining our tentative conclusions.

The information we received and the shortness of our meetings with modeling staff precluded a thorough technical analysis of CALSIM II. We believe such a technical review should be carried out. Only then will users of CALSIM II have some assurance as to the appropriateness of its assumptions and to the quality (accuracy) of its results. By necessity our review is more strategic. It offers some suggestions for establishing a more complete technical peer review, for managing the CALSIM II applications and for ensuring greater quality control over the model and its input data, and for increasing the quality of the model, the precision of its results, and their documentation.

In this review we were asked to address the following questions:

1. Is CALSIM a reasonable modeling approach for current and proposed applications and problems?
2. Do other modeling approaches show similar or greater promise and flexibility for such problems? If so, how?
3. What are the major comparative strengths and weaknesses of the current CALSIM approach and alternative approaches?
4. What are major scientific, technical, and institutional limitations, uncertainties, and impediments for current and proposed applications of CALSIM?
5. What model, software, and data developments, special studies or tests would be beneficial to improve CALSIM for current and proposed uses?
6. How might CALSIM development and applications be managed and overseen to improve the quality assurance of model results for current and proposed applications?

7. What are your suggestions for long-term use, development, or replacement of the current suite of models and data available for the current and proposed uses of CALSIM?

The following sections of this summary present our responses to these questions. The main parts of this report and its appendices provide additional detail.

3. CALSIM Modeling Approach

CALSIM II is a simulation model developed as a joint venture between the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) to (i) provide a significant modernization and upgrading of the DWRSIM and PROSIM models developed and used by these organizations, (ii) develop a comprehensive modeling system that simultaneously addresses the current and future needs of both the SWP and CVP systems; and (iii) develop a generalized modeling system that could be applied in any river basin system, in contrast with the previous models that were less generalized and more specifically designed for the existing SWP and CVP systems. In this respect, CALSIM II represents a state-of-the-art modeling system that is similar in general concept, while differing in specific details, to other data-driven river basin modeling systems such as ARSP, MODSIM, OASIS, REALM, RiverWare and WEAP.

CALSIM uses linear programming to solve sets of equations that simulate water movement through the CVP-SWP system in accordance with various objectives and constraints. This is a modeling approach which has been used successful in California (Johnson et al., 1991). In a complex system such as that being modeled, it is essential to have some mathematical representation of system flows that reflects all of the interconnections and constraints. Use of an optimization algorithm allows good decisions to be identified from among all possible and feasible decisions. To the extent this simulates what actually occurs, it is a good modeling approach. To the extent it optimizes when in reality no such optimization is implemented, it has the potential to produce inaccurate and overly optimistic outputs.

Most successful applications of optimization that attempt to simulate the behavior of a system have calibrated their objective functions (i.e., set the weights that prioritize flows over time and space) so that the model results correspond to what actually happens or would happen under a particular hydrologic and demand scenario. In these cases the model's decisions correspond to those the operators would make, as often prescribed by rules that have been worked out in a legal/political process. It does not appear that such a calibration of the objective function weights in CALSIM has yet been completed.

4. Other Modeling Approaches

There are two aspects of modeling, the model structure and algorithms used, and the model software. The use of linear optimization algorithms to solve simultaneous equations for simulating hydrology is a common way of avoiding a typically long list of procedural rules for simulating regional water systems. Such sets of procedures can be difficult to generate for

complex systems, and very different and new rule sets may be needed if structural or significant policy changes are to be investigated. In addition the performance of the system when simulated will be less than that which can be achieved in practice if a good set of rules is not provided. Optimization models are generally easier to reformulate when system changes are to be investigated. However unless the optimization is calibrated in such a way as to actually resemble what takes place in practice it can produce an optimistic description of system performance. This is particularly true if the optimization model is allowed to have perfect foresight of future events that in practice would not be available to system operators.

Large simulation models using optimization and procedural rules both need to have internal checks to ensure to the extent possible that errors in mass balances, for example, do not occur due to errors made when the model is being defined or created. Such internal checking is not apparent to us in our admittedly brief review of CALSIM II. Nor were calibration procedures well defined.

One obvious limitation of using linear optimization procedures is its inability to model accurately and efficiently some of the non-linear hydrologic and decision processes that occur in systems as complex as the CVP-SWP. One approach to addressing this issue of model accuracy, and possibly for decreasing the computational time as well, is to link linear optimization models to non-linear simulation models in a way that permits the simulation to represent the hydrology in any spatial and temporal detail desired. The optimization is used to determine what the decisions should be at every site where a water allocation, reservoir release, or other management decisions must be made. The time steps for simulation could be daily, or weekly or longer, depending on the needs of the user, but would likely be of shorter durations than the optimization time steps. After a predetermined number of simulation time steps, the optimization model would be run. The initial state of the optimization should be set at the beginning of each optimization time step. The optimization component should include multiple future time periods, with imperfect hydrologic and demand forecasts, but once solved only the current period's solutions are implemented – i.e., these decision variable values are sent to the simulation component. The decisions indicated for future periods are ignored. When appropriate, the initial state of the multi-period optimization model is updated and the model is again solved. And so on. Such a modeling approach may prove to be both more realistic, more accurate, and require less time, once developed. We believe such an approach might be worth considering for future development.

CALSIM II currently consists of a combination of software modules developed in several languages, including FORTRAN, Java and C. Several of the modules require proprietary software packages in order to run CALSIM II (Lahey FORTRAN and XA Solver). DWR and USBR staff have said that these components are being replaced by public domain software that can be obtained free of charge. We agree with this decision. Very good public domain software packages of optimization, visualization, file management, and data base support are currently available, and new ones will continually be produced. Periodic updates should be anticipated as part of the business of maintaining the modeling system.

Significant thought should be given to the sustainability of the CALSIM II software. How will future programmers be able to maintain this software? How will future software developments

be incorporated into the system? Will the solver currently being developed by LBNL be adequate in terms of accuracy and computation speed? Will other solvers need to be tested? Can the system accommodate these future developments without major modifications? What reasonable modifications could be made now in anticipate of future developments?

5. Comparative Strengths and Weaknesses

Many of the stakeholder perceived strengths and weaknesses of CALSIM and CALSIM II are very well identified in the survey report from the University of California at Davis (Ferreira, et al. 2003). Our background materials and briefings covered various strengths and weaknesses, but without first hand experience, all we can do here is to summarize those that we have heard expressed by others.

Here we provide a brief summary list.

5.1 Some Prominent Strengths

The strengths of CALSIM II are many. Most are expressed in comparison to previous DWRSIM and PROSIM models DWR and USBR were using. Some of these strengths include:

- Consensus model. CALSIM II is the official joint modeling environment of the State DWR and USBR. This includes a common schematic, hydrologic representation of the system, common set of facility capacities, and common representation of system operating policies. This helps all parties improve representations, rather than compete over representations.

- Common effort. The joint development of CALSIM II by USBR and DWR has provided more focused and effective use of resources and expertise than previous development of agency-specific models. CALSIM II development has also involved other agencies and consulting expertise more than pervious models of this system.

- Data-driven model. CALSIM II is a rather data-driven simulation model with an optimization engine. This modeling approach provides:
    a. greater flexibility than its predecessors and traditional water resources simulation approaches.
    b. a promising framework for improving transparency, data, and model documentation, compared to other approaches.

- Public domain. The model and data are substantially in the public domain, facilitating transparency and adaptability for California's decentralized water system.

- Steady improvements. Data improvements have been steadily pursued following the adoption of CALSIM II, although deficiencies remain.

- Improved Delta water quality representation. Although problems appear to remain, the model developers have made substantial gains in representing Delta water quality operating criteria and performance.

- Better groundwater representation. Efforts to better include groundwater and non-CVP-SWP project operations merit continuation and expansion.

- Benchmark Studies. The development of documented benchmark studies have resulted in significant model improvements and aided in the development of comparative model applications. Such exercises should be continued and improved.

- Long-term vision. The vision of a more transparent and publicly available model that can be employed by those outside the major agencies is excellent. This is a major change in direction, and achieving this vision will require adjustments over time. Often, these adjustments will be externally driven. Externally-driven improvements are a price of success and evidence of success for an open, public, modeling policy.

- Important CALSIM II features:
    a. CALSIM II is able to simulate the operation of the complete CVP-SWP system in all areas that contribute flow to the Delta in monthly time-steps.
    b. CALSIM II is being applied to examine a diverse range of options including flood control, water conservation and supply, power generation, recreation, water transfers, groundwater banking, recycling, desalination, conjunctive use, the purchase of options and streamflow and water quality protection.
    c. CALSIM II has successfully been applied by both DWR and USBR to examine both structural and non-structural changes to the CVP-SWP system as well as to ascertain the risks involved with different potential operating scenarios and to quantify the impacts of proposed actions.
    d. CALSIM II can dynamically model operation of environmental water accounts.
    e. Demands may vary according to various levels of development (e.g. 2001, 2020) and to hydrologic conditions.
    f. The regulatory environment under which the projects must operate can be simulated.
    g. CALSIM II can link to external modules as needed, e.g., to estimate the salinity at water quality stations within the Delta.

5.2 Some prominent weaknesses

As its strengths are many, so are its weaknesses. It seems worth saying, however, that no model can perfectly (meaning efficiently and effectively) serve all interests in a system as complex as the CVP-SWP. Tradeoffs need to be made. This can result in what some would call weaknesses. Such weaknesses are often accepted to gain strengths in another ways.

We heard that the CALSIM II model was too complex. We also heard that it did not handle particular components of the system with sufficient detail. And such is the dilemma of any

complex model, such as CALSIM II. The model is clearly too complex, and not complex enough. The root of this difficulty is that when such a model is constructed, it is not clear what level of detail is needed, so the model must be made sufficiently complex to ensure it is complex enough. And the complexity needed to address some issues will remain in the model when it is used to address other less complex issues, or the same issues at less complex locations. One approach to addressing this issue is to develop different linkable modules of CALSIM II having different complexities. In this way the level of detail can be varied to be consistent the application or study at hand, and level of sophistication and resources available to the user.

Other weaknesses model users would like addressed include:

- The model provides limited and inadequate coverage of non CVP or SWP water and of the California water system south of the Delta.
- The model assumes that facilities, land-use, water supply contracts and regulatory requirements are constant over this period, representing a fixed level of development rather than one that varies in response to hydrologic conditions or changes over time.
- Groundwater has only limited representation in CALSIM II.
- Groundwater resources are assumed infinite, i.e., there is no upper limit to groundwater pumping.
- The linear programming model considers only the current month, and hence CALSIM II operating rules are required to determine annual water allocations, to establish reservoir carryover storage targets, and to trigger transfers from north of Delta to south of Delta storage.
- Better quality control is needed both for the model and its current version and the input data. Procedures for model calibration and verification are also needed. Currently many users are not sure of the accuracy of the results. A sensitivity and uncertainty prediction capability and analysis is needed.
- Need improved ways of altering the model's geographic scope and resolution and its temporal resolution to better meet the needs of various analyses and studies.
- Need to improve the model's comparative as well as absolute (or predictive) capabilities.
- CALSIM II needs better capabilities for analyzing economic, water quality, and groundwater issues.
- Need improved documentation explaining how the model works, its assumptions, its limitations, and its applicability to various planning and management issues.
- DWR and USBR have not provided a centralized source of support for CALSIM II. More training for CALSIM II is needed. There is a need for more people who can run CALSIM II. There is a need for a well-publicized user group. A more extensive users' guide is needed.
- Improved capabilities are needed for real-time operations especially during droughts, gaming involving stakeholders during a simulation run, handling of evapotranspiration and agriculture demand changes over time, water transfers, Delta storage, carryover contract rights, refuge water demands and more up to date representation of Feather River, Stanislaus River, Upper American River, San Joaquin River and Yuba River operations.

- Need an improved graphical user interface to facilitate input of model data, setting of model constraints and weights, operating the model, and displaying and post analysis of model results.
- Need to be able to change the model time period durations for improved accuracy of model results.

6. Limitations, Uncertainties, and Impediments

6.1 Absolute Values or Comparative Results

Modelers sometimes make a distinction between the use of a model for *absolute* versus *comparative* analyses. In an absolute analysis one runs the model once to predict an outcome. In a comparative analysis, one runs the model twice, once as a baseline and the other with some specific change, in order to assess change in outcome due to the given change in model input configuration. The suggestion is that, while the model might not generate a highly reliable absolute prediction because of errors in model specification and/or estimation, nevertheless it might produce a reasonably reliable estimate of the relative change in outcome. The panel is somewhat skeptical of this notion because it relies on the assumption that the model errors which render an absolute forecast unreliable are sufficiently independent of, or orthogonal to, the change being modeled that they do not similarly affect the forecast of change in outcome; they mostly cancel out. This feature of the model is something that would need to be documented rather than merely assumed.

In our opinion CALSIM II has not yet been calibrated or validated for making absolute predictions values. Yet it is apparent that there has been a distinct need by model users for absolute predictions. In the absence of alternatives, users are adopting CALSIM II results as the best absolute prediction available and they are likely to continue to do so. We recommend that model developers recognize the requirement for CALSIM II to provide absolute predictions. To satisfy this new purpose, additional calibration of the model will be required to ensure that the output it produces is fit for this purpose. Regardless of how possible it is to match the model closely with observed behavior, statistics on the accuracy of the calibration run should be supplied to users to enable them to gauge the likely errors involved with using the model output.

6.2 Sensitivity and Uncertainty Analyses

Sensitivity analyses would be useful to identify which parameters and input data have major impacts on decisions and system performance criteria of concern. Uncertainty analyses would help users of the model understand better the risks of various decisions and the confidence they can have in various predictions.

6.3 Graphical User Interface

Having a graphical user interface would substantially aid those who use the model in managing both input and output data, and in controlling or managing model operations. This model will not likely become as available to and as well understood by the public, to the extent desired by the model developers, until an effective menu-driven GUI has been created that can help create and draw from a database of system parameters and characteristics, and simulation results.
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6.4 Documentation and Training

When if ever is adequate documentation and training available? Rarely, but we believe there is a serious need to improve the documentation as well as the training available for all those interested in using CALSIM II.

7. Options for Improving CALSIM

7.1 CALSIM Model Software

We encourage the developers of CALSIM to convert their present software to that which is publicly available and to develop a useful graphic based user interface that can facilitate the input, editing, and display of all the data that are input to and output from CALSIM II. There are many options, some of which we have discussed with the model developers.

The CALSIM package should be made more modular and capable of linking to other more complex models of components of the CVP-SWP system. If the changes in code and modeling approach result in a quicker running model, it might be possible to link, when desired, modules that facilitate position analyses and other types of uncertainty analyses. A modular system would allow alternative representations of different components of the system. Thus different levels of spatial detail, or representations of the fundamental processes, would be allowed within the overall system representation and record of California hydrology. This will allow the use of more general and streamlined models for use of preliminary investigation and general planning, as well as a more detailed representation of the system for final analyses and more detailed studies. This would be very useful.

7.2 Sensitivity and uncertainty analyses

Both sensitivity analyses need to be performed, and procedures need to be developed to enable the estimation of measures of uncertainty associated with model output. Perhaps workshops focused on just these needs should be scheduled to better determine how best to meet these needs. There are numerous procedures available that could be applied. Appendix H contains some approaches for performing sensitivity and uncertainty analyses.

7.3 Model calibration

There is a need to develop the model so that it is able to provide absolute estimates of key model outputs rather than limiting the use of the model to comparative studies. One way to do this is to subject the model to a comprehensive calibration process where it is fine-tuned until it is able to reproduce the historical behavior of the system with sufficient accuracy to provide absolute results. The calibration of the model should aim to test all the key outputs of model including water quality in the San Joaquin River and in the Delta. It is necessary to test the monthly values of outputs for those outputs for which the monthly pattern is important.

7.4 Other extensions and improvements

- The opportunity of improving the collection of data on the use of water (preferably broken down by irrigation district and water source) should be investigated. The use of groundwater should be included in this investigation.
- It would be useful to expand the geographic extent of the model so that it includes all the components of the linked water supply system, including both the San Joaquin and Tulare Lake Basins of the Central Valley. The model should also account in some manner for imported supplies of water to users in southern California from the Colorado River.
- The linkage between surface water and groundwater would appear to be of critical importance and output that would enable the impact of surface water use on groundwater extractions would appear to be useful.
- Examination of the report *'CALSIM II Simulation of Historical SWP/CVP Operations',* DWR (2003) indicates that the current formulation of CALSIM II:
  - Overestimates water deliveries to SWP and CVP contractors,
  - Determines carryover storage target values that differ from those the operators have determined in the past, and
  - Operates the San Luis Reservoir at lower levels and fills it later in the season than operators have in the past.

8. Managing CALSIM Development and Applications

The predicted impacts and other information derived from CALSIM II applied to the CVP and SWP can influence major investment decisions. It is thus self evident that those who use the model results need to have some confidence as to their precision. Is the science behind the information derived from CALSIM II been reviewed and judged correct? Is the model software free from errors? Are the assumptions made when performing the modeling the correct ones? Are the model results accurately and fully reported? In other words, just how much credence should decision makers place in the model output? Users of the model results should be assured that they are credible and unbiased. One way to help ensure this is to have the models, their associated software, and their applications under the control of some interagency organization that can oversee and provide quality control over model development, application and documentation. They can also plan and implement needed peer reviews.

One possible means of facilitating the peer review processes and for maintaining control on the particular versions of CALSIM II and accompanying models used for CVP-SWP planning and management decisions is to create an interagency modeling consortium (IMC) consisting of DWR, USBR, and other stakeholder organization (including university) personnel if they are interested and want to participate. This center would be responsible for maintaining a toolbox of 'acceptable' models for use by the agencies and contractors. The models placed in the toolbox should be peer reviewed with respect to their applicability and suitability for use in particular applications. Those that are not peer reviewed should be considered for peer review. New models proposed for use in California should be peer reviewed with respect to their suitability, and for their strengths and limitations, before being placed in the toolbox. The review should be of the theory underlying the model, the model's software, the documentation of the model as well as of its software, the model's functions and capabilities including those pertaining to model data input and output, the input data themselves, model calibration and verification, capabilities for sensitivity and uncertainty analyses, user control of all model operations including pre and post analyses (GUIs), spatial and temporal resolutions, and its limiting assumptions.

9. Future Use, Development, or Replacement of CALSIM

9.1 A coupled optimization simulation approach

Given a system as complex as the SWP/CVP system, it seems to us it might make sense to consider the development of a more detailed simulation 'engine' and couple it to an optimization or management 'engine'. The simulation component can more accurately model hydrologic processes. For example it can include the deterministic non-linear routing of flows and their quality constituents through the system on a smaller time step (e.g., daily) and hence much more realistically or accurately, than can linear optimization using longer time steps, even with all the known tricks for linearizing separable (single variable) non-linear functions and 'if-then-else' statements. The simulation engine itself may require a simultaneous equation solver, especially for the Delta. But the simulation engine needs to know what to do, i.e., what decisions to make. Periodic use of the optimization, say once a week or even less frequently if conditions are relatively constant, for determining the decisions to be simulated, e.g., the water allocation and reservoir release decisions, eliminates much of the maze of rules that otherwise would be required and which developers of CALSIM II are avoiding through the use of optimization. Each time the optimization or management 'engine' is run it is first updated with the current state of the system as determined from the more precise simulation 'engine'. The optimization component would include multiple time periods only to the extent that the current period's solution is not affected by the time horizon in the optimization. The other time period solutions are ignored. This coupled optimization-simulation approach has the potential to be both more accurate as well as quicker to execute. In our opinion it is worth considering for future development.

9.2 Models as hypotheses

CALSIM II is really about the future, not the past. Benchmarking studies can help establish the credibility of the model and provide estimates of its accuracy by comparing its performance to actual historical operations. A concern is how well the model reproduces historical operations, not whether it is valid or invalid on some absolute scale of perfection. But the real issue is how well CALSIM can predict what might happen in the future with sets of hydrological and meteorological conditions that have not yet been experienced, and may be significantly different from the past if climate variability and climate change are considered. In these cases the ability of the model to forecast what will happen depends both upon its ability to describe what would happen should a particular system operating policy, priorities and water demands be adopted. In this sense CALSIM II modeling studies should be thought of as the exploration of a hypothesis that particular policies and priorities have been adopted. Our ability to predict the future has generally been poor, but it is the obligation of agencies such as DWR and USBR to attempt to ensure that should water demands, water supplies, and water policies evolve as one would expect, society is prepared for the consequences. And that would seem to be what CALSIM II is about.

9.3 Future Model Development and Use

From the list of perceived weaknesses above, there are clearly many opportunities for further refinement of CALSIM II. Rather than attempt to meet all needs using only one model, namely CALSIM II, it seems preferable to improve its adaptability to various levels of detail through its ability to link to other models when additional detail in a particular region or for a particular feature is desired. For example, the monthly time step used by CALSIM II is sufficient for many studies. Yet some seasonal (multi-month) decision making is needed in CALSIM II to reflect decisions made by the SWP and CVP as to what Table A and other allocations to honor in full. On the other hand, it is clear that many water quality and ecosystem management decisions would profit from more detailed weekly or daily time steps. However, such shorted time-step models will need the guidance of a longer time-step model. As discussed earlier, models with shorter time scales can require increased spatial resolution, both of which lead to increased model complexity and a strong argument for model modularity.

Additional potential applications of CALSIM II include operational planning using gaming, or the involvement of potential decision makers during the simulation runs via a well developed graphical user interface, and to improve the capability of modeling water quality, energy production, conjunctive groundwater and surface water interactions and use, to mention a few.

There will always be a need to perform alternative 'what if' policy analyses where a relatively fast model that also provides some capability for uncertainty analyses is required. Perhaps CALSIM II will never be able to serve this need, and if so another more simplified modeling approach could be developed to fill that need. This simpler screening tool would be calibrated to produce results comparable to those of CALSIM II or observed data. Is this possible? We can not be certain but feel the idea should be seriously considered.

Acknowledgments

We want to acknowledge and thank all those who were involved in preparing the materials we received, in presenting additional information to us, and in arranging our activities and taking care of us during our brief review visit. Our special thanks to Kim Taylor for leading this effort, and to all those who did their best to educate us on the finer points of CALSIM II. All those involved in the development and implementation of CALSIM II are to be congratulated for extending the state-of-the-art in water systems modeling and for making it a critical part of the planning, development and management of California's water resource infrastructure.

Caveat

Just as all models are approximations of reality, so may all advice be an approximation of what it should be. We hope what we have written in this report is correct and useful, but encourage CALSIM model managers and California's water community to take our assessments and suggestions for what they are, arrived at based on our own experiences and some limited exposure to those who know much more about CALSIM and CALSIM II than we do.

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Appendix A: CALSIM II Science Review Schedule

Appendix B: Briefing Material for CALSIM II Peer Review

Appendix C: CALSIM II Review Process and Timeline

Appendix D: Peer Review Panel

Appendix E: Managing Model Development, Application, Documentation and Communication.

Appendix F: Analysis of the November 2003 CALSIM II Validation Report

Appendix G: Some Principles for Strategic Water Analysis

Appendix H: Model Sensitivity and Uncertainty Analysis

Appendix I: Model Calibration Examples

1. CALSIM Compared to Other Modeling Approaches

Management of complex systems such as coordination of the California State Water Project (SWP) and the Federal Central Valley Project (CVP) requires effective decision support tools for simulating and analyzing system components in a fully integrated manner. The classic definition of a decision support system (DSS) provided by Sprague and Carlson (1982) is *"an interactive computer-based support system that helps decision makers utilize data and models to solve unstructured problems."*

A DSS integrates the following interactive subsystems: (i) dialog generation and management subsystem (DGMS) for managing the interface between the user and the system; (ii) data base management subsystem (DBMS); and (iii) model base management subsystem (MBMS).

CALSIM II is a DSS developed as a joint venture between the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Bureau) to (i) provide a significant modernization and upgrading of the previous models DWRSIM and PROSIM employed by these organizations, (ii) develop a comprehensive modeling system that simultaneously addresses the current and future needs of both the SWP and CVP; and (iii) develop a generalized modeling system that could be applied in any river basin system, in contrast with the previous models that were less generalized and more specifically designed for the SWP and CVP. In this respect, CALSIM II represents a state-of-the-art modeling system that is similar in general concept, while differing in specific details, to other river basin modeling systems such as AQUATOOL (Valencia Polytechnic University, Spain), ARSP (Acres Reservoir Simulation Program) (Boss International, 2003), IRAS (Interactive River-Aquifer Simulation) (Loucks, et al. 1996), MIKE BASIN (Danish Hydrologic Institute, 2002), MODSIM (Labadie and Larson, 2000), OASIS (Randall, et al., 1997), RAISON (Young, et al. 2000), ResSim (U.S. Army Corps of Engineers, Hydrologic Engineering Center), Ribasim (River BAsin SIMulation Model) (Delft Hydraulics, Netherlands), REALM (REsource ALlocation Model) (James, 2003), RiverWare (Zagona, et al. 1998), WaterWare (Jamieson and Fedra, 1996), and WEAP (Water Evaluation and Planning System, 2003) (Hansen, 1994). All of these can be categorized as decision support systems since all three subsystems of a DSS are embodied within them.

A distinguishing feature of several of these modeling systems is the use of optimization on a period by period basis (not fully dynamic) to "simulate" the allocation of water under various prioritization schemes, such as water rights, without the presumption of perfect foreknowledge of future hydrology and other uncertain information. This is a valid approach since use of optimization overcomes the disadvantage of employing numerous, unwieldy prescriptive rules governing water allocation. Systems employing optimization in this manner include: ARSP, MODSIM, OASIS, REALM, RiverWare, and WEAP and are therefore more akin to CALSIM II. ARSP, MODSIM, REALM and Ribasim are further distinguished by use of specialized minimum cost network flow optimization algorithms, although of these only MODSIM includes iterative structures using an imbedded scripting language for including non-network "side constraints" in the optimization. The other modeling systems are essentially limited to a

pure network structure that does not allow inclusion of all the complex, non-network type constraints necessary to model the complex CVP-SWP system.

It may be useful to compare this use of optimization with some other uses that have appeared in the modeling literature. One use of optimization is purely for computational convenience; in this case optimization is employed as a numerical method for obtaining the solution of a series of simultaneous (often linear) equations. This approach, which was used in the first generation of computational economic models about forty years ago, exploited the fact that some existing computational algorithms for solving optimization problems were faster than those for solving large systems of simultaneous equations. A second use of optimization applies when the solution of the system of equations characterizing a water balance has multiple possible solutions; this is essentially the case described above, where optimization is being used primarily to identify a unique solution for a system of equations. Both of these uses of optimization are primarily descriptive rather than prescriptive (also referred to as positive vs. normative) in intent: the goal is to model how a system, characterized by a set of equations, operates. To the extent that the real–world managers of the system do optimize some objective function, the aim is to mimic their behavior by setting up and solving a similar optimization. But, the goal is to model what they actually do, not to advise them what they ought to do. The third use of optimization adopts an explicitly prescriptive goal and sets out to ascertain what managers ought to do if they wished to optimize some objective function (e.g. maximize economic efficiency). While this is certainly a legitimate analytical exercise, it should be kept conceptually distinct from the use of optimization in a purely descriptive context.

1.1 Advantages of Optimization-Driven Simulation

For large, complex, integrated systems, simulation models that optimize operation and allocation of water within each time-step by operational priorities have become the major simulation approach. Models of similar approach include ACRES (Acres Engineering), AQUATOOL (Spain), MODSIM (Colorado State U.), OASIS (Hydrologics, Inc.), WASP (Australia), and WEAP (Tellus Institute). Priority-based simulation models with optimization engines have become widespread in part because:

- The models are simpler to develop, comprehend, and modify.
- Their software is easier to upgrade, since the data set describing the system and its operating policies is substantially separate from the software code.
- Data are easier to update and modify, since changes require little or no software changes.
- Priority-based operations are a common basis for water rights and operating policies.
- Priority-based operations are relatively easy to explain.

The major exception to this technological trend in simulation modeling is to use more traditional procedural operating rules in simulation models with a graphical user interface for primarily flood control operations (HEC-RESSIM) or for exploratory study of large systems or detailed management of relatively small systems (Stella-type models).

Similar to several of these systems, CALSIM II allows specification of objectives and constraints in strategic planning and operations without the need for reprogramming of

complex models. The CALSIM II authors developed the English-like WRESL (Water Resources Engineering Simulation Language) as an intuitive means of defining the objective function and constraints for a mixed-integer linear programming model, similar to the OCL (Operational Control Language) used in OASIS and the Policy Editor employed in RiverWare. In MODSIM, the optimization model is formulated directly through the graphical user interface with no need for a modeling language, but with supplemental features of the optimization defined through the PERL scripting language. WRESL allows planners and operators to specify targets, objectives, guidelines, constraints, and their associated priorities, in ways familiar to them. WRESL provides simple text file output that is converted to FORTRAN 90 code by a parser-interpreter program, whereas PERL is fully embedded in the network optimization code. Both modeling systems are data centered, meaning that model operation is controlled solely by user specification of input data rather than hidden rules or hard-wired data structures.

CALSIM II, OASIS, RiverWare and MODSIM are similar in that all use a high level language with syntax and logical operators; are written to simple text files which are subsequently parsed and interpreted; use rule-based or IF-THEN-ELSE conditional structures; are designed to be easy for planners and operators to use without the need for reprogramming; allow adaptive and conditional rules which are dependent on current system state variable information; include constructs for assigning targets, guidelines and constraints, along with their associated priorities; and include a goal seeking capability. CALSIM employs a mixed integer linear programming solver for repeated period by period solution that is less efficient computationally than the network solver employed in MODSIM, ARSP, REALM and Ribasim.

Unfortunately, unlike these aforementioned modeling systems, CALSIM lacks a comprehensive graphical user interface for constructing and editing the river basin system topology. CALSIM II would be greatly enhanced if, similar to RiverWare, IRAS, and MODSIM, objects representing features of the basin such as reservoirs, canals, and river reaches, could be created on the palette of a graphical user interface by simply clicking and dragging various icons for the objects to the display. The objects are instances of various classes that share certain common characteristics, and each object contains its own physical process methods and associated data. We believe that complaints concerning the complexity of using CALSIM II would be greatly reduced with development of such an object-oriented graphical user interface.

2. Comparative Strengths and Weaknesses

2.1 Some Prominent Strengths

CALSIM II has important strengths as a general inter-regional operations planning model, particularly compared with available alternatives and its predecessors. The primary strengths include:

- Coordination of Federal and State Interests A unique aspect of CALSIM II is the high degree of cooperation between Federal (i.e., U.S. Bureau of Reclamation) and State (i.e.,

California Department of Water Resources) interests in its development. This kind of cooperation is rare, and in fact this may be the only such example of such coordination for a system of this scale and complexity. Although it is clear that DWR staff have taken the greatest degree of responsibility in the planning, development, coding, testing and application of CALSIM II, it is also clear that USBR staff have also played an important role. CALSIM II can provide a showcase for other states as to what can be accomplished with Federal and State cooperation for river basin management.

- Consensus model. CALSIM II is the official joint modeling environment of the State and USBR. This includes a common schematic, hydrologic representation of the system, common set of facility capacities, and common representation of system operating policies. This saves a lot of unproductive bickering and helps all parties improve representations, rather than compete over representations.

- Common effort. The joint development of CALSIM II by USBR and DWR has provided more focused and effective use of resources and expertise than previous development of agency-specific models. CALSIM II development has also involved other agencies and consulting expertise more than pervious models of this system.

- Data-driven model. CALSIM II is a rather data-driven simulation model with an optimization engine. This modeling approach provides:

    a. much greater flexibility than its predecessors and traditional water resources simulation approaches.
    b. a promising framework for improving transparency, data, and model documentation, compared to other approaches.

- Public domain. The model and data are substantially in the public domain, facilitating transparency and adaptability for California's decentralized water system. Ongoing software development efforts will improve CALSIM in this regard.

- Steady improvements. Data improvements have been steadily pursued following the adoption of CALSIM II, although deficiencies remain widespread.

- Improved Delta water quality representation. Although problems appear to remain, the model developers have made substantial gains in representing Delta water quality operating criteria and performance.

- Better groundwater representation. Efforts to better include groundwater and non-CVP-SWP project operations are good efforts in the right direction, and merit continuation and expansion.

- Benchmark Studies. The development of documented benchmark studies seems to have resulted in significant model improvements and aided in the development of comparative model applications. Such exercises should be continued and improved.

- Long-term vision. The vision of a more transparent and publicly available model that can be employed by those outside the major agencies is excellent. This is a major change in direction, and achieving this vision will require adjustments over time. Often, these adjustments will be externally driven. Externally-driven improvements are a price of success and evidence of success for modeling policy that is open and public.

Few, if any, modeling organizations in the country have consistently done as good a job on model development and application for such a large, complex, and controversial system as the modeling group which developed CALSIM II. They are to be commended for their work to take California water modeling beyond past "closed shop" practices in favor of the development and dissemination of modeling capabilities that are more relevant to California's current water management problems. Most areas and suggestions for improvement noted below are meant to aid the model developers in moving further and faster in the direction they are already heading.

2.2 Some Prominent Weaknesses

The strengths and weaknesses of CALSIM II are not only technical (software, data, and methods), but also are institutional regarding how this model has been developed and employed. The administrative setting and objectives of model development and application are important, and difficult to manage. Alas, the management/policy problems of a system change frequently, while data and modeling capability change more slowly, and effective administrative structures change very slowly, if at all.

- Inadequate data development and management are principal shortcomings of CALSIM II. There has not been a sufficiently systematic, transparent, and accessible approach to the development and use of hydrologic, water demand, capacity, and operational data for CALSIM II. This problem extends beyond inadequate documentation and has led to controversy, confusion, and inefficiency in application of CALSIM II.
    a. Inadequate data management steepens the unavoidably difficult learning curve inherent for a complex system. Data have mostly been considered a "back room" activity of a few experienced experts. Retirement, promotion, or departure of these experts has left many gaps in knowledge and created difficulties for re-developing data for newer policy and planning problems.
    b. The administration of data development is fragmented, disintegrated, and lacks a coherent technical or administrative framework. Data required by CALSIM II are developed by several administrative units, without systematic technical vision or quality control for modeling purposes. Within DWR, different groups develop hydrologic and water demand data under different Deputy Directors, without effective coordination. This division must be overcome for a coherent data and analytical framework to be developed and implemented.
    c. In many cases it appears that water use and other hydrologic data inputs to CALSIM II are based on data collection and analyses that took place during the 1960s when DWRSIM and PROSIM were being constructed. It is important to ensure that data used for CALSIM II are up-to-date and consistent with the best current information

- The expertise and insights of many in local agencies, system operators, and consulting firms have not been prominent in the development of CALSIM II. For such a system with many hundreds of local experts, this is somewhat unavoidable, especially early in model development. Periodic re-examinations of how each area in CALSIM II is represented, in consultation with local agency and consulting experts, might overcome these technical shortcomings, and create and maintain a broader technical, user, and credibility base for CALSIM II. Active involvement of local agencies in CALSIM II development and applications would be much easier with better data management, and would be rewarded with a broader base of CALSIM II expertise and enhanced model credibility.

- Compared to the current CALSIM II, any central operations planning model for California water management should be:
    a. Expanded in geographic scope to include major non-CVP-SWP areas, especially the Tulare Basin, the Colorado River, and southern California. Operations and demands in these regions seem increasingly important for CVP and SWP operations, and are important for the integrated operations of California's major local and regional water management agencies.
    b. Expanded in management scope to include local management options such as water conservation, reuse, water transfers, groundwater and conjunctive use management, etc. These additional water management options are important for local, regional, and statewide water policy, planning, and management efforts and can have significant effects on CVP and SWP water demands.
    c. Made regionally modular, so smaller regional models can be run independently and tested locally, with boundary conditions consistent with the larger model.
    d. Made modular in terms of hydrologic, water management, and water demand processes, allowing better development, comparison, and updating of hydrologic and water demand process models. Agricultural, urban, environmental, and other water demands should be represented more directly, and explicitly. Groundwater should be represented and operated more explicitly. Land use based local hydrology and water demand approaches might be implemented in such standardized modules.
    e. Subject to a systematic model and data testing regime and continuous quality improvement program. As the problems of California water change, different and greater demands will be placed on analytical capability, requiring an essentially continuous testing, re-testing, and improvement of data and models. This might parallel a continuous review of local representations and data involving local agency and consulting experts.
    f. Financed on a broader base, by more than the CVP and SWP projects. Increasing use of CALSIM II is being made by local, regional, State, and Federal agencies interested in developing bilateral or multi-lateral water transfers or projects, which incidentally involve the CVP and SWP. To develop inter-regional modeling capability needed to integrate these activities at local, regional, and inter-regional scales, more sustained funding and involvement from local and regional agencies is needed. In effect, local and regional agencies have been "free riders" on CALSIM

II's analytical capabilities, and it is not necessarily a good bargain for them. Everyone should benefit from broader technical and financial participation.

g. Capable of analyzing a wide range of scenarios. More capability is needed to examine various long-term scenarios with respect to hydrologic, water demand, and operational uncertainties in the future. There also needs to be a better capacity to accommodate other approaches to representing hydrologic uncertainty and variability besides simply simulating 70-plus years of record.

- Input data and its development. Important aspects of CALSIM II rest upon the representations of other models of Delta hydrodynamics and water quality, water demands, and groundwater. The credibility of CALSIM II also rests on testing these models that send important data/representations to CALSIM II, and documenting them adequately. These models include:
  a. CU Model and SIMETAW: The consumptive use model and the newer SIMETAW model, used to develop hydrologic inputs and estimate return flows, also require testing and more explicit documentation. The underlying data for these models also need more systematic, standardized, and transparent treatment.
  b. DSM2: Representation of the Sacramento-San Joaquin Delta will always be important and prone to controversy, given the prominent importance of Delta flows and water quality for the operation and planning of California's water system. The difficulties of representing the Delta in operations and planning models are compounded by the tidal nature of the Delta, which usually implies a need for shorter time-steps. Representation of Delta water quality constraints currently falls heavily on an ANN method within CALSIM II. This ANN is calibrated (trained) based on a hydrodynamics model, DSM2. Thus, controversies regarding Delta representation in CALSIM II are likely to lead to questions of the adequacy of DSM2. The transparency and testing procedures valuable for establishing the credibility and limitations of a Central Valley operations model would also seem to apply to DSM2, or any other Delta hydrodynamics-water quality model. Tests of methods used to represent small-time step phenomena with larger time-steps (e.g., "partial month standards") should be tested in a forum that would give the approach credibility and where its limits could be developed, discussed, and documented.
  c. CVPM/CALAG/LCPSIM/IWR-MAIN: Representations of water demands in CALSIM II rely heavily on other models, particularly CVPM and eventually CALAG for agricultural water demands and LCPSIM and eventually IWR-MAIN for urban water demands. Thus, these models also will attract attention, and will probably require the same types of testing, transparency, and documentation suggested for DSM2 and CALSIM II. Many water contractors of the CVP and SWP also have internal water sources (groundwater, water conservation, and water reuse) and side contracts with other agencies to supply water that can increase or decrease (at different times) their water demands from the CVP and SWP contracts and from the demands estimated from CALAG and IWR-MAIN types of models.
  d. IGSM /CVGSM: Water users in California rely on groundwater as a water source and as the major source of over-year drought storage. Groundwater is also being increasingly used and looked-towards as a source of storage as part of conjunctive use schemes, and water transfer and market schemes. Thus, representation of

groundwater in the system is important, and probably should be expanded considerably. The representation of groundwater quantities, storage, and recharge and pumping capability will also attract attention from interested and critical parties. Thus, the IGSM/CVGSM modeling efforts of DWR and USBR should include the same types of transparency, documentation, and testing suggested for CALSIM II.

e. Agricultural demands: _Agricultural demands in the model are estimated by an external modeling system (CU model). Staff noted that the estimation methods being used are include out of date information on agricultural cropping patterns and irrigation technology, both of which result in inaccurate estimates of agricultural water demands. This estimation process needs to be revised and updated to include current information on an ongoing basis. The methodology needs to be improved to include economic factors in the estimation of cropping decisions and water demands. In many case, the preferred spatial scale for the economic modeling of agricultural water demand is going to be the individual irrigation district rather than very broad areas containing multiple quite heterogeneous districts.

- CALSIM II is currently awkward to apply for broader State and CVP-SWP policy questions. Practically, the time needed to complete analyses is too long and CALSIM II does not explicitly represent many of the management options which policy makers are interested in investigating, evaluating, and orchestrating.

- More CALSIM II modelers are needed. Many water managers and policy makers across California look to CALSIM II for many purposes, and there is near-universal consensus that the application of CALSIM II is currently limited by a dearth of knowledgeable modelers. Current training by DWR and USBR on CALSIM software is useful, but clearly insufficient. To be a functioning and credible CALSIM II modeler one must understand both CALSIM software and the operational complexities of the system (which probably no one can know in its entirety). Improved model and data documentation is also essential here.

- Stakeholders and policy makers are poorly guided in how to interpret CALSIM II results. Not only must CALSIM II become more responsive to current planning and policy concerns and management options, but current policy makers must receive some education in the benefits and limits of such modeling for their purposes. This is a very difficult problem that will often involve the role assigned to modeling and model results within larger politically-driven policy making processes.

- Non-interpretation of model results is not helpful. Several recent DWR reports based on CALSIM II results have been considerable improvements over past practices in terms of presenting model results, discussion of the model, and examination of model performance in a historical context. However, often the studies have not contained the kind of written discussion and interpretation of results that would demonstrate that the authors have thought about the results and drawn conclusions in a realistic and self-critical manner. This detracts from the perceived credibility of the work and makes the study less informative for readers (most of who surely do not have the modeling background of the authors).

- Some needs exist to improve CALSIM software. These are well-known to the model developers and include:
    a. Elimination of the need for the FORTRAN compiler,
    b. A public-domain mixed integer-linear programming (MIP) solver,
    c. A graphical user interface, including ties to databases and GIS display if possible,
    d. Post-processing tools for users to help new users and broader application and scrutiny of CALSIM II results,
    d. Version control software and system (also a problem for model administration),
    e. Better data and database management software and protocols (this has great data management and administration implications),
    f. An ability to more systematically set objective function weights,
    g. More automated input and output data checking is needed to improve productivity in model application and quality control of modeling output. This would also facilitate use of CALSIM II by a broader range of modelers,
    h. Ability to access and employ sensitivity analysis information coming from the MIP solver to identify possible multiple optima and identify binding constraints and slacks,
    i. A debug version of the code where water can be added or subtracted at any location and time (at a great penalty) to quickly identify locations and times of model infeasibilities. (Prof. J. Lund has had great success with this approach to correcting infeasibilities in the CALVIN model of California for a network flow algorithm.),
    j. Time-step issues should be explored and evaluated comparatively. There are major drawbacks to shortening time-steps system-wide (run-time, data development, interpretability of results, etc.), but short time-step components within the model or other approaches might adequately represent short-period aspects of the system for many purposes.

There will be some who argue that CALSIM II is and should remain a model of only the CVP and SWP system. While this would be simpler administratively and financially, it seems technically and politically untenable. California's water system is being asked to operate in an increasingly integrated manner across local and regional scales, with multiple local water demands, supplies, and aquifers being coordinated with the operations of major aqueduct and storage infrastructure. Any model of the CVP and SWP systems must be responsive to this operational integration, either implicitly through better parameterization of local supplies and demands, or explicitly by widening the geographic and functional scope of the model.

3. Limitations, Uncertainties, and Impediments

3.1 Removal of Unnecessary Ties to DWRSIM and PROSIM

Much of the spatial detail employed in CALSIM II is a carryover from the previous DWRSIM model. This is particularly evident in the coarse delineation of watersheds and sub-areas, which may no longer be relevant for future applications of CALSIM II. It is recommended that all unnecessary ties to the previous DWRSIM and PROSIM models be removed in further development of CALSIM II.

3.2 Relative vs. Absolute Predictions

As noted in the Executive Summary, we are skeptical of the usefulness of the distinction between comparative and absolute predictions. To declare that CALSIM II is intended for comparative predictions and should not be used for absolute predictions is not a helpful or desirable strategy. Rather than embracing this limited view of what CALSIM II can be expected to accomplish, we recommend that model developers recognize the requirement for CALSIM II to provide absolute values. To satisfy this purpose, additional calibration of the model will be required to ensure that it provides a reasonably reliable depiction of how the California water system operates. In addition, data on model accuracy and the outcome of the calibration runs should be made available so that users can gauge the likely errors involved in using the model for their own particular purposes. Some methods for doing this and performing sensitivity and uncertainty analyses are contained in Appendix H.

Model uses should realize that model calibration and validation exercises can illustrate only how well the model can reproduce historical decisions and system behavior. Our ability to predict future policy decisions and the emergency responses to water shortages is clearly limited, thus decreasing the absolute precision of any model's predicted values of various system performance measures. Thus it is useful to distinguish between the ability of the model to reproduce correctly the physical operations of the water systems in California (which should be good), its ability to reproduce and anticipate decisions by the agricultural sector that determine the quantities of water the consume, and its ability to mimic historical and current water operation decisions by the CVP, SWP and other water management agencies.

In general, it appears that the developers of CALSIM II do not have a clear idea of how to define the scope of CALSIM II use and many of the applications are evolving in a reactionary manner. Model developers should identify clearly the desired uses for CALSIM II and then determine acceptable approaches for satisfying those desires. Developers should seek to improve data accuracy and overcome unrealistic assumptions to improve confidence in model results.

3.3 Hydropower

CALSIM II is currently greatly lacking in hydropower computations, which is an important of the federal CVP system. This should include risk-based power capacity evaluation, and possible incorporate the ISM (indexed sequential hydrologic modeling) method that the Bureau has used for many years in hydropower capacity analysis. Also, hydropower should not simply be an after-the-fact calculation, but explicitly included in the system objectives.

3.4 Daily operations

A great challenge awaits the developers as they attempt to adapt CALSIM II to daily operations. These challenges are primarily related to the impacts of routing on distribution of flows and scheduling of reservoir releases. Under the current period-by-period optimization structure over daily time increments, without appropriate consideration of routing there is the

danger that the model will allow diversion of upstream flows to lower priority users, resulting in injury to higher priority downstream users in the following days where travel times exceed 1 day. The proper inclusion of routing in the daily operations requires some kind of look-ahead capability in CALSIM II, which is currently lacking. In addition, scheduling of reservoir releases on a daily basis creates difficult timing issues in order to minimize unnecessary downstream spills or shortages caused by routing and attenuation of upstream reservoir releases. Another complexity in moving into daily operations is that reservoir discharges now become head-dependent, whereas this can usually be ignored on a monthly time scale. This means that the maximum reservoir release in any day will be dependent on the head, and should be based on the average head over the day, which introduces the potential for time consuming iterative processes to deal with nonlinear relationships in discharge-head curves for any reservoir.

3.5 Groundwater model

Groundwater has only limited representation in CALSIM II. This resource is modeled as a series of inter-connected lumped-parameter basins. Groundwater pumping, recharge from irrigation, stream-aquifer interaction and inter-basin flow are calculated dynamically by the model.

The purpose of the multi-cell groundwater model is to better represent groundwater levels in the vicinity of the streams to better estimate stream gains and losses to aquifers.

In the Sacramento Valley floor, groundwater is explicitly modeled in CALSIM II using a multiple-cell approach based on DSA boundaries. For the Sacramento Valley, there are a total of 14 groundwater cells.

Currently no multi-cell model has been developed for the San Joaquin Valley. Instead stream-aquifer interaction is estimated from historical stream gage data. These flows are fixed and are not dynamically varied according to stream flows or groundwater elevation.

The approach to modeling groundwater in CALSIM II, a lumped-parameter “tank” model seems to be a reasonable approach. However, few details of this implementation were provided to the review panel, that it is not possible to assess its accuracy or reliability. Details of the calibration and verification activities performed to date should be carried out and reported for the groundwater tank model. The effect of using large size tanks should be assessed and the level of uncertainty in computed results reported. In addition, the effect of these uncertainties on CALSIM II calculations should also be assessed. The San Joaquin valley aquifers are not well represented in the tank model, but it is in the CVGSWM. The San Joaquin valley groundwater should also be modeled in CALSIM II.

Groundwater availability from aquifers is poorly represented in the model. This results from the fact that aquifers in the northern part of the state (Sacramento Valley) have not been investigated regarding storage and recharge characteristics. Thus, in the model, upper bounds on potential pumping from aquifers are undefined. This does not represent reality, since, if CALSIM II is used for statewide planning, it would allow pumping of vast quantities of water for export to southern parts of the state, something which agency staff claim is unrealistic.

Realistic upper bounds to pumping from any of the aquifers represented in the model need to be developed and implemented.

In addition, historical groundwater pumping is used to estimate local groundwater sources in the model. However, the information on the historical pumping is very limited, causing these pumping rates to be very uncertain. Better pumping information is needed and an analysis of the effect of this uncertainty on model results needs to be conducted.

In general, the level of representation of groundwater in CALSIM II is not reasonable from the point of view of the reviewers. This is due to several factors, perhaps the most important being the lack of information presented to the reviewers for their assessment. Another factor is the lack of data collected and analyzed by the State of California to properly account for groundwater resources in the Central Valley. These data are critical to an understanding of the availability of water in the state and the operation of the major water systems that supply water to agriculture and small municipalities in the Central Valley. Assumptions of unlimited groundwater resources in the Sacramento Valley are unfounded and unbelievable. Efforts should be taken to make reasonable estimates of these resources.

There are other approaches that provide reasonably accurate estimates of river-aquifer interactions and groundwater basin response, while not sacrificing computer time. The response function approach is a good example, whereby the CVGSM model is used to develop kernel functions describing this response. A similar approach is described in Fredericks, et al. (1998). These kernels may require readjustment as head conditions change in the basin, but they provide a more accurate prediction tool and are easily incorporated in the MIP model since they apply a linear superposition assumption and retain the linearity of the constraints in the model. A dynamically linked CALSIM-CVGSM configuration is not necessary for reasonably accurate solutions. If computer run time for CALSIM II is considered excessive now, it could only considerably worsen if this type of linkage is incorporated.

Soil moisture is not dealt with in a realistic manner and needs to be improved in applications where the model output might be sensitive to these assumptions.

3.6 Dynamic Variation of Priority Weights

A severe restriction in CALSIM II is the inability to dynamically vary the weights used to prioritize flow allocation in the system. It should not only be possible to dynamically vary these weights, but this variation should be conditional on the current system state, however that state (or states) is defined. In addition to dynamic variation of weights, more explanation is needed of the reservoir operating rules and how these rules are incorporated into CALSIM II. The description of operating rules used in the system is not very clear. For example, what kinds of hedging or shortage rules are used to mitigate the effects of drought?

3.7 Expanding Scope of CALSIM II

CALSIM II is a considerable advance on earlier models in that it fully incorporates both the State Water Project run by the Department of Water Resources and the Central Valley Project

operated by the Bureau of Reclamation. However to be able to examine the full range of Californian water issues, it would be desirable that all components of the linked system should be incorporated in the model including the Friant system, the larger Tulare Basin, and southern California and its links to the Colorado River. Also because of the very important linkage between surface water and groundwater use, improvements should be made in this area particularly with regard to how that linkage affects demand for surface water and how access to groundwater reduces the economic impact of surface water restrictions.

When expanding the geographical scope of the model to include non CVP-SWP areas, as well as Southern California, a hierarchical, decomposition approach would allow development of separate models for these areas that can then be linked together through iterative processes. Otherwise, the CALSIM II model can become extremely unwieldy. Again, integration can still be achieved through appropriate iterative interaction between the regional models. In the same vein, it is also unnecessary to explicitly integrate water quality and detailed water demand/consumptive use models into the model structure. Iterative schemes involving successive estimation of water quality and other parameters can produce comparable accuracy at reduced computer run times, while reducing the complexity of the model.

The replacement of DSM2 with a neural network is consistent with reinforcement or machine learning methods which are increasingly being used to replace complex, computationally time consuming models employed in decision support systems. The complex models are only used to provide the data sets used for training the neural network. Current research at Colorado State University and elsewhere is using neural networks for groundwater surface water interaction and return flow computation to replace computationally expensive groundwater models.

3.8 Key Model Outputs

In the past, the primary purpose behind the development of CALSIM II and its predecessors has been the examination of the reliability of water supplied to the State Water and the Central Valley Projects. However it is clear that there is now a demand for a model that will provide a wider range of outputs including:

- Water supply reliability for all water users
- Demand for water by existing users
- Outflows to Delta
- Use of groundwater and the rate of depletion of aquifers
- Water quality in the Delta and in the San Joaquin River
- Indicators of ecological health in particular with regard to key fish species
- The value of hydroelectric generation.

Although the modules in the CALSIM II package currently address many of these areas, the recognition that all these outputs are important may necessitate some further model development and a greater degree of testing and calibration of these parameters.

3.9 Modeling Allocation, Accounting and Operating Rules

CALSIM II uses a system of weights and constraints to define the water allocation process and the operating rules for storage reservoirs. Unfortunately these do not accurately reflect how operators of the state and federal water projects behave in managing their complex systems. Ideally, CALSIM should both reflect how the operators behave and be accepted by them as a useful tool when considering their management alternatives. The failure to achieve this limits the usefulness of CALSIM to investigate the specific operating or accounting rules that are of interest to those operators. For example, CALSIM II was not used to test changes to the accounting and allocation rules that have recently been proposed by the Department of Water Resources and the US Bureau of Reclamation because the rules that were changed do not exist in CALSIM II.

4. Options for Improving CALSIM

4.1 Optimization Model and Run Times

Many of the complaints regarding using of CALSIM II relate to long run times, which is not conducive to sensitivity or uncertainty analyses. Since CALSIM II employs a mixed integer linear programming (MIP) solver, the usual sensitivity information available in linear programming solvers, such as dual variables and right-hand-side ranging, are not available. The problem is that small changes in right-hand-side constants or objective coefficients (i.e., weights on water allocation priorities) can produce large abrupt changes in model solutions. In this case, dual variables do not provide useful information for MIP problems. Sensitivity analysis can only be conducted through trial and error processes involving incremental adjustment of important weights, coefficients, and uncertain data inputs with subsequent repetitive execution of the model. In light of this, it is crucial that the MIP solver employed in CALSIM II is upgraded. Significant advances have been made in MIP solvers, as described by Bixby, et al. (2000), which are not reflected in the current XA solver utilized in CALSIM II. There have been many recent improvements to the branch and bound method which should be incorporated, and the LP solver itself can be improved with better sparse matrix analysis. As planned by the CALSIM II developers, removal of the need for use of the FORTRAN 90 compiler will also improve run times when changes in optimization model structure are required.

4.2 Confidence in the model

The usefulness of a computer model in water resource management is only as good as the confidence that the stakeholders have in the accuracy and reliability of the model and the trust that they have in the modelers. There are several factors that affect that confidence and a number of ways that confidence can be improved.

- **Documentation**

Producing documentation of models requires considerable resources to do properly and ongoing resources to maintain especially when model development is continuing. Typically documentation of any water resource model is poorly done. However, where there are external model users, as is the case with CALSIM II, it is important. The survey conducted by Ferreira et al (2003) indicated that many users of the model thought that documentation of CALSIM II was poor.

- **Seminars**

In the Murray-Darling Basin, seminars with key users and interest groups in which the operation of the model is described and discussed have proved to be useful in increasing confidence in models. The practicality of this approach will depend on the number and location of the prospective participants and the resources available to support the process.

- **Data**

A model can only be as good as the data that is used to develop and calibrate it. The agreement over an acceptable set of hydrologic data that occurred during the development of CALSIM II is a considerable advance. However, there appears to be a need to improve the collection and use of data on water diversions and return flows. Because of the close links between the surface water use and groundwater use there also is a need to have better information on the use of groundwater.

The models used to calculate the Local Water Supplies in the Depletion Study Areas depend on estimates of surface water use, crop evapotranspiration rates and water use efficiencies developed using data from the 1970's. Confidence would be improved if more recent data were available to check these estimates.

- **Calibration**

A very good way to improve confidence in a model is to calibrate it against historical data to ensure that the model output is able to reproduce the observed data. Calibration is the process of using the model to reproduce the historical behavior of the system and then fine-tuning the model so that the match between modeled and observed values improves. The calibration of the model assists in detecting errors in the model and the input data. It also enables a comparison to be made between the way that the operators actually manage the system and the way that the model assumes that the system is managed.

A further consequence of the calibration process is that the statistics of the match between modeled and observed values can be used as a reasonable estimate of the absolute accuracy of the model output.

It is legitimate in a calibration/validation run to incorporate changes to infrastructure, institutional or operational rules as they occurred especially if these changes are specified as

input parameters to the model. This was done to a limited extent in the CALSIM II validation run with three regulatory periods modeled related to decisions made by the State Water Resources Control Board. It is also legitimate to incorporate growth in demand especially if that growth is described in a manner that is consistent with the way that demand is specified in the production run. Demand north of the Delta was specified in the validation run by inputting the historical crop areas.

A Calibration/Validation report should be very useful in demonstrating the accuracy of the model. However there are a number of elements in the CALSIM II validation run and the validation report which reduce that confidence including:

- State Water Project (SWP) demands south of the Delta were set at historical deliveries in years with no restriction and at the contractor's request level in restricted years. Neither of these pieces of information is available to a production run which calculates demand based on crop areas. Therefore the validation run does not provide reliable information on how well the model can represent these demands.
- The validation run omitted Article 21 deliveries. Although this omission will not affect the delivery of 'Table A' volumes south of the Delta, it will affect flow in the Delta and Delta water quality. Also, in the example model run presented in the paper by Draper A.J. et al (2003) which was supplied as part of the review, changes to Article 21 deliveries constituted the largest impact resulting from a change to the allowable pumping capacity at Banks between March and December. This suggests that the modeling of these demands is important.
- The DWR (2003) report produces estimates of SWP and Central Valley Project (CVP) deliveries south of the Delta but then adjusts them for changes in storage before presenting comparisons of those results with observed deliveries. This process merely checks that the model is preserving a water balance and does not present a legitimate validation of model deliveries.
- The report provides statistics on long term average deliveries and flows but no statistics on the fit for individual years. Additional analysis of the output would assist stakeholders to assess whether the estimate of water supply reliability and in particular the modeled volumes of water available in the most restricted years are accurate.
- In some instances, such as the examination of water quality in the Delta, the ability to accurately model monthly flows and deliveries will be important. The validation report contains no information that would enable the ability to model monthly flows to be assessed.
- A key model output is the water quality in the Delta. It would assist the validation of the model if a comparison of parameters such as the location of the X2 boundary was provided.

The users of CALSIM should recognize that models are a summary of what one believes to be true and important about a system. Validation is then an exercise to test how good that summary and understanding really is.

Appendix I contains brief descriptions of calibration modeling in the Murray-Darling Basin in Australia and in the State of Texas.

4.3 Assessment of the reliability of "delivered" water

An important recent application of CALSIM II which has drawn widespread attention is the "State Water Project Delivery Reliability Report. While this is an important step forward in the use of CALSIM for policy purposes, it highlights a number of issues, both conceptual and empirical, that need to be resolved in order to provide a more adequate assessment of the reliability of water supply in California.

First, it illustrates the need for sound calibration of CALSIM. The question being asked is not a comparative one – What are the consequences of changing some aspect of the system from X to Y? – but rather an absolute one – How does the system function at present? How often can users expect a shortage in deliveries of Z%?

Second, it highlights the fact any water system model such as CALSIM requires a blend of hydrology and behavioral analysis. To conduct a water balance, the model needs to know what deliveries are required by the customers of the given project, and what are the diversions by other user groups who extract water from the same surface or groundwater sources. These are fundamentally questions of economic and institutional behavior, not matters of hydrology. Therefore they cannot be dealt with by hydrologists alone. Like its predecessors, CALSIM tends to treat these as black boxes. The diversions by water users outside the CVP-SWP are taken as exogenously given, based on an assumed "level of development" and simplistic assumptions about the patterns of water use associated with that level of development. The deliveries required by the water users who are served by CVP-SWP are generally taken as given. For reasons explained below, both of these treatments are simplistic and unsatisfactory.

In CALSIM modeling exercises the level of development plays two different roles depending upon the context. In a simulation context, the level of development is used to represent hydrologic variability and uncertainty; in a calibration/validation context, it is used to reflect the actual historical demand for water withdrawals. These are very different purposes and it is important to keep them distinct. In most applications of CALSIM prior to the recent reliability study, the main focus was simulation and the representation of hydrologic variability. The chief purpose served by using 73 years of adjusted streamflow records was to represent the variability and uncertainty in the streamflow that one can expect to observe in any single year. Therefore, the calendar date of the record has no substantive significance, the (adjusted) streamflows for 1952 or 1982 are not being used to represented what happened historically in 1952 or 1982, but rather as an indication of the variation in streamflow that could be expected to occur next year, or any other year. In this context of simulating hydrologic variability, it makes good sense to apply the *same* level of development (i.e. the same pattern of water use) to every year in the sequence, rather than a series of different levels of development that vary with calendar time, because the streamflows represent alternative hydrologies that can occur in any given year.[1] The situation is different when one is conducting a calibration or validation

[1] This could be modified to allow for the fact that local weather conditions have a significant impact on irrigation (and urban) demands – e.g., farmers plant fewer acres of crops in a drought year. In that case, one could have different levels of water demand and extraction in different year *types;* but, these would all be keyed to the same overall level of economic development (e.g. the California economy in the 1990s). CALSIM II does not presently

exercise. In that case, one wants to represent the historical demands in 1952 or 1982 in order to compare what the model predicts with what actually happened. Therefore, in a calibration or validation exercise one wants the level of development to change each year in order to reflect the demand that occurred historically.

Both simulation and calibration/validation raise some other important technical issues. In the context of simulation, there are several different ways to generate a hydrologic sequence that is calibrated to a fixed level of development. One can use all 73 years for which data are available. One could use a subset of those years chosen either according to some deterministic rule or randomly. The subset could be oriented, for example, towards the extremes of the 73 sequence of annual records. However, the drawback of any approach based on sampling from the observed historical record is that it *understates* the full variability in streamflow that could be experienced in the future. The 73 years of record are drawings from a probability distribution the extremes of which extend beyond the minimum and maximum flows observed in the historical record. Relying on this record, therefore, understates the true minimum and maximum flows that might be encountered. In a reliability assessment exercise, one might want to take some steps to minimize the potential understatement of streamflow uncertainty. This could be accomplished by fitting a (parametric) probability model to the historical streamflow record and then sampling from the tails of the fitted distribution (Stedinger, 1981). The use of statistical models of streamflow variability could be considered in future applications of CALSIM to assess delivery reliability.

The assessment of delivery reliability requires that particular attention be given to the definition and measurement of the water users' demands. In this context, the user's demands play two roles: they affect the definition of "deliveries" and they influence the assessment of "reliability". With respect to deliveries, CALSIM II considers water to be delivered whenever it has the water irrespective of the ability of a contractor to use the water or to store it; The reality is that, if the contractor does not have a demand for the full quantity of water and is not able to store the excess, that amount will not be delivered. Therefore, the calculation of deliveries would be flawed. Furthermore, reliability cannot be assessed without reference to demand. Stating that a water supply system can deliver 100 acre feet in a wet year but only 70 acre feet in a dry year is useful only if one knows what the demands will be in wet and dry years. The implications are quite different if the user needs 105 acre feet per year than if he or she needs 65 acre feet per year. Thus, the users' demands should serve as the norm against which reliability is assessed. Instead, the recent reliability report uses the so-called 'Table A' water amounts as the norm for assessing deliveries to SWP contractors. This does not seem to be a satisfactory approach because there is no presumption that the Table A amounts, negotiated in 1960, measure the actual demands of SWP contractors in any particular year. The actual demands of the individual contractors will be influenced by how much storage they have, what access they have to other surface water or groundwater, and the demands of the farmers they serve to plant crops and apply water. Without accounting for these factors, it is difficult to generate a meaningful assessment of supply reliability.

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consider the impact of annual weather conditions on demands. In order to model water demands accurately in a year, the climate conditions would be linked to the flow conditions to provide an input set for a particular year.

The assessment of reliability should ideally go beyond a comparison with quantities demanded to incorporate the notion of a loss function. If a user has a demand for 100 acre feet and can only receive 90 acre feet in one scenario and 80 acre feet in another, while the shortfall is twice as large in the second scenario the actual *consequences* of the shortfall to the user, in terms of lost profit or higher cost, might be more than twice as large. To assess the economic value of reliability, or the economic cost of a lack of reliability, one needs to be able translate shortages into monetary losses. To accomplish this, the warning time provided and the delivery shortfalls from CALSIM would need to be processed through an economic model of the value of water to different SWP contractors.

Because water users face difference demands and have access to different sources of supply, when assessing reliability it is unhelpful to aggregate all contractors and simply present the results in terms of total annual project deliveries, as was done in the report. Precisely because of the potential non-linearity of the loss function, a given aggregate shortfall can have different consequences when distributed differently among the individual contractors. A similar observation applies to the temporal distribution of delivery shortfalls across the year. It is unhelpful to aggregate supply system deliveries into an annual total, as done in the report. For a user to be able to obtain 100% of his or her demands in the period from March to May but only 60% in the next three-month period from June to August has different consequences than being able to obtain 80% in each of the six months. Furthermore, for both agricultural users and many urban users, major decisions affecting water use have to be made in the spring. They are based on the expectation around March about the amount of water that will subsequently be available for delivery during the summer months. What matters to these users when assessing supply reliability is the amount of water they can expect around March to be delivered over the summer, rather than the ultimate total delivery.

For both reliability assessment and also model calibration/validation, it is important to avoid excessive aggregation when describing shortfalls between demand and supply, or deviations between model predictions and actual outcomes. In regression analysis, it is the convention to measure the goodness of fit of a regression equation not by the average deviation but rather by the sum of the squared deviations. In ordinary least squares regression, by definition the average deviation is always zero (that is to say, the average of the predicted values of the dependent variable always equals the average of the actual values) regardless of how well or badly the regression equation fits the data. The average deviation thus provides *no* information regarding the goodness of fit; by contrast, the sum of squared deviations or the sum of the absolute values of the deviations are sensitive measures of goodness of fit. Although the calibration of CALSIM is not an exercise in least squares regression, the same general principle applies. To judge whether the model is doing a good job, the goodness of fit should be measured by reference to the disaggregate results and not simply by the overall average deviation.

Additional comments on the 2003 CALSIM II Validation Report are contained in Appendix F.

5. Managing CALSIM Development and Applications

The costs of not continuously and substantially improving our analytical capabilities are political (in terms of continued controversy and diminished agency credibility), economic (as inferior system performance for agricultural and urban water users), environmental (in terms of inferior environmental system performance), and financial (lawyers and policy consultants are more expensive than engineers and scientists).

CALSIM II is a substantial improvement over its predecessor models, DWRSIM and PROSIM, with a great deal more flexibility, transparency, and potential than these earlier models. The modeling team for CALSIM has identified an exciting and relevant vision of how modeling should be done for this complex and difficult system in the coming years. However, implementation of this vision in a coherent technical manner that leads to both technical and stakeholder credibility will be a difficult process, requiring financial and institutional support if this kind of capability is to be developed and sustained.

To accomplish these objectives CALSIM II developers need to be in an institutional position where they can see the model more as "outsiders" view it. This would allow them to be more responsive in supporting the credibility of their work and the relevancy of their tools and results to the broad range of current water management problems. As such CALSIM II should no longer be solely responsible to CVP-SWP managers, but should be responsible to a broader range of technical managers from additional interests, reflecting its current and prospective uses.

It would be imprudent to manage a state's finances, a business, or a retirement plan without quantification – quantification in such matters is necessarily imperfect, but necessary nonetheless. While shortcomings have been identified in CALSIM II, it would be similarly irresponsible to manage California's water budget without carefully-interpreted quantification. Progressive and continuous improvement in our quantitative understanding of California's water system provides a common basis for improving its performance for all interests.

One possible means of maintaining control of the quality of particular versions of CALSIM II and accompanying models used for SWP-CVP planning and management decisions is to create an interagency modeling consortium (IMC) consisting of DWR, USBR, and persons from other stakeholder organizations if they are interested and want to participate. This consortium would be responsible for maintaining a toolbox of 'acceptable' models for 'official' use by the agencies and contractors.

IMC responsibilities and authority could include:

- Prioritize, coordinate, and provide consistency, technical guidance and oversight for all modeling applications,
- Approve model selection and insure that each requested application is carried out using the most appropriate model(s) and input data,
- Provide or otherwise insure documentation of the modeling process itself as well as the modeling results,

- Insure that the results are expressed and made available in a way such that others can understand and benefit from that modeling application, as applicable.
- Implement peer reviews of models and their applications as deemed appropriate.

To help meet their responsibilities the IMC will need to establish, publish and implement some procedures for insuring the quality of the entire model development and application process. They will need to identify among all the models that might be used, which are the most appropriate to address each of these separate groups of model applications. They must identify various models, i.e., establish a model toolbox, from which clients can choose the one that best meets their needs (or perhaps argue that another model should be added to the toolbox). The IMC will also need to maintain model documentation and provide for peer reviews of any model, its documentation, and/or its use in a project.

Further suggestions and discussion on the creation and operation of a possible IMC for model development and application, as well as for managing peer reviews of both the models and their applications, are contained in Appendix E.

6. Recommendations for Future Use, Development, and Application of CALSIM II

The most concise recommendation we might make would be to fix the shortcomings beginning with what are considered the most serious, and proceeding to those that are less serious, taking into account the time and other resources needed to address each weakness. However, we believe it is more useful to suggest ideas on how to systematically address both present shortcomings and those likely to emerge as stakeholders' quantitative understanding of California's water system and its problems continue to evolve.

6.1 Model development and support consortium

As discussed in the previous section and in Appendix E, it might be useful to explore creation of a broader interagency modeling consortium for developing operations planning models for California. The joint DWR-USBR development strategy used for CALSIM II has shown some notable successes, and should be expanded to include additional parties and sources of expertise. Such a consortium might include staffs from several agencies (DWR and USBR, as well as potential members from MWD, KCWA, CCWD, and other agencies), NGOs, some consultants, and universities. Such a model development forum would:

a. Bring a wider range of expertise to bear on model development problems.
b. Facilitate having more agencies involved in supporting model development with expertise and financial resources.
c. Better enable model developers to see the model as "outsiders" see it.
d. Potentially improve contracting for model development and testing.

e. Take model development and testing outside of the explicit agency framework; a broader consortium should be more conducive to self-critical and transparent technical practices.
f. Provide a common training ground for agency, NGO, and consulting staffs to become effective modelers, broadening the talent base for technical work in California.
g. Reduce impediments to model development and testing arising from current State budgetary and personnel hiring problems.

Many of the questions, concerns, and problems mentioned in the user community interviews could be addressed well in such a distributed model development, testing, and support framework. It would still be necessary for each stakeholder group and agency to maintain its own modeling staff, but these would be partially shared in an interagency modeling consortium.

The governance and finance of such a consortium would be difficult and would probably require a steering committee or governing board, but any resulting model(s) would have broader credibility and a broader and deeper technical base.

In the immediate term, a users' group should be formed and the formal listing of model development activities should be posted on the web, including short descriptions of each development activity and contact information.

6.2 Quality Control Program

The DWR and USBR modeling team (or a broader model development consortium) need an explicit quality control program. Such a program should include a variety of activities:

a. periodic external reviews on the broad modeling program
b. specialized external reviews of model products and applications
c. a standing (or sitting) external technical advisory body
d. software engineering and maintenance
e. a regime of model testing
f. model and data documentation
g. data development and management
h. user group activities
i. local agency and interest involvement
j. model, data, and documentation accessibility (including web site use).
k.

Such a quality control program would benefit from deep consultation with stakeholders and the broad community of water technical people, perhaps via the California Water and Environment Modeling Forum (www.cwemf.org).

6.3 A Training Program

DWR, USBR, and assorted agencies and consultants should establish a more formal common regimen to train new CALSIM II users in both CALSIM software and the complexities of actual system operation. All these groups currently rely on a relatively small pool of perhaps a

dozen knowledgeable CALSIM II users and all proclaim a need for many more capable users. A training regimen consisting of current CALSIM II training classes, supplemented by additional training in software application and system operation and apprenticeships or rotations through operations and model development shops would be useful to all concerned. The entire water community would benefit from having such expertise being widespread. Having widespread CALSIM II modeling expertise also makes explaining CALSIM II and its results easier. This might be an appropriate activity for a model development consortium.

6.4 Extend Improvements in Modeling Practice to Supporting Models

CALSIM II is at the center of a web of additional models used by DWR, USBR, and other agencies to prepare inputs for CALSIM II and post-process outputs from CALSIM II.

Delta controversies and difficulties of representation seem endemic to problems of modeling Central Valley operations. The technical basis for representations of Delta operations and water quality performance requires a similar level of transparency and testing to avoid this becoming a "weak link" in the Valley-wide operations planning model. Since so much is based on the DSM2 Delta model, documentation of fairly strenuous tests of the DSM2 model are highly desirable. This would provide a firm foundation for the use of ANN or other approaches for summarizing DSM2 behavior in an operations model. Similar documentation, testing, and development are desirable for the other models mentioned above which provide data for CALSIM II (CVGSM/IGSM, CVPM/CALAG, IWR-MAIN, LCPSIM, CU model, and SIMETAW).

6.5 Hydrologic Data and Data Development

An effort should be made to step back and perhaps re-define a more systematic and solid basis for developing hydrology for water management models of California's inter-tied water system. Currently, several efforts exist to develop surface or groundwater hydrologies for parts of the Central Valley (sponsored by DWR-USBR, USACE-Sacramento District, USEPA, USGS, CALFED, local agencies, etc.). An effort should be made to broaden the range of hydrologic expertise involved in hydrology data development for management modeling of California's inter-tied water system, and establish a consistent and high, but reasonable, standard of documentation and testing for developed data and any underlying hydrologic models. Establishing such a standard of documentation and testing would make existing hydrologic studies more accessible and useful for future studies and encourage the comparison and further development of existing representations of the system's hydrology.

6.7 Performance-Based Optimization

Performance-based optimization should be added to CALSIM's capabilities; it would not be difficult in terms of software or data, and would add much greater ability to explore and seek improvements in management within a complex system. The multi-period optimization approach being developed (CAM) is an operations-oriented first step in this direction, but could be expanded without great difficulty.

For large-scale water resource systems of great complexity and many options for system management, it is often difficult to find "optimal" operations with simulation modeling. There are simply many myriads of decision options and combinations of options, which theoretically each require a simulation model run – which would be prohibitive in terms of analysis cost and time. In such situations, performance-based optimization models, such as those seeking maximum economic performance, can offer useful insights as to where to look for improving system operations and management. Metropolitan Water District of Southern California (MWD) and San Diego County Water Authority (SDCWA) employ performance-based optimization modeling of parts of California's water system to gain strategic insights for planning and management. An economic-engineering optimization model has been developed for California and, despite significant limitations, shows several insights for California (CALVIN), suitable for identifying promising operational and management strategies worthy of more detailed analysis (Jenkins et al. 2001; Draper et al. 2003; Jenkins et al. 2004). The CALSIM II modeling approach could easily be adapted to provide greater functionality to this type of performance optimization. Having performance-based optimization capability together with a compatible simulation model for more detailed analysis and trade-off evaluation could greatly improve the capability of California's water community to explore and develop promising and creative options for improving operations, facilities, and overall system management.

6.8 Modular and Layered Versions of CALSIM II

Speedier versions of CALSIM II are needed for operations planning and integrated water planning studies. Such versions would be regional modules of CALSIM II (for regional studies) or explicitly aggregated system-wide models from the most detailed CALSIM II schematic for system-wide or statewide studies. Both approaches would simplify the model for particular purposes, yet be tied to a common detailed schematic and detailed hydrologic, operations, and water demand data sets.

Geographically modular or aggregated system-wide versions would allow additional local and regional water management options to be represented for particular operations and policy planning purposes and allow users to more quickly explore and develop operating policies. The final runs from such integrated or exploratory studies could then be evaluated using a more detailed and complete version of CALSIM II.

Modular regional models might represent regions with relatively few inter-ties, such as: Sacramento Valley, Delta and eastside streams, San Joaquin Valley, San Francisco Bay Area, Tulare Basin, and Southern California (DWR's South Coast and Colorado River hydrologic regions). (We have had good success with the CALVIN model of California with 5 modular regional models, which combine to form a system-wide model. These geographic sub-models greatly improved quality control in model development, work flow and data checking, and identification of problems in the model.)

6.9 Model Calibration and Testing

Many approaches exist for model calibration and testing (Modeling Forum 2000). Calibrating a planning model oriented to operations in an uncertain and distant future is always challenging. For a model that serves many uses (including policy-urgent uses unforeseen by developers), use-specific testing will often be impossible within a responsive time frame and budget. Such unavoidable situations call for more thorough, general, and well-documented model calibration and testing than would otherwise be needed.

For the model to have technical credibility, stakeholder credibility, and to serve the kind of training and reference function needed for the water management community, a systematic and coherent means of setting parameter values in the model and documenting these values is needed. Similarly, a systematic self-critical means of testing is needed for a model to establish and retain credibility, and have defined limitations, for a range of applications.

A potentially excellent resource for model testing is comparisons of seasonal operations planning CALSIM II model runs with recent years' seasonal operations, as done by actual operators. Similarly, system operators could scrutinize historical simulations, such as those in the recent November report, for systematic differences from operating practice. Such comparison with operator policies and philosophy could also be performed with SWP or CVP delivery reliability estimates. Such comparative analyses would both help define the likely (and unavoidable) differences between actual and modeled operations and water deliveries and identify potential opportunities to narrow such differences.

Credibility arises, in part, from demonstration that problems and limitations are systematically identified and addressed or considered in model development and in making and interpreting model runs. This can be accomplished by use of documentation, metadata, written guidance, and protocols and logs for identifying model problems and recording model improvements.

Given present and anticipated uses of CALSIM II, the model should be calibrated, tested, and documented for "absolute" or non-comparative uses. This is what many applications require today and will be increasingly desired and required in the future. Maintaining the traditional "comparative-only" use of CALSIM II is undesirable if the model is to be useful for the CVP and SWP systems, the operations of water contractors, or for statewide planning purposes.

6.10 Documentation of Model Improvements

Along with better documentation of model versions, logs of data and model improvements and "bug fixes" should be maintained. Explicit protocols and records for identifying and correcting modeling errors and problems would enhance the credibility of the modeling effort with technical people and policy makers. Such protocols also provide an internal aid to staff and staff development in modeling. I understand that this kind of record-keeping is done, but the precise form of, nature, and extent of this record-keeping is unclear. It would be useful and reassuring to stakeholders and policy makers to know that this kind of record-keeping of the software and data was being done.

6.11 Better Model Integration in Decision-Processes and Stakeholder Education

Greater aid should be given to interested parties and decision-makers who must work with the unavoidable limitations of any model. If possible, a document should be prepared for stakeholders and interested parties outlining the model, summarizing the model's primary limitations, and providing guidelines for interpreting model results. Those developing policy-making forums and processes should thoughtfully incorporate computer models in these processes in ways that do not assume model omniscience, or otherwise place too great or exclusive a reliance on model results.

Models and model results will never be perfect. If models are to be important for planning and policy-making, they be must be presented and used in ways that enlighten policy-makers more than they add confusion and controversy to already difficult situations, if possible.

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A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California

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Appendix A: CALSIM II Science Review

Dates: Nov 13-14th
Location: Bay-Delta Room, CBDA Offices
650 Capitol Mall, 5th Floor
Sacramento, CA

Day 1: The Management Context, Model and Application Details

9:00 Welcome – Kim Taylor
- Overview of the CALFED Bay Delta Program -
- Introduction of the Panel

9:15 Water issues in California – Francis Chung
- General Hydrology
- SWP/CVP
- Operational challenges
- Sacramento-San Joaquin Delta – Ron Ott (5 min.)

9:35 Panel Q&A

9:45 Planning Models – Andy Draper
- CALSIM software
- CALSIM II application overview
- Interaction with other models

10:10 Panel Q&A

10:20 Break

10:30 Summary of CALSIM Applications
- DPLA/CalFed/US Bureau of Reclamation: Integrated Storage Investigations – Steve Roberts
- Bay Delta Office (DWR): SWP Delivery Reliability Report - Kathy Kelly
- USBR: Multi-layered modeling to simulate CVPIA (b)(2) water and Environmental Water Account Operations – Nancy Parker
- Operations Control Office (DWR): Oroville Relicensing, SWP Allocation decision procedure – Curtis Creel
- Department of Planning and Local Assistance (DWR): California Water Plan Update – Kamyar Guivetchi/Ken Kirby

12:15 Panel Q&A

12:30 Lunch

1:15 Summary of User and Stakeholder Interviews
- 1:15 Interview Summary and Findings – UC Davis
- 1:35 Panel Q&A
- 1:50 Public Comment

2:15 CalSim II Details
- Development philosophy – Francis Chung
- Operation priorities, constraints, common assumptions – Erik Reyes
- Hydrology development – Andy Draper
- Delta water quality constraints – Ryan Wilbur

3:15 CalSim Evaluation
- Historical Operations Study / Sensitivity Analysis – Sushil Arora

3:30 Panel Q&A

3:45 Break

4:00 Future Directions
- Data Structure / Version Control / Multi-Period Prescriptive Optimization – Ryan Wilbur
- Daily Time Step - Dan Easton
- CalSim II – CVGSM Integration – Tariq Kadir
- Water Quality / Upstream Models – Nancy Parker

5:00 Panel organizational meeting (additional information needs, questions of specific staff, discussion plan)

Day 2—Panel Deliberations and Preliminary Report

8:30 Panel Q&A with specific DWR and USBR staff on request

9:30 Panel *in camera* discussions

11:00 Panel presentation of draft main findings—Pete Loucks

12:00 Wrap up and next steps - Kim Taylor

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Appendix B: Briefing Material for CALSIM II Peer Review

California Water
Averting a California Water Crisis (3 pages)
California Water Today, Bulletin 160-0, Chapter 2 (20 pages)
Water Supplies, California Water Plan Update, Bulletin 160-98, Chapter 3 (11pages)
Urban, Agricultural and Environmental Water Use, California Water Plan Update, Bulletin 160-98, Chapter 4 (17 pages)
California's Major Water Projects (map) (1 page)

CVP and SWP
State Water Project Operations (6 pages)
Central Valley Project Operations (16 pages)

CalSim and CalSim II Overview
CalSim: A Generalized Model for Reservoir System Analysis (19 pages)

CalSim Software Details
CalSim water resources simulation model: Users guide (18 pages)
CalSim water resources simulation model: Wresl language reference (11 pages)

CalSim II Details
Network Representation (1 page)
Sacramento-San Joaquin Delta Operations (9 pages)
Coordinated Operating Agreement (3 pages)
Reservoir Rule Curves (2 pages)
CalSim ANN Implementation (8 pages)
CVPIA (b)(2) Management and Operations (6 pages).ii
EWA Management and Operations (8 pages)
Multi-Cell Groundwater Model (2 pages)
SWP and CVP Delivery Allocation Logic (3 pages)

Hydrology Development
Surface Water Hydrology Development for CalSim II (8 pages)

Supporting Computer Models
Model Interaction (1 page)
CALAG (2 pages)
CU Model (2 pages)
DSM2 (2 pages)
IGSM2 – CVGSM (4 pages)
LCPSIM (5 pages)

CalSim II Evaluation
Planned Sensitivity Analysis (7 pages)
CalSim II Simulation of Historical SWP-CVP Operations - Extracts (61 pages)

CalSim II Applications
CalSim II Project Applications Summary (not completed)
SWP Delivery Reliability Report – Extracts (25 pages)
North of Delta Offstream Storage Investigations (3 pages)
In-Delta Storage Investigations (3 pages)
California Water Plan Update 2003 (3 pages)
*CalSim II and SWP Operations Control Office (1 page).*iii

Future Model Development

(a) CalSim Software
CalSimMulti-period Prescriptive Optimization (not completed)
CalSim Daily Time Step Model (not completed)
CalSim Water Quality Module (not completed)
Data Structure / Version Control (not completed)
CalSim Graphical User Interface (not completed)

(b) CalSim II Applications
CalSim II – CVGSM Integration (not completed)
CalSim II Geographical Expansion (not completed)
Global Climate Change (not completed)
Refined Spatial Resolution (not completed)
Expansion of Land Use Based Demands (not completed)
CalSim II – CALVIN Integration (not completed)
Revision of Urban Water Demands (not completed)

(c) Supporting Models
Replacement of Consumptive Use Model (not completed)

Appendix C: CALSIM II Review Process and Timeline

Establishing the Peer Review Panel

Dr. Pete Loucks (Cornell University and South Florida Water Management District) has accepted the CALFED Science Program's invitation to chair the panel. Other members are being currently being contacted by the Science Program staff

Organization of Briefing Material

Science Program and key agency staff, in consultation with the review panel chair, are identifying and organizing briefing material for panel members. Target date for completion is Sept 1, 2003. (This was extended to December 8, 2003)

Public Meeting of Review Panel

Target: 2-day session in November, 2003 in Sacramento area

Review workshop structure will include:

- Presentation overviews of California hydrology, water management, current issues, and the development of CALSIM II
- Presentations on the range of different current and potential applications of CALSIM for planning, operations, and supply reliability projects
- A summary of an independent interview project by Dr. Jay Lund of users and stakeholders explaining the major questions people are trying to answer with CALSIM II and other models
- Public comment to the panel
- Detail discussion of the model, including assumptions used in different applications, verification studies, and sensitivity analyses
- Opportunity for panel members to ask follow up questions of CALSIM developers and users
- An in camera session for panelists to discuss and begin compiling review comments
- A public presentation of the panel's draft findings

Panel Chair Provides Final Report to CALFED Lead Scientist

The panelists will be asked to finalize their review comments within 3 weeks of the public meeting and to transmit those directly to the Lead Scientist. The Science Program will transmit the completed review to CBDA and the CALFED community.

Appendix D: Panelists CALSIM II Review, Nov. 13-14, 2003

Name	Affiliation	Position	Address/Phone/E-mail
Andy Close	Murray Darling Basin Commission	Lead Modeler and System Manager	GPO Box 409 Canberra ACT 2601, AUSTRALIA (02)62790102 andy.close@mdbc.gov.au
Michael Haneman	UC Berkeley	"Senior Economist, Professor"	327 Giannini Hall, Berkeley, CA 94720-3310 (510)642-2670 hanemann@are.berkeley.edu
John Labadie	Colorado State University	Professor	B211 Engineering, Fort Collins, CO 80523 (970)491-6898 John.Labadie@colostate.edu
Pete Loucks	Cornell University	Professor	"Civil and Environmental Engineering, 311 Hollister Hall, Ithaca, NY 14853 " (607) 255-4896 DPL3@cornell.edu
Jay Lund	UC Davis	Professor	Civil and Environmental Engineering 3109 Engineering III, Davis, CA 95616" (530)752-5671 jrlund@ucdavis.edu
Daene McKinney	University of Texas at Austin	Professor	Civil and Environmental Engineering Campus Mail Code: C1786, Austin, TX 78712 (512)471-8772 daene_mckinney@mail.utexas.edu
Jery Stedinger	Cornell University	Professor	Civil and Environmental Engineering, Hollister Hall, Ithaca, NY 14853 (607) 255 2351 JRS5@Cornell.edu

Appendix E: Managing Model Development, Application, Documentation and Communication.

One possible means of maintaining control of the quality of particular versions of CALSIM II and accompanying models used for SWP-CVP planning and management decisions is to create an interagency modeling consortium (IMC) consisting of DWR, USBR, and persons from other stakeholder organizations, including NGOs and universities, if they are interested and want to participate. This consortium would be responsible for maintaining a toolbox of 'acceptable' models for 'official' use by the agencies and contractors.

IMC responsibilities and authority could include:

- Prioritize, coordinate, and provide consistency, technical guidance and oversight for all modeling applications,
- Approve model selection and insure that each requested application is carried out using the most appropriate model(s) and input data,
- Provide or otherwise insure documentation of the modeling process itself as well as the modeling results,
- Insure that the results are expressed and made available in a way such that others can understand and benefit from that modeling application, as applicable.
- Implement peer reviews of models and their applications as deemed appropriate.

To help meet their responsibilities the IMC will need to establish, publish and implement some procedures for insuring the quality of the entire model development and application process. They will need to identify among all the models that might be used, which are the most appropriate to address each of these separate groups of model applications. They must identify various models, i.e., establish a model toolbox, from which clients can choose the one that best meets their needs (or perhaps argue that another model should be added to the toolbox). The IMC will also need to maintain model documentation and provide for peer reviews of any model, its documentation, and/or its use in a project.

CMM Level 3 Performance Expectations

Firms that develop professional software are typically required to meet certain software standards. One such standard is defined in a book from Carnegie Mellon University. These so called Capability Maturity Model (CMM 1994) standards have various levels. For example, the South Florida Water Management District, that develops hydrologic models used as inputs to major investment decisions, strives to meet Level 3 standards. To meet such standards in software development and peer review, one needs to show that

- Modeling related problems are anticipated and prevented

- Model development and application groups work together as an integrated product team.
- Model use training is planned and provided as is needed.
- New modeling methodologies are identified and evaluated for possible implementation on a qualitative basis.
- Data are collected and used in all defined processes.
- Data are systematically shared across various projects.
- Both the models and their applications are evaluated and judged satisfactory by independent reviewers.

It seems to this panel that CALFED could without too much difficulty meet such standards if it chose to. Clearly planning for, conducting, and documenting these activities will require additional time and money. The expectation is that in the long run, such documentation and review will save time and money by redirecting misguided initiatives, identifying alternative approaches, or providing valuable technical support for a potentially controversial decision.

Model Toolbox

The IMC in collaboration with all agencies involved in water resources planning could be responsible for creating and maintaining a collection of models that agencies can use to meet their needs. As shown in Figure 1, this collection of models might be called the model toolbox. The criteria to be used as a basis for deciding whether a proposed model should or should not be included in the toolbox will depend in part on an assessment of the attributes of that model compared to alternative models and the suitability of the model to meet the needs of the project. Associated with the model toolbox is a library of completed model application documents and data bases for use by anyone who could benefit from them.

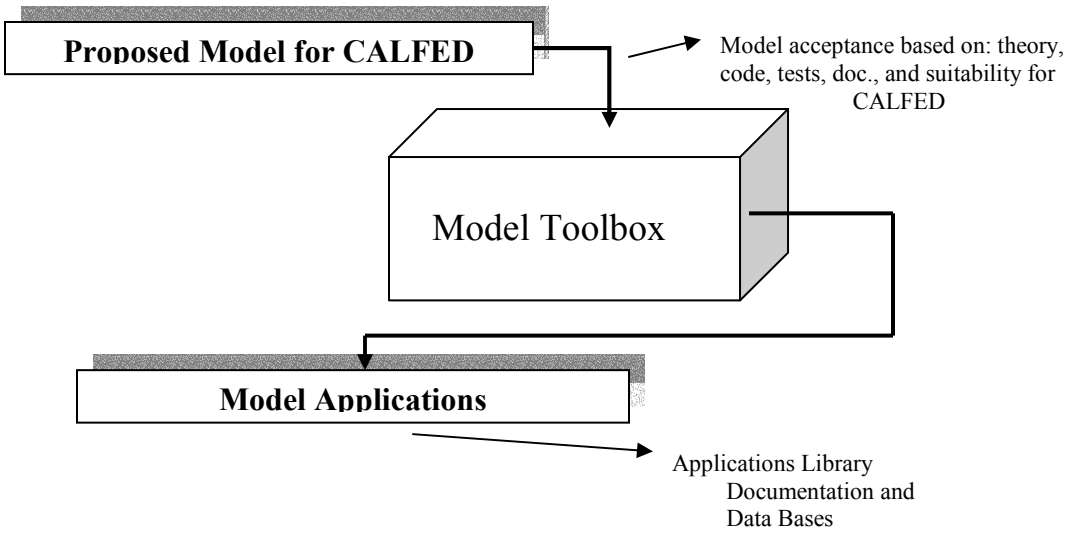

Figure 1. Model Toolbox consisting of approved models for use and Applications Library consisting of documentation and model data bases.

Everyone would agree that all modeling applications should be performed with the 'best' models available. But 'best' does not mean that all models used should be the most detailed, complex, realistic and thus usually the most expensive models available. The decision regarding the 'best' or most appropriate model should be based on the particular issues or questions being addressed, on the quantity and quality of the available input data, and on the time, personnel, and money available to perform the modeling application. The central question to be answered before initiating any modeling application is just what model output information (and precision) is needed to meet the needs of the decision making process. Expressed in other words, just how sensitive will the decision be to the type, amount and precision of the model output?

IMC in consultation with the other agencies could provide guidance on the adequacy of a particular version of CALSIM II or other associated model requested by each client with respect to the theory upon which it is based, its data requirements, its spatial and temporal resolutions, its documentation and status with respect to peer reviews, its capabilities, and its limitations. Similar considerations must be given to the proposed input data. To provide these services to each client requesting services from the IMC would require IMC to be staffed with personnel acquainted with the models in the toolbox, as well as be able to perform or review the simulations requested by various agencies.

There will likely be requests to use models not yet included in the model toolbox. IMC together with others from the DWR and/or USBR will need to judge the merits of such requests and if deemed beneficial, consider including such models in the toolbox. Undoubtedly the extent and quality of the documentation, testing, and peer review of various models in the toolbox will vary. However, a model's inclusion in the toolbox should signify that the model has been judged to be the best available for meeting the goals for which it was designed and is applicable to conditions in California.

Information Flows and Documentation

The IMC will probably be devoting a substantial amount of time giving guidance to clients and, when applicable, to the public. They will need to be working with the clients who are requesting model applications, and in situations where they are not doing this work, they will need to be reviewing and approving the work of the agencies or contractors who are performing the modeling services. IMC would provide technical assistance as well as oversight and coordination among all CALSIM II modeling activities.

Requests for modeling are easy to make, and time and money are required to carry them out. Requests sent to this proposed IMC should reflect some thought by those requesting such model runs as to just why the model application is desired, and just how the results are to be used. We would propose that requests include such items as:

- Reason for modeling,

- Type of modeling (e.g., event based or continuous),
- Particular model preference if any, and why, and possible alternatives,
- Model output information (data) needed and why and when it is needed,
    - What questions are the model results going to answer?
    - What issues are being studied?
    - What decisions are to be made, or at least to be informed, based on these model results?
    - When are the model results needed?
    - What formats are desired for presenting the model results?
- Location or site being modeled and the spatial and temporal scales desired,
- Particular input data assumptions, boundary conditions and other regional assumptions required,
- Source of input data, and format required or desired for the output data,
- Model calibration and verification needs and preferred procedures if any,
- Money and time available for modeling,
- Extent (duration) of the simulations to be performed,
- Desired performance measures, other than variables being simulated, if any,
- Alternative scenarios to be modeled (i.e., number of simulation runs needed),
- Other analyses or model applications that may or will need the output from this model application,
- Sensitivity and uncertainty analyses needed, and for which decision variables and why,
- Client contact person,
- Requirements for intermediate reviews of results or needs for periodic review of modeling application process logs and documents, and
- Other particular requirements or needs.

The use of a model nearly always takes place within a broader context. The model itself can also be part of a larger whole, such as a network of models in which some are using the outputs of other models. These conditions may impose constraints on the simulation modeling project. All these considerations need to be specified in the modeling application request.

Along with the proposal, there should also be a simple order-of-magnitude estimate of the expected values of all relevant decision variables based on simple mass-balance analytical solution methods that can be used without requiring a computer. These estimated values should be used to validate (check the reasonableness of) selected portions of the model runs. If there are any serious discrepancies, it may signify a major problem in the model output.

Is all this paperwork useful? It is to the extent it leads to a more effective and efficient use of personnel, money and time. Preparing a formal modeling application request requires some serious thought as to just why this is necessary and just what information is needed to further the project or analysis. It involves defining the objectives that are to be accomplished. Writing this down in some detail helps reduce the differences in perception that can exist between those who need information and those who are going to provide that information (IMC or a contractor). The problem as stated is often not the problem as understood, by either

the client or the model user. In addition, problem perceptions and modeling objectives can change over the duration of a project. One should ask and answer the question of whether or not modeling in general is the right way to obtain the needed information. What are the alternatives to modeling?

The objective of any modeling project should be clearly understood with respect to the domain and the problem area, the reason for using a particular model, the questions to be answered by the model, the model assumptions and limitations, and the scenarios to be modeled. Throughout the project these objective components should be checked to see if any have changed and if they are being met.

If IMC is to serve as a central point to coordinate CALSIM II-related modeling activities, and to provide modeling services, it needs to have the authority to do so. This authority extends to giving advice on issues related to model and input data selection, and for reviewing, approving and prioritizing requests for services. Should contractors be involved in particular model applications, IMC must be authorized to specify the technical terms to be met and oversee the work done by the contractor. Finally IMC will need the financial and human resources needed to do this in a timely manner.

Modeling Application Documentation

One common problem of model studies once they are underway occurs when one wishes to go back over a series of simulation results to see what was changed or why a particular simulation was made or what was learned. It is also commonly difficult if not impossible for third parties to continue from the point at which any previous modeling project was terminated, especially if some time has passed. These problems are caused by a lack of information on how the study was carried out. What was the pattern of thought that took place? Which actions and activities were carried out? Who carried out what work and why? What choices were made? How reliable are the end results? These questions should be answerable if a model journal is kept. Just like computer programming documentation, modeling project documentation is often neglected under the pressure of time and perhaps because writing it is not as interesting as running the models themselves.

The paper trail of what has happened, what assumptions have been made, how calibration and verification were carried out, what results were obtained, why changes, if any, were made, what sensitivity analysis procedures were used and their results, and so on, could be contained in a modeling application documentation (MAD). Once the model application is completed, a copy of the MAD should be given to the requesting agency, as applicable and a copy should remain in IMC. These reports, or at least a summary of them, should be available for downloading from the web. Should further model applications be requested and approved, the requester as well as the IMC can refer to this previously prepared documentation to better understand what was done previously that pertains to the current request.

Model Calibration

Once a model is tested satisfactorily, it can be calibrated. Calibration of models such as CALSIM II are difficult because there are no historical observations of future scenarios to compare with model results. Historical runs, such as have been made, can provide some basis for calibration. In general the smaller the deviation between the calculated model results and the field observations, the better the model. This is true to a certain extent, as the deviations in a perfect model are only due to measurement errors. In practice, however, a good fit is by no means a guarantee of a good model.

The deviations between the model results and the field observations can be due to a number of factors. These factors include possible software errors, inappropriate modeling assumptions such as the (conscious) simplification of complex structures, neglecting certain processes, errors in the mathematical description or in the numerical method applied, inappropriate parameter values, errors in input data and boundary conditions, and measurement errors in the field observations.

To determine whether or not a calibrated model is a 'good' predictor, it should be validated or verified. Calibrated models should be able to reproduce field observations not used in calibration. Validation can be carried out for calibrated models if an independent data set has been kept aside for this purpose. If all available data are used in the calibration process in order to arrive at the best possible results, validation will not be possible. A decision to leave out validation may be a justifiable one especially when data are limited.

Philosophically it is impossible to know if a simulation model of a complex system is 'correct'. There is no way to prove it. Experimenting with a model, such as by carrying out multiple validation tests, can increase confidence in that model. After a sufficient number of successful tests, one might be willing to state that the model is 'good enough', based on the modeling project requirements. The model can then be regarded as having been validated, at least for the ranges of input data and field observations used in the validation.

If model predictions are to be made for situations or conditions for which the model has been validated, there may be some confidence in the reliability of those predictions. Yet one cannot be certain. Much less confidence can be placed on model predictions for conditions outside the range for which the model was validated.

While a model should not be used for extrapolations as commonly applied in predictions and in scenario analyses, this is often exactly the reason for the modeling project. What is likely to happen given events we have not yet experienced? A model's answer to this question should also include the uncertainties attached to these predictions. Depending on the type of model selected and used, one might end up predicting an incorrect future with great accuracy, or predicting the correct future with great uncertainty'. We don't yet know how to predict the correct future with great accuracy – so we do 'what ifs'. One can then argue about what scenarios – the ifs – are the most reasonable or probable, or about the impacts from improbable scenarios that you want to avoid should such scenarios occur.

Use the model

Once the model has been judged 'good enough,' the model may be used to obtain the information desired. Close communication between the client and the modeler during the modeling application process is essential to avoid any unnecessary misunderstandings about what information is wanted and the assumptions on which that information is to be based.

Before the end of this model-use step one should determine whether all the necessary simulations have been performed and whether they have been performed well. Questions to ask include

- did the model fulfill its purpose?
- are the results valid?
- are the quality requirements met?
- was the discretization of space and time chosen well?
- was the choice of the model restrictions correct?
- was the correct model and/or model program chosen?
- was the numerical approach appropriate?
- was the implementation performed correctly?
- what are the sensitive parameters (and other factors)?
- was an uncertainty analysis performed?

If any of the answers to these questions is no, then the situation should be corrected. If it cannot, the reason(s) for why it cannot be corrected should be documented in the model application document (MAD).

Interpret model results

Interpreting the information resulting from models is a crucial step in the modeling application process, especially in situations in which the client may only be interested in those results and not the way they were obtained. The model results can be compared to those of other similar studies. Are the results consistent? IMC must make that judgment. Any unanticipated results should be discussed and explained. The results should be judged with respect to the modeling project objectives.

The results of any modeling project typically include large files of time-series data. Only the most dedicated of clients will want to read those files. Thus these data must be presented in a more concise form. Statistical summaries should explicitly include any restrictions and uncertainties in the results. They should identify any gaps in the domain knowledge, thus generating new research questions or identifying the need for more field observations and measurements.

Report model results

Once the modeling application is completed, the organization doing the modeling will be responsible for preparing a report. The contents of this report should conform to the agreement

made between modeling organization and the client prior to the initiation of the modeling application (see above). Although the results of a model are very rarely used as the sole basis for policy decisions, those requesting model applications may have a responsibility to translate their model results into policy recommendations. Policymakers, managers, and indeed the participating stakeholders typically want simple and clear unambiguous answers to complex questions. Much of the scientifically justified discussion, say regarding the uncertainties associated with some of the data, included in the main body of a report are not included in the executive summary of that report. This executive summary is often the only part read by those responsible for making decisions. Therefore, the conclusions of the model study must not only be scientifically correct, but also concisely formulated, without jargon, and fully understandable by managers and policymakers. When preparing or reviewing contractor model results reports, the IMC should consider this need.

These model application and model results reports should include sufficient detail to allow others to reproduce the model study (including its results) and/or to proceed from the point where this study ended. The report therefore requires a clear indication of the validity, usability and any restrictions of the model results.

Data Management

CALSIM II and its associated or linked models will require data. They will also produce data. Many of these data will have spatial and temporal dimensions. This information must be documented (meta data), preserved, and made accessible to IMC customers, coordination agencies and others. IMC should participate in data management strategic development, storage, documentation and dissemination. It should work with data base managers of various agencies to help them satisfy the IMC's data management requirements.

The availability of quality assured data is a critical dependency that must be met to facilitate timely completion of model development, implementation and application. To mitigate the impact of the availability of data on the timeline for the major model completion deadlines, the following issues should be addressed. :

- Updating land use / land cover data at regular and timely intervals.
- Developing and maintaining a common modeling database. This data base should include infrastructure design and operating policy data as well as water quality, ecological, land use, economic and of course hydrological data. Many of these data sets will have spatial as well as temporal dimensions. Each data set should have an associated metadata file.
- Pre-processed and post-processed datasets from previous model runs should be archived along with its metadata file in a central location for ease of access and availability.
- Measures to insure the consistency and quality of the input data.
- Measures to insure adequate communication among model developers, users and stakeholders. This includes measures to assist in developing documentation appropriate for each type of stakeholder.

Support of IMC activities

Common failures of IMC type organizations are typically due to:

- Insufficient staff to enable cross-training. This may lead to the dependency on one person or a very small group of employees for each sub module or the overall effort.
- Inadequate funding to institute good project management discipline.
- Inadequate funding to contract for technical writers and software engineers.
- Inadequate funding to contract for peer reviews.

Risk assessments

A risk assessment of CALSIM II and its associated models and data should be completed. The timely availability of quality assured data for example, is a risk. Project risk management includes the processes concerned with identifying, analyzing, and responding to uncertainties. Risk management attempts to minimize the results of adverse events. As a guide, the template, such as shown at the end of this Appendix, may be used to facilitate the assessment of risks.

Problem Management

Given the high visibility and criticality of the CALSIM II modeling effort an issue or problem management process should be developed within IMC. Issue/problem management includes the process for identifying, communicating, and resolving issues and problems.

The purpose of this procedure is to ensure that:

- Issues are identified, reported, managed, and resolved in a timely and effective manner. Responsibility is assigned to an owner for reporting, managing and resolving each issue
- All affected stakeholders are aware of the status of the issues
- Escalation of unresolved issues take place according to a defined procedure

In order to ensure that project issues and problems are appropriately managed various issue/problem management steps should be identified and followed to track the actions taken to resolve the issue or problem throughout the life of a modeling project.

B. Managing Peer Reviews

One means of quality control involves peer reviews of the models, their associated software, and their applications. One possible means of facilitating the peer review processes and for maintaining control on the particular versions of CALSIM II and accompanying models used for SWP-CVP planning and management decisions is another reason to create an interagency modeling consortium (IMC) consisting of DWR, USBR, and other stakeholder organization personnel if they are interested and want to participate. As suggested above, this consortium could be responsible for maintaining a toolbox of 'acceptable' peer-reviewed models for use by the agencies and contractors. The peer reviews should be of the theory underlying each

model, the model's software, the documentation of that software, the model's functions and capabilities including those pertaining to model data input and output, model calibration and verification, sensitivity analyses, uncertainty analyses, user control (GUIs), spatial and temporal resolutions, limiting assumptions, and on the model (as opposed to code) documentation.

Just having evidence of published articles about a particular model in peer reviewed journals is not a substitute for a peer review of the model software and its applicability or suitability for certain types of analyses for SWP-CVP. Peer reviews of all models, their software, and their use should be accomplished by experts both within and outside of the originating agencies. 'Inside' agency (or internal) reviews may uncover some needed changes and identify other issues or problems that external reviewers could be asked to specifically examine and address. Internal reviews can make the external review process more effective, less costly and less time consuming.

Peer reviews are considered a key process area for Level 3 and higher of the Capability Maturity Model guidelines for improving the software process (Carnegie Mellon University, 1994). The purpose of peer review evaluations is to find defects in the model formulation and software and in its use, i.e., model application. Peer reviewers can also identify possible ways of correcting those defects, if any. If there are no defects, or after all known defects have been corrected, both the developers and users of any model and its software can have a stronger basis for believing that their product and its output are reliable.

Peer reviews serve the same function as accountants. Once a firm's financial records have been peer reviewed by accountants (assuming they are qualified, objective and honest) the board of directors as well as the stockholders will have more assurance of the liabilities and net worth of their firm, and just how well it is being managed. In this case it is the assurance of the quality of the models, their software, and on their use in project evaluations, that actual and potential users of the model results depend upon.

The types of problems and issues for which a model, its software, and its documentation are designed to address are called the model's 'application niche'. Peer review of model development should include the evaluation of the intended application niche along with consideration of other aspects of model performance. Users of any model should be aware of the types of analyses for which the model is best suited and those for which the model is not well suited. This, along with the results of a peer review of any model application, should help the potential model user, or the user of the model results, better understand the limitations of the scientific basis of the model and just how much confidence can be placed on the model output.

Peer review triggers

Clearly judgment will have to be exercised as to just when and in what detail a peer review needs to be implemented. However the triggers on when a decision about a peer review needs to be made can be defined.

As shown in Figure 2, decisions regarding peer review are needed when models are proposed for the tool box and when model applications are completed. Should IMC decide a peer review is warranted when either of those events takes place, they will have to decide on the type of review and its level of detail. They will also need to identify the individuals to be asked to carry out that peer review.

Peer reviews are going to take time and cost money. They will also require IMC time to prepare the documentation needed for the peer reviewers and to read and act on reports prepared by the peer reviewers. This will apply if the peer review is internal or external.

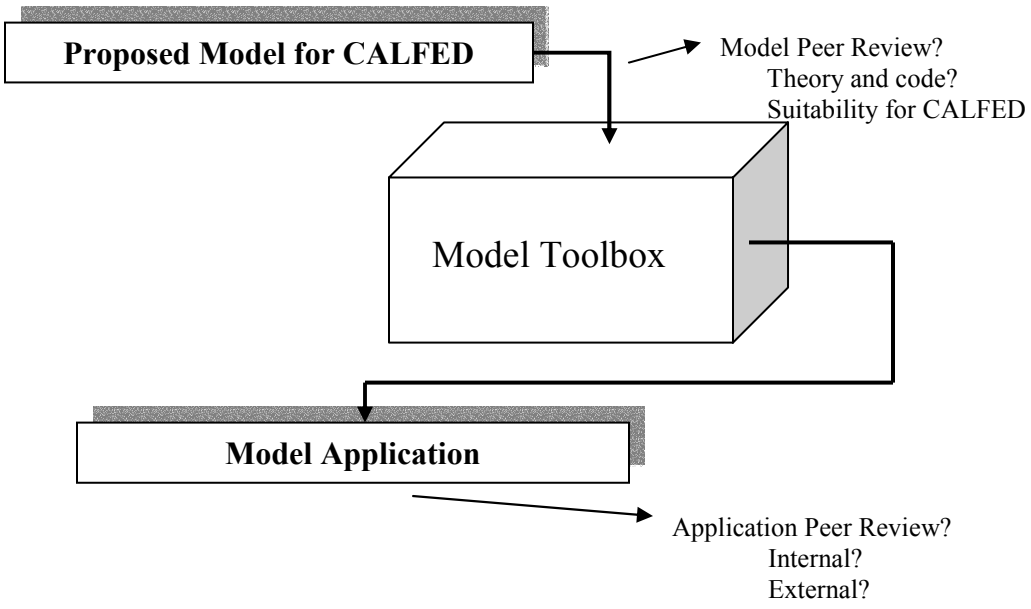

Figure 2. Schematic showing events where a peer review decision can be made.

The particular models and their associated software and documentation to be peer reviewed should be identified by the individuals or departments or agencies. This can include model process descriptions, software source code, documents, test results, and other supporting materials, as needed, for an adequate peer review of the entire model and its software. These products to be reviewed should be identified in writing and a written history of the review of different versions of each item should be maintained.

Events that take place in the progression of model development and use and subsequent modifications that warrant a peer review should be identified and specified in a written document. (This fits in to the model development and use documentation that should be maintained for Level 3 or higher CMM) When these events take place a peer review process should be considered, and if warranted, implemented. Depending on the event, the review can be solely internal, or it can involve an independent external review team as well.

Model application reviews should include an evaluation of the intended model application niche, and its applicability to current needs. Peer review may be appropriate for existing models when new information becomes available that could negate some or all of the conclusions of previous reviews or suggest a change in the currently specified application niche. Peer review of a model's applicability to a particular study should be planned well in advance of when model results are needed. The results of application reviews can influence the decisions made based on the model outputs. Once a peer review has been conducted for a particular model and its input data, peer reviews of subsequent applications of a model with similar inputs might be unnecessary. However, any time the model results may be controversial, or end up in litigation, another peer review may be justified.

Peer Review Process

The extent and process of performing and responding to peer reviews can vary in any organization. The ones discussed in this section attempt to follow the processes recommended by the Capability Maturity Model Level 3 guidelines.

Project peer review process should be specified in writing. A first step in this process should be to identify the particular modeling products and processes that will undergo peer review. This includes the models (i.e. the processes being modeled and the assumptions built into the models for describing these processes), their supporting software, the documentation of the model and its software, as well as all the written guidelines on how the models are to be used.

A second step is to perform an internal peer review prior to a model's use for project evaluation. It should be peer reviewed for accuracy, its suitability for use, and for identifying any possible errors in its logic, its coding, or in its documentation. Following an internal review, an external peer review can be performed.

Following the successful conclusion of internal and external peer reviews of a model and its documentation, the model can be applied to evaluate alternative projects. After the model has been applied to a particular project, the modeling process and its results should be peer reviewed to insure that the model has been applied properly, that the input data were appropriate, and that the conclusions drawn were valid.

Peer review teams should be selected, along with a peer review team leader. The particular personnel on the team will depend on the particular model and its software and documentation being reviewed. CALFED should have a list of qualified peer reviewers representing all applicable disciplines, both internal and external, that it can call upon to perform these reviews. The peer reviews are to be of the models and their use, not of the people who developed or used them. The reviews are to be used to evaluate the quality of modeling products and processes, not of the personnel involved.

Establishing and carrying out ongoing peer review processes costs money. Adequate funding must be made available to

1. identify and recruit a peer review team and team leader
2. prepare and distribute the peer review materials to the peer review team
3. support the time required for the team to review the materials prior to a team meeting
4. support the team meeting and to participate in it as appropriate (e.g., answering questions, conducting model experiments and sensitivity analyses, etc.)
5. reproduce and distribute the team report and to take actions as needed
6. monitor the modifications or changes being made to the model, its software, and its documentation, or redoing the model application, as needed.
7. prepare and distribute to model developers and potential users a report on the results of the peer review and the actions taken.

The particular peer review process may depend on just what is being peer reviewed and the resources and time available to perform the review. In general, however, the steps of a peer review could include the following:

1. DWR or CALFED should identify and establish a pool of possible reviewers representing various disciplines, with sufficient redundancy to allow for scheduling conflicts when ever some subset of those reviewers are needed. This includes both internal as well as external reviewers. What ever administrative work is need to establish this pool should be completed prior to when these reviewers will be needed.

2. At particular milestones in any new model development or in model application an internal peer review process could be initiated, to examine the modeling assumptions, the software that implements those assumptions in the case of model development or the data being used for model inputs in the case of model applications, and the documentation being prepared to describe the processes, to document the software code, and to document the tests that were run to test the code, or to document the results of the model application. If deemed appropriate, an external peer review could also be performed. If an external review is to take place, the particular reviewers need to be selected, notified, sent supporting documents, and be scheduled for one or more meetings, as needed. They should be issued contracts specifying the requirements (the checklist of items to be reviewed) and products expected.

3. Recommendations made by the peer review team need to be addressed and the actions taken along with the rationale for those actions should be documented.

4. The peer review team should review the actions taken and the results obtained from these actions. If not judged acceptable new recommendations should be made and submitted. A final report should be prepared by the peer review team when all recommendations have been successfully implemented or addressed, or if no further actions based on review team's recommendations will be taken by the model developers or users.

The time and effort required for various levels of review should also be assessed and provided to the review team so that they can carry out the level of review requested of them. Otherwise the reviews may be superficial and while appearing to be peer reviewed, a model and its

associated products may in fact be inadequately reviewed. Peer review teams have the responsibility to specify in writing the scope and limitations of their reviews.

As was the case for this peer review panel, the materials to be sent to the review team to allow them to prepare for their meeting should include the statement of review objectives and the level of detail desired, the applicable requirements and standards upon which to judge the adequacy of the products being reviewed, and of course the material that is to be reviewed. There should be a list of questions for the reviewers to address. Each review team member should be assigned and given responsibility for answering specific questions and for completing specific aspects of the overall review. All team members should be given specific review standards or requirements, including the expected completion dates. Checklists should be provided the review team that are applicable to the specific type of product being reviewed and the level of detail to be examined. These checklists will contain the criteria for judging the product, such as compliance with any standards and procedures, completeness, correctness, rules of construction, and maintainability.

Peer Review Issues and Questions

Each model development or application review will dictate its own special set of questions to be addressed. Some of these questions could relate to:

- Model Purpose and Objective
    - Use of model related to decisions being considered.
    - Model application niche, and why.
    - Model strengths and weaknesses –is it the best model?
- Model Processes and Limitations
    - Model processes, spatial and temporal scales, grid resolution.
    - Model variables and level of aggregation.
- Model Theoretical Basis
    - Model algorithms, numerical or analytical methods,
    - Model process formulation
    - Modeling approach in comparison with other models
    - Any shortcomings in relation to application niche
- Model Parameter Estimation
    - Methods used
    - Data available for parameter estimation
    - Parameter estimate reliabilities
    - Boundary conditions and appropriateness.
- Model Input Data Quantity/Quality
    - Data used in design of model
    - Data adequacy (quantity, quality, resolution) for model purpose and application
    - Data necessary for application of model
    - Key data gaps in model application
    - Additional data needs and why
- Model Key Assumptions
    - Basis for major assumptions

    - Sensitivity of model outputs to key assumptions
    - Sensitivity of potential decisions to key assumptions
    - Ease in modifying key assumptions
- Model Performance Measures
    - Criteria for assessing model performance
    - Correspondence of model output with measured observed data
    - Any model bias throughout range of model predictions
    - Variability and uncertainty analyses and representations in model results
    - What determines model's variability and uncertainty.
    - Model performance relative to others in application niche
- Model Documentation and User's Guide
    - Clarity of documentation, comprehensiveness of user's guide
    - Model applicability and limitations
    - Input data requirements for calibration, verification, model runs
    - Post modeling analyses, display and interpretation of results
    - Model code documentation
    - Model application documentation examples for prospective users.
- Review Retrospective
    - How well model and its application meet objectives and needs of project
    - Possible changes in the model to improve model performance
    - Robustness of model solutions to small changes in uncertain parameters, etc.
    - Ease of including uncertainty analyses associated with uncertain input data.
    - Key research needs for model improvement.

Peer Review Completion Reports

Procedures need to be established to track and confirm actions based on suggested changes or modifications in the material being reviewed. Once these actions are taken and completed, and documented, the peer review process for that particular product is completed. Peer review completion reports should contain data on what was reviewed and the results of the review. These data should include a description of the products that were reviewed, the level of detail of the review, any review limitations or qualifications, the number and backgrounds of the reviewers, the time spent preparing for and during review team meetings, the defects found and recommendations made, and the actions taken to address these recommendations.

Overall Peer Review Evaluations

The IMC or initiating agency should document the planning for and scheduling of peer reviews. The products to be reviewed and the level of detail to be examined also need to be specified. The procedures to be followed for selecting peer review team members, and the team leader, should also be determined and documented. Procedures for training potential reviewers, if such training is needed, should be identified and implemented, as required.

Periodically the IMC or applicable agency should assess just how well the plan described in the preceding paragraph is being carried out, and just how beneficial these peer reviews are to the overall modeling effort. Measures should be identified and used to determine the status of the

peer review activities. These measures could include the number of completed peer reviews performed compared to the number expected to be performed, the overall effort expended on peer reviews compared to that expected, and the number and extent of peer review recommendations requiring actions.

At a minimum these periodic reviews should verify that

1. The planned peer reviews and/or audits are conducted.
2. The peer review leaders are adequately trained for their roles.
3. The reviewers are properly trained or experienced in their roles.
4. The processes for preparing for and conducting peer reviews, and for following up on reviewer's recommendations are adequate and are being followed.
5. The reporting of peer review results is complete, accurate, timely and is being made available to model users.

Risk Management Template

Risk Definition Name	Enter a short name that uniquely defines the risk
Risk #	Enter a unique number assigned to the risk. Range starts with 1 and continues.
Date Risk Identified	Enter the date the risk was identified
Risk Identification Source	Enter the source of the risk identification. In example, meeting name, group, or person.
Risk Owner	Enter the name of the person who will be responsible for ensuring the risk is approved, managed, periodically assessed, communicated, and tracked through closed or transfer.
Risk Detailed Description	Enter a detailed description of the risk so that a reader clearly understands the risk.
Probable Impact of Risk on Project (H, M, L)	Enter the impact on the project. o High = the risk will most likely occur and the impact could prevent the project from achieving its purpose. o Medium = there is a 50/50 change the risk would occur and the impact is serious but the project could still achieve its purpose if appropriately managed. o Low = there is a low probability that the risk would occur and minimal impact to the project's purpose.
Probable Impact of Risk on Project Costs	Enter the impact on the project in dollars. Determine what the potential cost to the project would be if the risk occurs.
Probable Impact of Risk on Project Schedule	Enter the schedule impact on the project. Determine how the schedule would be potentially impacted if the risk occurs.
Probable Impact of Risk on Project Results	Enter the impact on the project. Determine how the overall project purpose and results will be potentially impacted if the risk occurs.
Detailed Plan to Mitigate or Transfer Risk	Enter the detailed plan to mitigate the risk or a statement that the risk will be accepted. Mitigation could include ways to minimize, avoid, or transfer the risk to another party or group. Risk transfer would include evidence of agreement by the accepting party.
Detailed Project Action Items Required to Mitigate or Transfer Risk	Enter the detailed action items required to mitigate the risk. These items will be summarized and assigned within the project Action Log, along with an action item owner, and target completion date.
Detailed Project Plan Tasks Required to Mitigate Risk	Enter the detailed project plan task required to mitigate the risk. These items will be summarized and contained within the MS Project Schedule along with the effort, duration, schedule, and assigned resources.
Comments	Enter any permanent comments that cannot be included in the above items.
Referenced Documents	Enter any documents that a reader should consider in understanding, analyzing, mitigating, or accepting this risk.
Date Risk Closed	Enter the date this risk was closed. This would include when all action items or project tasks were completed, or the risk was transferred to another party or group.

Appendix F: Analysis of the November 2003 CALSIM II Validation Report

The following comments come from an analysis of the model results presented in the validation report *'CALSIM II Simulation of Historical SWP/CVP Operations'*, DWR (2003). The observations relate to the formulation of the model at November 2003. Changes might be made to that formulation which could resolve these issues.

Overestimation of Project Deliveries

The validation run suggests that the modeled demands included in CALSIM II overestimate the actual demands. CVP demands south of the Delta are assumed to be always equal to the contract entitlement whereas the observed deliveries in unrestricted years are consistently less than this amount. The modeled North of Delta deliveries are also consistently higher than observed. The modeled and observed CVP deliveries from the validation report are listed in Table 1.

Table 1. Comparison of modelled and observed CVP deliveries (1975-1998)

Project	Simulated Delivery (Taf/yr)	Historical Delivery (taf/yr)	Difference (taf/yr)	% Difference
CVP North of Delta	1960	1750	210	12
CVP South of Delta	2650	2490	160	6.4

Because the SWP south of delta demands were set to historical deliveries in many years, comparison with the historical deliveries in the validation report is of limited validity. However the fact that the historical SWP deliveries over the last ten years have averaged only 2385 taf/year while the modeled 'year 2001 development' SWP Delta deliveries reported in the 2002 State Water Project Delivery Reliability Report average 3090 taf/year, suggests that modeled SWP deliveries may also be too high.

Allocations to Project Contractors

Seasonal allocations to SWP and CVP contractors are made on the basis of water in storage, forecast inflows, projected carryover storage requirements and in-Basin and Delta regulatory requirements. The allocation processes used by the operators and those used by CALSIM II, are not identical. An examination of the way that CALSIM II has restricted project deliveries during the dry period of 1987-1992 (Figures 10, 16, 17 and 24 of the validation report) suggests that CALSIM II has allocated less water in the early years of the dry sequence than occurred in practice and consequently had more water available in 1991 and 1992 when the most severe restrictions were experienced. The carryover storage rules adopted can have a significant impact on the expected frequency and severity of water supply restrictions. The

model rules need to be examined to ensure that the accurately reflect the way the system will be managed in the future.

San Luis Reservoir Operation

The rules used by the system operators for transferring water from headwater storages to the San Luis Reservoir can have a significant impact on:

- the pattern of flow in the Delta,
- the operation of accounting rules between the SWP and the CVP and
- opportunities for SWP wheeling of CVP water and possibly the availability of Article 21 water to SWP contractors.

A comparison of the modeled and observed storage behavior of the SWP component of San Luis (Figure 15) reveals that the model consistently underestimates the volume in storage. A comparison of the CVP component of the storage (Figure 23) indicates that the actual storage is filled earlier in the season and that the actual storage is also slightly higher than the modeled.

Users of CALSIM II output need to be confident that the rules adopted by the model for determining these transfers reflect the way this component of the system will be operated in the future.

Appendix G: Some Principles for Strategic Water Analysis for the California Water Plan Bulletin 160-03 (from the stakeholder review Draft, Sept. 30, 2003)

Strategy:

1) A frequently amended strategic document will lay out DWR's strategic analysis framework and identify the technical objectives, roles, and responsibilities of major DWR data collection efforts and analytical tools and their interactions and their responsible managers.

Transparency:

2) All data and models should be in the public domain and available on the web.
3) All data and models should have significant documentation.
4) Known limitations should be documented.

Longer-term viability:

5) Modularity: Major analytical tools will be designed and implemented to fit modularly and explicitly within the larger strategic analysis framework.
6) Adaptive data management framework: Major data efforts will fall within a larger data management framework, including protocols for data documentation and updating, and documentation of limitations.
7) A frequently-updated document will outline short-term and long-term efforts, budgets, and responsibilities for continuous improvement of analytical tools and data, with policy for continued user, local agency, and stakeholder involvement.

Coverage:

8) Spatial coverage for the basic data and analytical framework will be statewide.
9) Local and regional water management and resources will be explicitly represented.

Accountability and Quality Control:

10) In developing analytical tools, systematic efforts should be made to involve local agencies and stakeholders.
11) Major analytical products will undergo external review by a) external unaffiliated experts and b) local agencies whose systems are included in the model. User groups will exist for all major analytical products.
12) DWR's strategic analysis framework will undergo periodic internal and external review.

Appendix H: Model Sensitivity and Uncertainty Analysis

(This is a draft of a book chapter by DPL/JRS that may be useful for CALSIM II developers)

1. Introduction

2. Issues, concerns, and terminology

3. Variability and uncertainty in model output
- **3.1 Natural variability**
- **3.2 Knowledge uncertainty**
- **3.3 Decision uncertainty**

4. Sensitivity and uncertainty analyses
- **4.1 Sensitivity Analyses**
- **4.2 Uncertainty Analyses**

5. Performance indicator uncertainties
- **5.1 Performance measure target uncertainty**
- **5.2 Distinguishing differences between performance indicator distributions**

6. Communicating model output uncertainty

7. Conclusions

8. References

The usefulness of any model is in part dependent on the accuracy and reliability of its output data. Yet, because all models are imperfect abstractions of reality, and because precise input data are rarely if ever available, all output values are subject to imprecision. The input data and modeling uncertainties are not independent of each other. They can interact in various ways. The end result is imprecision and uncertainty associated with model output. This chapter focuses on ways of identifying, quantifying, and communicating the uncertainties in model outputs.

1. Introduction

Models are the primary way we have to estimate the multiple affects of alternative water resource system design and operating policies. Models predict the values of various system performance indicators. Model outputs are based on model structure, hydrologic and other time-series inputs and a host of parameters whose values describe the system being simulated. Even if these assumptions and input data reflect, or are at least representative of, conditions believed to be true, we know they will be wrong. Our models are always simplifications of the

real systems we are studying. Furthermore, we simply cannot forecast the future with precision. So we know the model outputs of future conditions are uncertain estimates, at best.

Some prediction uncertainties can be reduced by additional research and data collection and analysis. Before undertaking expensive studies to gather and analyze additional data it is reasonable to ask what improvement in estimates of system performance or what reduction in the uncertainty associated with those estimates would result if all data and model uncertainties could be reduced. Such information helps determine how much one would be willing to 'pay' to reduce prediction uncertainty. If prediction uncertainty on average is costing a lot, it may pay to invest in additional data collection, more studies, or in better models all aimed at reducing that prediction uncertainty. If that uncertainty has no, or only a very modest, impact on the likely decision that is to be made, one should find other issues to worry about.

If it appears that reducing prediction uncertainty is worthwhile, then one should consider how best to do it. If doing this involves obtaining additional information, then it is clear that the value of this additional information, however measured, should exceed the cost of obtaining it. The value of such information will be the increase in system performance, or the reduction in its variance, that one can expect from obtaining such information. If additional information is to be obtained, it should be that information which reduces the uncertainties considered important, not the unimportant ones.

This chapter reviews some methods for identifying and communicating model prediction uncertainty. The discussion begins with a review of the causes of risk and uncertainty in model output. It then examines ways of measuring or quantifying uncertainty and model output sensitivity to model input imprecision, concentrating on methods that seem most relevant or practical for large-scale regional simulation modeling. It builds on some of the statistical methods reviewed in Chapter III and the modeling of risk and uncertainty in Chapter VI.

2. Issues, concerns, and terminology

Outcomes or events that cannot be predicted with certainty are often called risky or uncertain. Some individuals draw a special and interesting distinction between risk and uncertainty. In particular, the term risk is often reserved to describe situations for which probabilities are available to describe the likelihood of various events or outcomes. If probabilities of various events or outcomes cannot be quantified, or if the events themselves are unpredictable, some would say the problem is then one of uncertainty, and not of risk. In this chapter what is not certain is considered uncertain, and uncertainty is often described by a probability distribution. When the ranges of possible events are known and their probabilities are measurable, risk is called objective risk. If the probabilities are based solely on human judgment, the risk is called subjective risk.

Such distinctions between objective and subjective risk, and between risk and uncertainty, rarely serve any useful purpose to those developing and using models. Likewise the distinctions are often unimportant to those who should be aware of the risks or uncertainties associated with system performance indicator values.

Uncertainty in information is inherent in future-oriented planning efforts. Uncertainty stems from inadequate information and incorrect assumptions, as well as from the variability of natural processes. Water managers often need to identify both the uncertainty as well as the sensitivity of, or changes in, system performance indicator values due to the any changes in possible input data and parameter values from what were predicted. They need to reduce this level of uncertainty to the extent practicable. Finally, they need to communicate the residual uncertainties clearly so that decisions can be made with this knowledge and understanding.

Sensitivity analysis can be distinguished from uncertainty analysis. Sensitivity analysis procedures explore and quantify the impact of possible errors in input data on predicted model outputs and system performance indices. Simple sensitivity analysis procedures can be used to illustrate either graphically or numerically the consequences of alternative assumptions about the future. Uncertainty analyses employing probabilistic descriptions of model inputs can be used to derive probability distributions of model outputs and system performance indices. Figure 1 illustrates the impact of both input data sensitivity and input data uncertainty on model output uncertainty.

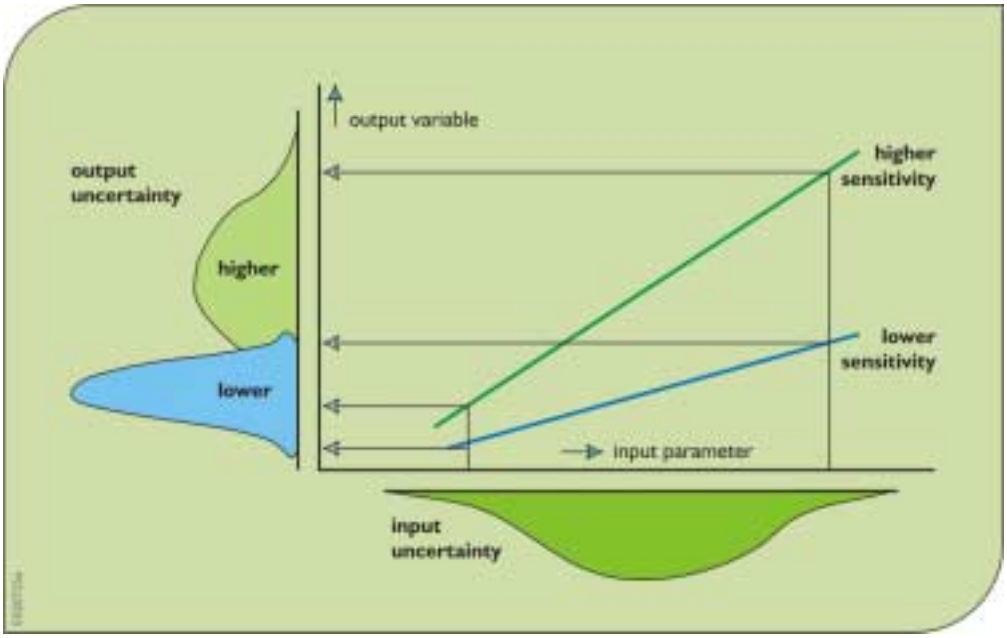

Figure 1. Schematic diagram showing relationship among model input parameter uncertainty and sensitivity to model output variable uncertainty (Lal, 1995).

It is worthwhile to explore the transformation of uncertainties in model inputs and parameters into uncertainty in model outputs when conditions differ from those reflected by the model inputs. Historical records of system characteristics are typically used as a basis for model inputs. Yet conditions in the future may change. There may be changes in the frequency and

amounts of precipitation, changes in land cover and topography, and changes in the design and operation of control structures, all resulting in changes of water stages and flows, and their qualities, and consequently changes in the impacted ecosystems.

If asked how the system would operate with inputs similar to those in the historical database, the model should be able to interpolate within the available knowledge base to provide a fairly precise estimate. Still that estimate will not be perfect. This is because our ability to reproduce current and recent operations is not perfect, though it should be fairly good. If asked to predict system performance for situations very different from those in the historical knowledge base, or when the historical data are not considered representative of what might happen in the future, say due to climate change, such predictions become much less precise. There are two reasons why. First, our description of the characteristics of those different situations or conditions may be imprecise. Second, our knowledge base may not be sufficient for calibrating model parameters in ways that would enable us to reliably predict how the system will operate under conditions unlike those that have been experienced historically. The more conditions of interest are unlike those in the historical knowledge base, the less confidence we have that the model is providing a reliable description of systems operation. Figure 2 illustrates this issue.

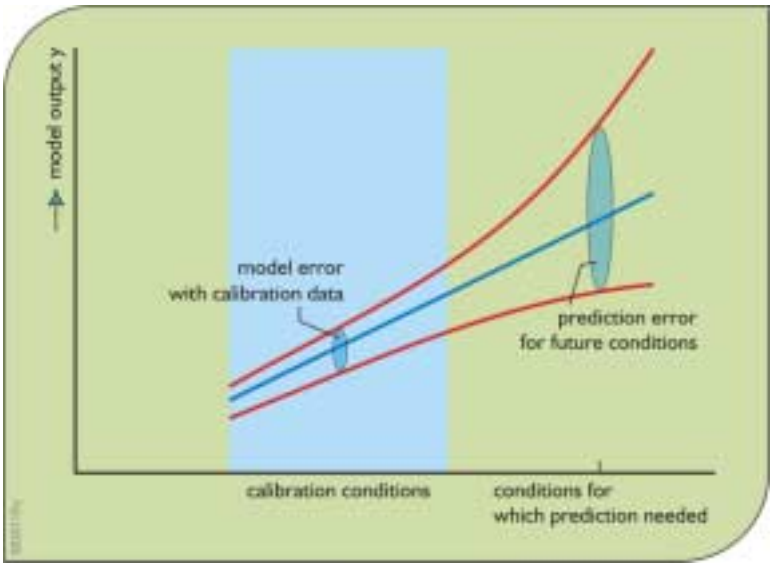

Figure 2. The precision of model predictions is affected by the difference between the conditions or scenarios of interest and the conditions or scenarios for which the model was calibrated.

Clearly a sensitivity analysis needs to consider how well a model can replicate current operations, and how similar the target conditions or scenarios are to those described in the

historical record. The greater the required extrapolation from what has been observed, the greater will be the importance of parameter and model uncertainties.

The relative and absolute importance of different parameters will depend on the system performance indicators of interest. Seepage rates may have a very large local effect, but a small global effect. Changes in system-wide evapotranspiration rates will likely impact system-wide flows. The precision of model projections and the relative importance of errors in different parameters will depend upon the:

(1) precision with which the model can reproduce observed conditions,
(2) difference between the conditions predicted and the historical experience included in the knowledge base, and the
(3) system performance characteristics of interest.

Errors and approximations in input data measurement, parameter values, model structure and model solution algorithms, are all sources of uncertainty. While there are reasonable ways of quantifying and reducing these errors and the resulting range of uncertainty of various system performance indicator values they are impossible to eliminate. Decisions will still have to be made in the face of a risky and uncertain future. Decisions can be modified as new data and knowledge are obtained in a process of adaptive management.

There is also uncertainty with respect to human behavior and reaction related to particular outcomes and their likelihoods, i.e., to their risks and uncertainties. As important as risks and uncertainties associated with human reactions are to particular outcomes, they are not usually part of the models themselves. Social uncertainty may often be the most significant component of the total uncertainty associated with just how a water resource system will perform. For this reason we should seek designs and operating policies that are flexible and adaptable.

When uncertainties associated with system operation under a new operating regime are large, one should anticipate the need to make changes and improvements as experience is gained and new information accumulates. When predictions are highly unreliable, responsible managers should favor actions that are robust (e.g., good under a wide range of situations), gain information through research and experimentation, monitor results to provide feedback for the next decision, update assessments and modify policies in the light of new information, and avoid irreversible actions and commitments.

3. Variability and uncertainty in model output

Differences between model output and observed values can result from either natural variability, say caused by unpredictable rainfall, evapotranspiration, water consumption, and the like, and/or by both known and unknown errors in the input data, the model parameters, or the model itself. The later is sometimes called knowledge uncertainty but it isn't always due to a lack of knowledge. Models are always simplifications of reality and hence 'imprecision' can result. Sometimes imprecision occurs because of a lack of knowledge, such as just how a

particular species will react to various environmental and other habitat conditions. Other times known errors are introduced simply for practical reasons.

Imperfect representation of processes in a model constitutes model structural uncertainty. Imperfect knowledge of the values of parameters associated with these processes constitutes model parameter uncertainty. Natural variability includes both temporal variability and spatial variability, to which model input values may be subject.

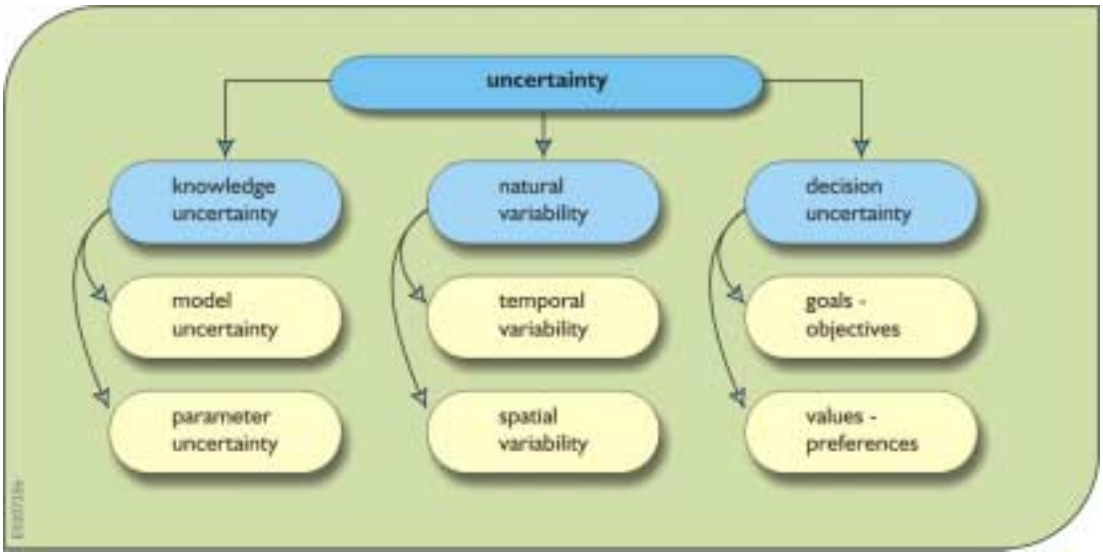

Figure 3. One way of classifying types of uncertainty.

Figure 3 illustrates these different types of uncertainty. For example, the rainfall measured at a weather station within a particular model grid cell may be used as an input value for that cell, but the rainfall may actually vary at different points within that cell and its mean value will vary across the landscape. Knowledge uncertainty can be reduced through further measurement and/or research. Natural variability is a property of the natural system, and is usually not reducible at the scale being used. Decision uncertainty is simply an acknowledgement that we cannot predict ahead of time just what decisions individuals and organizations will make, or even just what particular set of goals or objectives will be considered and the relative importance of each.

Rather than contrasting 'knowledge' uncertainty vs. natural variability vs. decision uncertainty, one can classify uncertainty in another way based on specific sources of uncertainty, such as those listed below, and address ways of identifying and dealing with each source of uncertainty.

Informational Uncertainties:

- imprecision in specifying the boundary and initial conditions that impact the output variable values
- imprecision in measuring observed output variable values

Model Uncertainties:

- uncertain model structure and parameter values
- variability of observed input and output values over a region smaller than the spatial scale of the model
- variability of observed model input and output values within a time smaller than the temporal scale of the model. (e.g., rainfall and depths and flows within a day)
- errors in linking models of different spatial and temporal scales

Numerical Errors:

- errors in the model solution algorithm

3.1 Natural variability

The main source of hydrologic model output value variability is the natural variability in hydrological and meteorological input series. Periods of normal precipitation and temperature can be interrupted by periods of extended drought and intense meteorological events such as hurricanes and tornadoes. There is no reason to think such events will not continue to occur and become even more frequent and extreme. Research has demonstrated that climate has been variable in the past and concerns about anthropogenic activities that may increase that variability increase each year. Sensitivity analysis can help assess the affect of errors in predictions if those predictions are based only on past records of historical time-series data describing precipitation, temperature and other exogenous forces across and on the border of the regions being studied.

Time series input data are often actual, or at least based on, historical data. The time-series values typically describe historical conditions including droughts and wet periods. What is distinctive about natural uncertainty, as opposed to errors and uncertainty due to modeling limitations, is that natural variability in meteorological forces cannot be reduced by improving the model's structure, increasing the resolution of the simulation, or by better calibration of model parameters.

Errors result if meteorological values are not measured or recorded accurately, or if mistakes are made in the generation of computer data files. Furthermore, there is no assurance the statistical properties of historical data will accurately represent the statistical properties of future data. Actual future precipitation and temperature scenarios will be different from those in the past, and this difference in many cases may have a larger affect than the uncertainty due to incorrect parameter values. However, the affects of uncertainties in the parameter values

used in stochastic generation models are often much more significant than the affects of using different stochastic generation models (Stedinger and Taylor, 1982).

While variability of model output is a direct result of variability of model input (e.g., hydrologic and meteorological data), the extent of the variability, and the lower and upper limits of that variability, may also be affected by errors in the inputs, the values of parameters, initial boundary conditions, model structure, processes and solution algorithms.

Figure 4 illustrates the distinction between the variability of a system performance indicator due to input data variability, and the extended range of variability due to the total uncertainty associated with any combination of the causes listed in the previous section. This extended range is what is of interest to water resource planners and managers.

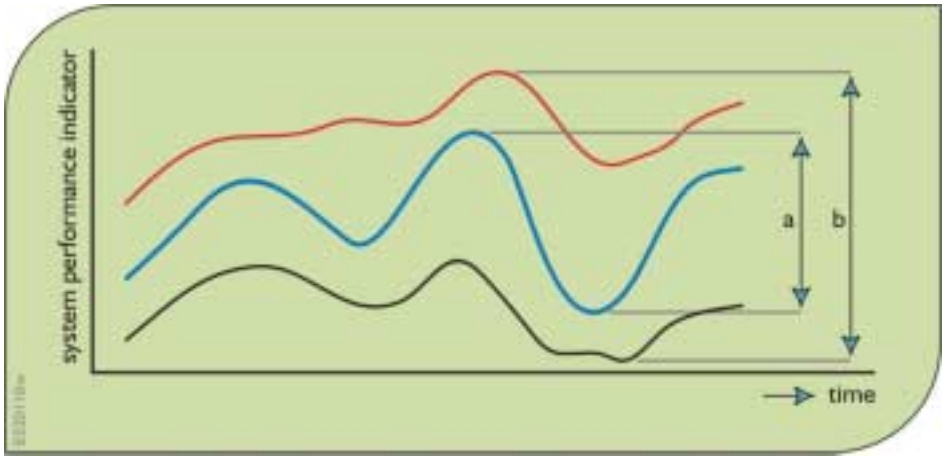

Figure 4. Time-series of model output or system performance showing variability over time. Range "a" results from the natural variability of input data over time. The extended range "b" results from the variability of natural input data as well as from imprecision in input data measurement, parameter value estimation, model structure and errors in model solution algorithms. The extent of this range will depend on the confidence level associated with that range.

What can occur in practice is a time-series of system performance indicator values that can range anywhere within or even outside the extended range, assuming the confidence level of that extended range is less than 100%. The confidence one can have that some future value of a time series will be within a given range is dependent on two factors. The first is the number of measurements used to compute the confidence limits. The second is on the assumption that those measurements are representative of - come from the same statistical or stochastic process yielding - future measurements. Figure 5 illustrates this point. Note that the time series may even contain values outside the range "b" defined in Figure 4 if the confidence level of that range is less than 100%. Confidence intervals associated with less than 100% certainty will not include every possible value that might occur.

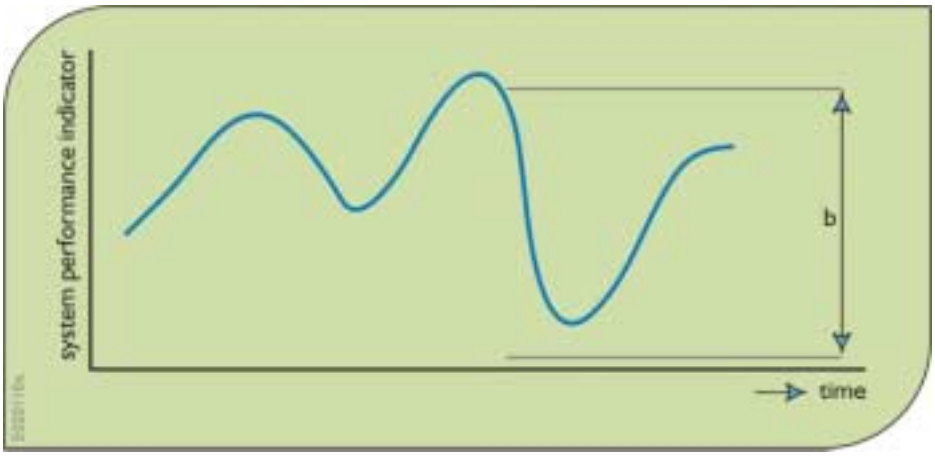

Figure 5. Typical time series of model output or system performance indicator values that are the result of input data variability and possible imprecision in input data measurement, parameter value estimation, model structure and errors in model solution algorithms.

3.2 Knowledge uncertainty

Referring to Figure 3, knowledge uncertainty includes model structure and parameter value uncertainties. First we consider parameter value uncertainty including boundary condition uncertainty, and then model and solution algorithm uncertainty.

3.2.1 Parameter value uncertainty

A possible source of uncertainty in model output results from uncertain estimates of various model parameter values. If the model calibration procedure were repeated using different data sets, different parameter values would result. Those values would yield different simulated system behavior, and thus different predictions. We can call this parameter uncertainty in the predictions because it is caused by imprecise parameter values. If such parameter value imprecision were eliminated, then the prediction would always be the same and so the parameter value uncertainty in the predictions would be zero. But this does not mean that predictions would be perfectly accurate.

In addition to parameter value imprecision, uncertainty in model output can result from imprecise specification of boundary conditions. These boundary conditions can be either fixed or variable. However, because they are not being computed based on the state of the system, their values can be uncertain. These uncertainties can affect the model output, especially in the vicinity of the boundary, in each time step of the simulation.

3.2.2 Model structural and computational errors

Uncertainty in model output can also result from errors in the model structure compared to the real system, and approximations made by numerical methods employed in the simulation. No matter how good our parameter value estimates, our models are not perfect and there is a residual model error. Increasing model complexity to more closely represent the complexity of the real system may not only add to the cost of data collection, but also introduce even more parameters, and thus even more potential sources of error in model output. It is not an easy task to judge the appropriate level of model complexity, and to estimate the resulting levels of uncertainty associated with various assumptions regarding model structure and solution methods. Kuczera (1988) provides an example of a conceptual hydrologic modeling exercise with daily time steps where model uncertainty dominated parameter value uncertainty.

3.3 Decision uncertainty

Uncertainty in model predictions can result from unanticipated changes in what is being modeled. These can include changes in nature, human goals, interests, activities, demands, and impacts. An example of this is the deviation from standard or published operating policies by operators of infrastructure such as canal gates, pumps, and reservoirs in the field, as compared to what is specified in documents and incorporated into the water systems models. Comparing field data with model data for model calibration may yield incorrect calibrations if operating policies actually implemented in the field differ significantly from those built into the models. What do operators do in times of stress? And can anyone identify a place where deviations from published policies do not occur?

What humans will want to achieve in the future may not be the same as what they want today. Predictions of what people will want in the future are clearly sources of uncertainty. A perfect example of this is in the very flat Greater Everglades region of south Florida in the US. Fifty years ago folks wanted the swampy region protected from floods and drained for agricultural and urban development. Today many want just the opposite at least where there are no human settlements. They want to return to a more natural hydrologic system with more wetlands and unobstructed flows, but now for ecological restoration objectives that were not a major concern or much appreciated some half a century ago. Once the mosquitoes return and if the sea level continues to rise, future populations who live there may want more flood control and drainage again. Who knows? Complex changing social and economic processes influence human activities and their demands for water resources and environmental amenities over time. Some of these processes reflect changes in local concerns, interests and activities, but population migration and many economic activities and social attitudes can also reflect changing national and international trends.

Sensitivity scenarios that include human activities can help define the affects of those activities within an area. It is important that careful attention go into the development of these alternative scenarios so that they realistically capture the forces or stresses that the system may face. The history of systems studies are full of examples where the issues studied were rapidly

overwhelmed by much larger social forces resulting from, for example, the relocation of major economic activities, an oil embargo, changes in national demand for natural resources, economic recession, sea-level rise, an act of terrorism, or even war. One thing is sure; the future will be different than the past, and no one is certain just how.

3.3.1 Surprises

Water resource managers may also want to consider how vulnerable a system is to undesirable environmental surprises. What havoc might an introduced species like the zebra mussel invading the Great Lakes of North America have in a particular watershed? Might some introduced disease suddenly threaten key plant or animal species? Might management plans have to be restructured to address the survival of some species such as salmon in the Rhine River in Europe or in the Columbia River in North America? Such uncertainties are hard to anticipate when by their nature they are truly surprises. But surprises should be expected. Hence system flexibility and adaptability should be sought to deal with changing management demands, objectives, and constraints.

4. Sensitivity and uncertainty analyses

An uncertainty analysis is not the same as a sensitivity analysis. An uncertainty analysis attempts to describe the entire set of possible outcomes, together with their associated probabilities of occurrence. A sensitivity analysis attempts to determine the relative change in model output values given modest changes in model input values. A sensitivity analysis thus measures the change in the model output in a localized region of the space of inputs. However, one can often use the same set of model runs for both uncertainty analyses and sensitivity analyses. It is possible to carry out a sensitivity analysis of the model around a current solution and then use it as part of a first order uncertainty analysis.

This discussion begins by focusing on some methods of uncertainty analysis. Then various ways of performing and displaying sensitivity analyses are reviewed.

4.1 Uncertainty Analyses

Recall that uncertainty involves the notion of randomness. If a value of a performance indicator or performance measure, or in fact any variable, like the phosphorus concentration or the depth of water at a particular location varies and this variation over space and time cannot be predicted with certainty, it is called a random variable. One cannot say with certainty what the value of a random variable will be but only the likelihood or probability that it will be within some specified range of values. The probabilities of observing particular ranges of values of a random variable are described or defined by a probability distribution. There are many types of distributions and each can be expressed in several ways as presented in Chapter III.

Suppose the random variable is X. If the observed values of this random variable can be only discrete values, the probability distribution of X can be expressed as a histogram, as shown in Figure 6a. The sum of the probabilities for all possible outcomes must equal 1. If the random variable is a continuous variable that can assume any real value over a range of values, the probability distribution of X can be expressed as a continuous distribution as shown in Figure 6b. The shaded area under the density function for the continuous distribution is 1. The area between two values of the continuous random variable, such as between u and v in Figure 6c, represents the probability that the observed value x of the random variable value X will be within that range of values.

The probability distribution, $P_X(x)$ shown in Figure 6 (a) is called a probability mass function. The probability distributions shown in Figure 6 (b and c) are called a probability density functions (pdf) and are denoted by $f_X(x)$. The subscript X of P_X and f_X represents the random variable, and the variable x is some value of that random variable X.

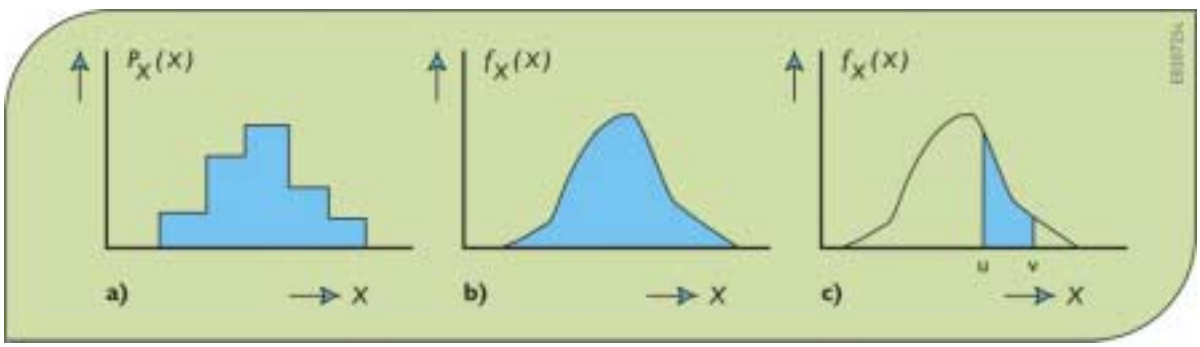

Figure 6. Probability distributions for a discrete or continuous random variable X. The area under the distributions (shaded areas in a and b) is 1, and the shaded area in c is the probability that the observed value x of the random variable X will be between u and v.

Uncertainty analyses involve identifying characteristics of various probability distributions of model input and output variables, and subsequently functions of those random output variables that are performance indicators or measures. Often targets associated with these indicators or measures are themselves uncertain.

A complete uncertainty analysis would involve a comprehensive identification of all sources of uncertainty that contribute to the joint probability distributions of each input or output variable. Assume such analyses were performed for two alternative project plans, A and B, and that the resulting probability density distributions for a specified performance measure were as shown in Figure 7. Figure 7 also identifies the costs of these two projects. The introduction of two performance criteria, cost and probability of exceeding a performance measure target (e.g., a pollutant concentration standard) introduces a conflict where a tradeoff must be made.

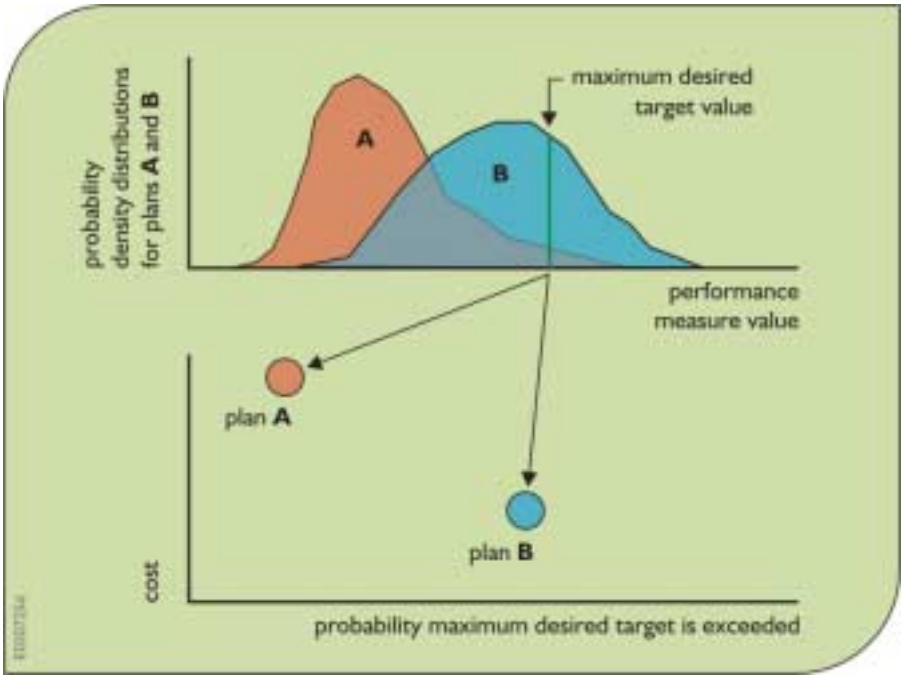

Figure 7. Tradeoffs involving cost and the probability that a maximum desired target value will be exceeded. In this illustration we want the lowest cost (*B* is best) and the lowest probability of exceedance (*A* is best).

4.1.1 Model and model parameter uncertainties

Consider a situation as shown in Figure 8, in which for a specific set of model inputs, the model outputs differ from the observed values, and for those model inputs, the observed values are always the same. Here nothing randomly occurs. The model parameter values or model structure needs to be changed. This is typically done in a model calibration process.

Given specific inputs, the outputs of deterministic models are always going to be the same each time those inputs are simulated. If for specified inputs to any simulation model the predicted output does not agree with the observed value, as shown in Figure 8, this could result from imprecision in the measurement of observed data. It could also result from imprecision in the model parameter values, the model structure, or the algorithm used to solve the model.

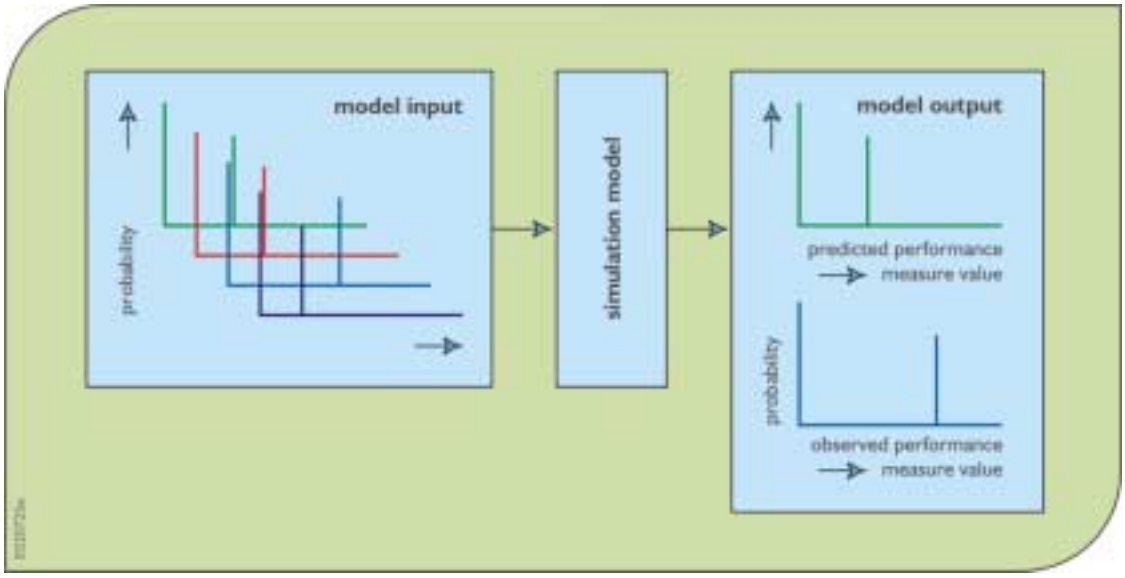

Figure 8. A deterministic system and a simulation model of that system needing calibration or modification in its structure. There is no randomness, only parameter value or model structure errors to be identified and corrected.

Next consider the same deterministic simulation model but now assume at least some of the inputs are random, i.e., not predictable, as may be case when random outputs of one model are used as inputs into another model. Random inputs will yield random outputs. The model input and output values can be described by probability distributions. If the uncertainty in the output is due only to the uncertainty in the input, the situation is similar to that shown in Figure 8. If the distribution of performance measure output values does not fit or is not identical to the distribution of observed performance measure values, then calibration of model parameter values or modification of model structure may be needed.

If a model calibration or 'identification' exercise finds the 'best' values of the parameters to be outside reasonable ranges of values based on scientific knowledge, then the model structure or algorithm might be in error. Assuming the algorithms used to solve the models are correct and observed measurements of system performance vary for the same model inputs, as shown in Figure 9, it can be assumed that the model structure does not capture all the processes that are taking place that impact the value of the performance measures. This is often the case when relatively simple and low-resolution models are used to estimate the hydrological and ecological impacts of water and land management policies. However, even large and complex models can fail to include or adequately describe important phenomena.

In the presence of informational uncertainties there may be considerable uncertainty about the values of the "best" parameters during calibration. This problem becomes even more pronounced with increases in model complexity.

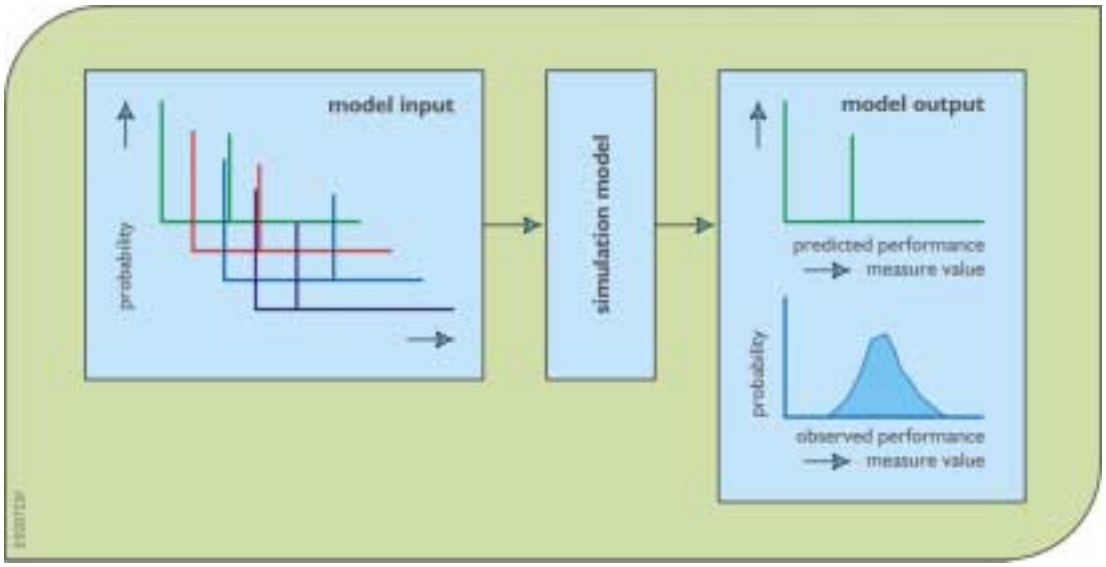

Figure A deterministic simulation model of a 'random or stochastic' system. To produce the variability in the model output that is observed in the real system, even given the same input values, the model's parameter values may need to vary over distributions of values and/or the model structure may need modification along with additional model inputs.

An example: Consider the prediction of a pollutant concentration at some site downstream of a pollutant discharge site. Given a streamflow Q (in units of 1000 m^3/day), the distance between the discharge site and the monitoring site, X (m), the pollutant decay rate constant k (day^{-1}), and the pollutant discharge W (Kg/day), we can use the following simplified model to predict the concentration of the pollutant C (g/m^3 = mg/l) at the downstream monitoring site:

$$C = (W/Q)\exp\{-k(X/U)\}$$

In the above equation assume the velocity U (m/day) is a known function of the streamflow Q.

In this case the observed value of the pollutant concentration C may differ from the computed value of C even for the same inputs of W, Q, k, X, and U. Furthermore, this difference varies in different time periods. This apparent variability, as illustrated in Figure 9, can be simulated using the same model but by assuming a distribution of values for the decay rate constant k. Alternatively the model structure can be modified to include the impact of streamflow temperature T on the prediction of C.

$$C = (W/Q)\exp\{-k\theta^{T-20}(X/U)\}$$

Now there are two model parameters, the decay rate constant k and the dimensionless temperature correction factor θ and an additional model input, the streamflow temperature, T. It could be that the variation in streamflow temperature was the sole cause of the first

equation's 'uncertainty' and that the assumed parameter distribution of k was simply the result of the distribution of streamflow temperatures on the term $k\theta^{T-20}$.

If the output were still random given constant values of all the inputs, then another source of uncertainty exists. This uncertainty might be due to additional random loadings of the pollutant, possibly from non-point sources. Once again the model could be modified to include these additional loadings if they are knowable. Assuming these additional loadings are not known, a new random parameter could be added to the input variable W or to the right hand side of the equations above that would attempt to capture the impact on C of these additional loadings. A potential problem, however, might be the likely correlation between those additional loadings and the streamflow Q.

While adding model detail removed some 'uncertainty' in the above example, increasing model complexity will not always eliminate or reduce uncertainty in model output. Adding complexity is generally not a good idea when the increased complexity is based on processes whose parameters are difficult to measure, the right equations are not known at the scale of application, or the amount of data for calibration is small compared to the number of parameters.

Even if more detailed models requiring more input data and more parameter values were to be developed, the likelihood of capturing all the processes occurring in a complex system is small. Hence those involved will have to make decisions taking this uncertainty into account. Imprecision will always exist due to less than a complete understanding of the system and the hydrologic processes being modeled. A number of studies have addressed model simplification, but only in some simple cases have statisticians been able to identify just how one might minimize modeling related errors in model output values.

The problem of determining the "optimal" level of modeling detail is particularly important when simulating the hydrologic events at many sites over large areas. Perhaps the best approach for these simulations is to establish confidence levels for alternative sets of models and then statistically compare simulation results. But even this is not a trivial or costless task. Increases in the temporal or spatial resolution typically require considerable data collection and/or processing, model recalibrations, and possibly the solution of stability problems resulting from the numerical methods used in the models. Obtaining and implementing alternative hydrologic simulation models will typically involve considerable investments of money and time for data preparation and model calibration.

What is needed is a way to predict the variability evident in the system shown in Figure 9. Instead of a fixed output vector for each fixed input vector, a distribution of outputs are needed for each performance measure based on fixed inputs (Figure 9) or a distribution of inputs (Figure 10.). Furthermore the model output distribution for each performance measure should 'match' as well as possible the observed distribution of that performance measure.

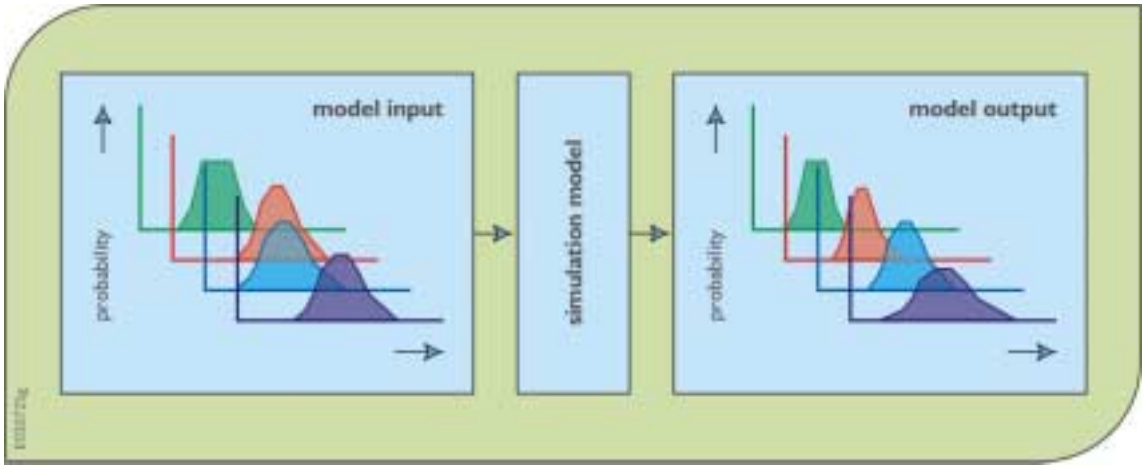

Figure 10. Simulating variable inputs to obtain probability distributions of predicted performance indices that match the probability distributions of observed performance values.

4.1.2 What uncertainty analysis can provide

An uncertainty analysis takes a set of randomly chosen input values (that can include parameter values), passes them through a model (or transfer function) to obtain the distributions (or statistical measures of the distributions) of the resulting outputs. As illustrated in Figure 11, the output distributions can be used to

- Describe the range of potential outputs of the system at some probability level.
- Estimate the probability that the output will exceed a specific threshold or performance measure target value.

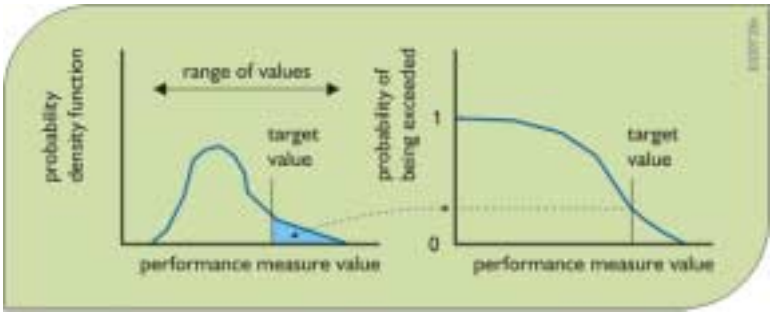

Figure 11. The distribution of performance measures defines range of potential values and the likelihood that a specified target value will be exceeded. The shaded area under the density function on the left represents the probability that the target value will be exceeded. This probability is shown in the probability of exceedance plot on the right.

Common uses for uncertainty analyses are to make general inferences, such as the following:

- Estimating the mean and standard deviation of the outputs.
- Estimating the probability the performance measure will exceed a specific threshold.
- Putting a reliability level on a function of the outputs, e.g., the range of function values that is likely to occur with some probability.
- Describing the likelihood of different potential outputs of the system.

Implicit in any uncertainty analysis are the assumptions that statistical distributions for the input values are correct and that the model is a sufficiently realistic description of the processes taking place in the system. Neither of these assumptions is likely to be entirely correct.

4.2 Sensitivity analyses

"Sensitivity analysis" is aimed at describing how much model output values are affected by changes in model input values. It is the investigation of the importance of imprecision or uncertainty in model inputs in a decision making or modeling process. The exact character of sensitivity analysis depends upon the particular context and the questions of concern. Sensitivity studies can provide a general assessment of model precision when used to assess system performance for alternative scenarios, as well as detailed information addressing the relative significance of errors in various parameters. As a result, sensitivity results should be of interest to the general public, federal and state management agencies, local watershed planners and managers, model users, and model developers.

Clearly, upper level management and the public may be interested in more general statements of model precision, and should be provided such information along with model predictions. On the other hand, detailed studies addressing the significance and interactions among individual parameters would likely be meaningful to model developers and some model users. They can use such data to interpret model results and to identify where efforts to improve models and their input values should be directed.

Initial sensitivity analysis studies could focus on two products:

(1) detailed results to guide research and assist model development efforts, and
(2) calculation of general descriptions of uncertainty associated with model predictions so that policy decisions can reflect both the modeling efforts best prediction of system performance and the precision of such predictions.

In the first case, knowing the relative uncertainty in model projections due to possible errors in different sets of parameters and input data should assist in efforts to improve the precision of model projections. This knowledge should also contribute to a better understanding of the relationships between model assumptions, parameters, data and model predictions.

For the second case, knowing the relative precision associated with model predictions should have a significant effect on policy development. For example, the analysis may show that, given data inadequacies, there are very large error bands associated with some model variables. When such large uncertainties exist, predictions should be used with appropriate skepticism.

Incremental strategies should be explored along with monitoring so that greater experience can accumulate to resolve some of those uncertainties.

Sensitivity analysis features are available in many linear and nonlinear programming (optimization) packages. They identify the changes in the values of the objective function and unknown decision variables given a change in the model input values, and a change in levels set for various constraints (Chapter V). Thus sensitivity analysis addresses the change in "optimal" system performance associated with changes in various parameter values, and also how "optimal" decisions would change with changes in resource constraint levels, or target output requirements. This kind of sensitivity analysis provides estimates of how much another unit of resource would be worth, or what "cost" a proposed change in a constraint places on the optimal solution. This information is of value to those making design decisions.

Various techniques have been developed to determine how sensitive model outputs are to changes in model inputs. Most approaches examine the affects of changes in a single parameter value or input variable assuming no changes in all the other inputs. Sensitivity analyses can be extended to examine the combined effects of multiple sources of error, as well.

Changes in particular model input values can affect model output values in different ways. It is generally true that only a relatively few input variables dominate or substantially influence the values of a particular output variable or performance indicator at a particular location and time. If the range of uncertainty of only some of the output data is of interest, then undoubtedly only those input data that significantly impact on the values of those output data need be included in the sensitivity analysis.

If input data estimates are based on repeated measurements, a frequency distribution can be estimated that characterizes natural variability. The shorter the record of measurements, the greater will be the uncertainty regarding the long-term statistical characteristics of that variability. If obtaining a sufficient number of replicate measurements is not possible, subjective estimates of input data ranges and probability distributions are often made. Using a mixture of subjective estimates and actual measurements does not affect the application of various sensitivity analysis methods that can use these sets or distributions of input values, but it may affect the conclusions that can be drawn from the results of these analyses.

It would be nice to have available accurate and easy-to-use analytical methods for relating errors in input data to errors in model outputs, and to errors in system performance indicator values that are derived from model output. Such analytical methods do not exist for complex simulation models. However methods based on simplifying assumptions and approximations can be used to yield useful sensitivity information. Some of these are reviewed in the remainder of this chapter.

4.2.1 Sensitivity coefficients

One measure of sensitivity is the sensitivity coefficient. This is the derivative of a model output variable with respect to an input variable or parameter. A number of sensitivity

analysis methods use these coefficients. First-order and approximate first-order sensitivity analyses are two such methods that will be discussed later. The difficulty of

1. obtaining the derivatives for many models,
2. needing to assume mathematical (usually linear) relationships when obtaining estimates of derivatives by making small changes of input data values near their nominal or most likely values, and
3. having large variances associated with most hydrologic process models have motivated the replacement of analytical methods by numerical and statistical approaches to sensitivity analysis.

Implicit in any sensitivity analysis are the assumptions that statistical distributions for the input values are correct and that the model is a sufficiently realistic description of the processes taking place in the system. Neither of these assumptions is likely to be entirely correct.

The importance of the assumption that the statistical distributions for the input values are correct is easy to check by using different distributions for the input parameters. If the outputs vary significantly, then the output is sensitive to the specification of the input distributions and hence they should be defined with care. A relatively simple deterministic sensitivity analysis can be of value here (Benaman, 2002). A sensitivity coefficient can be used to measure the magnitude of change in an output variable Q per unit change in the magnitude of an input parameter value P from its base value P_o. Let SI_{PQ} be the sensitivity index for an output variable Q with respect to a change ΔP in the value of the input variable P from its base value P_o. Noting that the value of the output $Q(P)$ is a function of P, the sensitivity index could be defined as

$$SI_{PQ} = [\ Q(P_o + \Delta P) - Q(P_o - \Delta P)\ ] / 2\ \Delta P \qquad (1)$$

Other sensitivity indices could be defined (McCuen 1973). Letting the index i represent a decrease and j represent an increase in the parameter value from its base value P_o, the sensitivity index SI_{PQ} for parameter P and output variable Q is could be defined as

$$SI_{PQ} = \{\ |\ (Q_o - Q_i) / (P_o - P_i\ )\ |\ +\ |\ (Q_o - Q_j) / (P_o - P_j\ )\ |\ \}\ /\ 2 \qquad (2)$$

or

$$SI_{PQ} = \max\ \{\ |\ (Q_o - Q_i) / (P_o - P_i\ )\ |\ ,\ |\ (Q_o - Q_j) / (P_o - P_j\ )\ |\ \} \qquad (3)$$

A dimensionless expression of sensitivity is the elasticity index, EI_{PQ}, that measures the relative change in output Q for a relative change in input P could be defined as

$$EI_{PQ} = [P_o / Q(P_o)]\ SI_{PQ} \qquad (4)$$

4.2.2 A simple deterministic sensitivity analysis procedure

This deterministic sensitivity analysis approach is very similar those most often employed in the engineering economics literature. It is based on the idea of varying one uncertain parameter value, or set of parameter values, at a time. The ideas are applied to a water quality example to illustrate their use.

The output variable of interest can be any performance measure or indicator. Thus one does not know if more or less of a given variable is better or worse. Perhaps too much and/or too little is undesirable. The key idea is that, whether employing physical measures or economic metrics of performance, various parameters (or sets of associated parameters) are assigned high and low values. Such ranges may reflect either the differences between the minimum and maximum values for each parameter, the 5 and 95 percentiles of a parameters distribution, or points corresponding to some other criteria. The system model is then run with the various alternatives, one at a time, to evaluate the impact of those errors in various sets of parameter values on the output variable.

Table 1 illustrates the character of the results that one would obtain. Here Y_0 is the nominal value of the model output when all parameters assume the estimated best values, and $Y_{i,L}$ and $Y_{i,H}$ are the values obtained by increasing or decreasing the values of the ith set of parameters.

Table 1. Sensitivity of model output Y to possible errors in four parameter sets containing a single parameter or a group of parameters that vary together.

parameter set	low value	nominal	high value
1	$Y_{1,L}$	Y_0	$Y_{1,H}$
2	$Y_{2,L}$	Y_0	$Y_{2,H}$
3	$Y_{3,L}$	Y_0	$Y_{3,H}$
4	$Y_{4,L}$	Y_0	$Y_{4,H}$

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A simple water quality example is employed to illustrate this deterministic approach to sensitivity analysis. The analysis techniques illustrated here are just as applicable to complex models. The primary difference is that more work would be required to evaluate the various alternatives with a more complex model, and the model responses might be more complicated.

The simple water quality model is provided by Vollenweider's empirical relationship for the average phosphorus concentration in lakes (Vollenweider, 1976). He found that the phosphorus concentration, P (mg/m^3), is a function of the annual phosphorus loading rate, L (mg/m^2•a), the annual hydraulic loading, q (m/a or more exactly m^3/m^2•a), and the mean water depth, z (m).

$$P = (L/q) / [\ 1 + (z/q)^{0.5}\ ] \qquad (5)$$

L/q and P have the same units; the denominator is an empirical factor that compensates for nutrient recycling and elimination within the aquatic lake environment.

Data for Lake Ontario in North America would suggest that reasonable values of the parameters are L = 680 mg/m^3; q = 10.6 m/a; and z = 84 m, yielding P = 16.8 mg/m^3. Values of phosphorus concentrations less than 10 mg/m^3 are considered oligotrophic, whereas values greater than 20 mg/m^3 generally correspond to eutrophic conditions. Reasonable ranges reflecting possible errors in the three parameters yield the values in Table 2.

Table 2. Sensitivity of estimates of phosphorus concentration (mg/m^3) to model parameter values. The two right most values in each row correspond to the Low and High values of the parameter, respectively

	parameter value		phosphorus concentration	
	low	high	P_{low}	P_{high}
L – P loading (mg/m^3. a)	500	900	12.4	22.3
q – hydraulic loading (m/a)	8	13.5	20.0	14.4
z – mean depth (m)	81	87	17.0	16.6

One may want to display these results so they can be readily visualized and understood. A tornado diagram (Eschenbach, 1992) would show the lower and upper values of P obtained from variation of each parameter, with the parameter with the widest limits displayed on top, and the parameter having smallest limits on the bottom. Tornado diagrams (Figure 12) are easy to construct and can include a large number of parameters without becoming crowded.

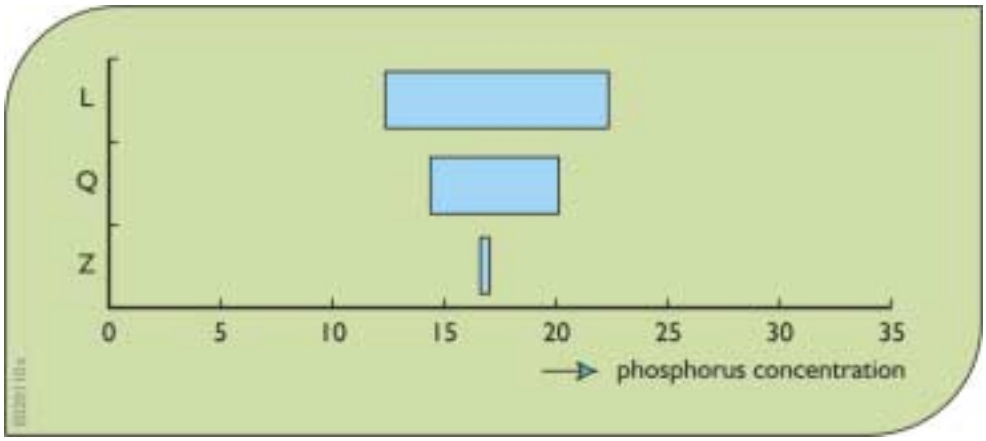

Figure 12. A Tornado diagram showing the range of the output variable representing phosphorus concentrations for high and low values of each of the parameter sets. Parameters are sorted so that the largest range is on top, and the smallest on the bottom.

An alternative to tornado diagrams is a Pareto chart showing the width of the uncertainty range associated with each variable, ordered from largest to smallest. A Pareto chart is illustrated in Figure 13.

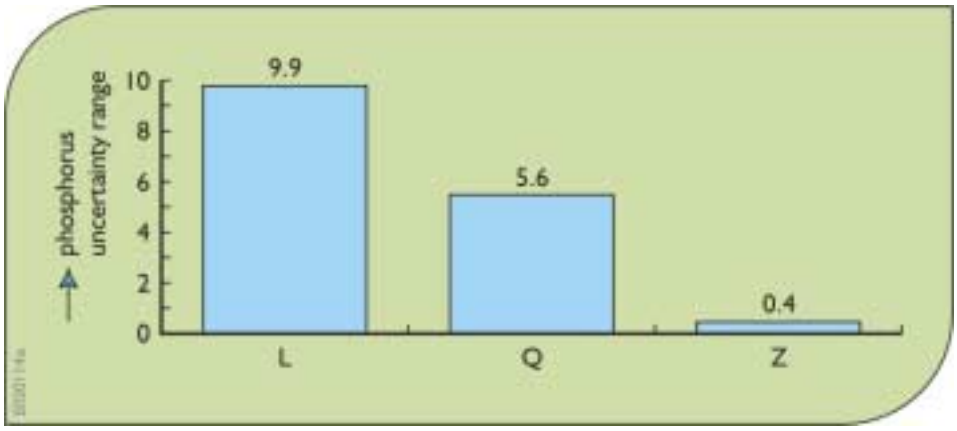

Figure 13. A Pareto Chart showing the range of the output variable representing phosphorus concentrations resulting from high and low values of each parameter set considered.

Another visual presentation is a spider plot showing the impact of uncertainty in each parameter on the variable in question, all on the same graph (Eschenback, 1992; DeGarmo, 1993, p. 401). A spider plot, Figure 14, shows the particular functional response of the output to each parameter on a common scale, so one needs a common metric to represent changes in all of the parameters. Here we use percentage change from the nominal or best values.

Spider plots are a little harder to construct than tornado diagrams, and can generally include only 4 - 5 variables without becoming crowded. However, they provide a more complete view of the relationships between each parameter and the performance measure. In particular, a spider plot reveals nonlinear relationships and the relative sensitivity of the performance measure to (percentage) changes in each variable.

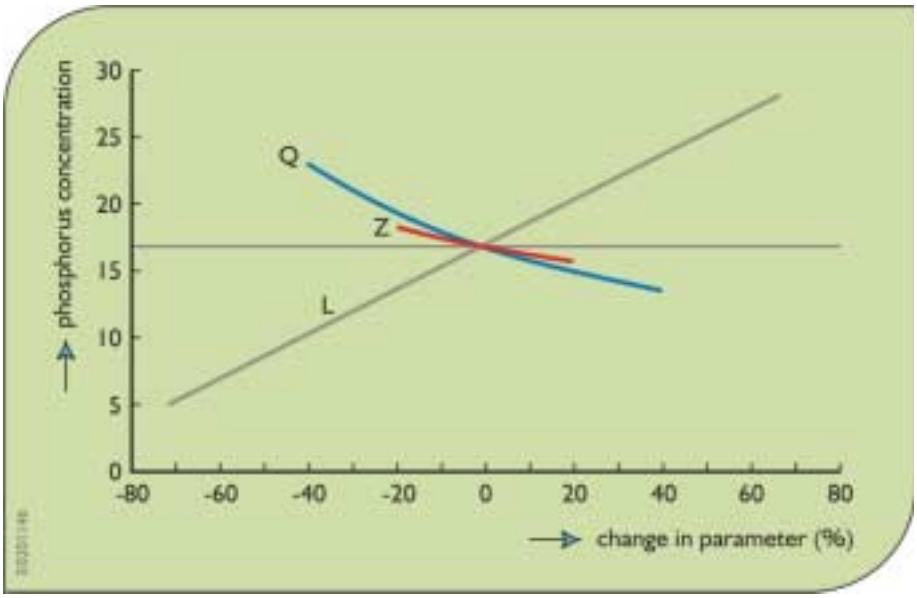

Figure 14. Spider Plot illustrates the relationships between model output describing phosphorus concentrations and variations in each of the parameter sets, expressed as a percentage deviation from their nominal values.

In the spider plot, the linear relationship between *P* and *L* and the gentle nonlinear relationship between *P* and *q* is illustrated. The range for *z* has been kept small given the limited uncertainty associated with that parameter.

4.2.3 Multiple errors and interactions

An important issue that should not be ignored is the impact of simultaneous errors in more than one parameter. Probabilistic methods directly address the occurrence of simultaneous errors, but the correct joint distribution needs to be employed. With simple sensitivity analysis procedures, errors in parameters are generally investigated one at a time, or in groups. The idea of considering pairs or sets of parameters is discussed here.

Groups of factors. It is often the case that reasonable error scenarios would have several parameters changing together. For this reason, the alternatives have been called parameter sets. For example, possible errors in water depth would be accompanied with corresponding variations in aquatic vegetation and chemical parameters. Likewise, alternatives related to changes in model structure might be accompanied with variations in several parameters. In other cases, there may be no causal relationship among possible errors (such as model structure

versus inflows at the boundary of the modeled region), but they might still interact to effect the precision of model predictions.

Combinations. If one or more non-grouped parameters interact in significant ways, then combinations of one or more errors should be investigated. However, one immediately runs into a combinatorial problem. If each of m parameters can have 3 values (high, nominal, and low) there are 3^m combinations, as opposed to 2m + 1 if each parameter is varied separately. [For m = 5, the differences are $3^5 = 243$ versus 2(5)+1 = 11.] These numbers can be reduced by considering instead only combinations of extremes so that only $2^m + 1$ cases need be considered [$2^5 + 1 = 33$], which is a more manageable number. However, all of the parameters would be at one extreme or the other, and such situations would be very unusual.

Two factors at a time. A compromise is to consider all pairs of two parameters at a time. There are m(m-1)/2 possible pairs of m parameters. Each parameter has a high and low value. Since there are 4 combinations of high and low values for each pair, there are a total of 2m(m-1) combinations. [For m = 5 there are 40 combinations of two parameters each having two values.]

The presentation of these results could be simplified by displaying for each case only the maximum error, which would result in m(m-1)/2 cases that might be displayed in a Pareto diagram. This would allow identification of those combinations of two parameters that might yield the largest errors and thus are of most concern.

For the water quality example, if one plots the absolute value of the error for all four combinations of high (+) and low (-) values for each pair of parameters, they obtain Figure 15.

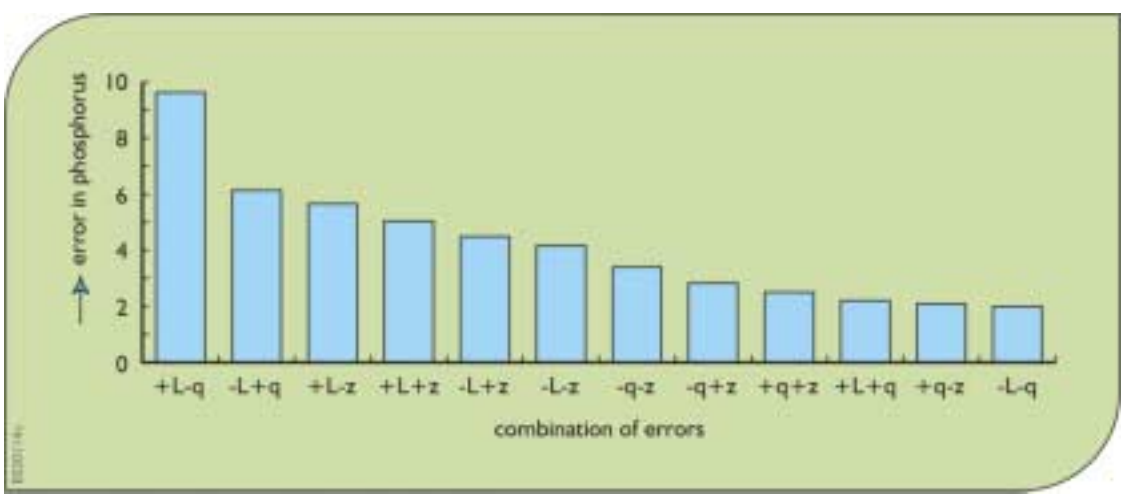

Figure 15. Pareto diagram showing errors in phosphorus concentrations for all combinations of pairs of input parameters errors. A + indicates a high value, and a - indicates a low value for indicated parameter. *L* is the phosphorus loading rate, *q* is the hydraulic loading, and *z* is the mean lake depth.

Considering only the worst error for each pair of variables yields Figure 16.

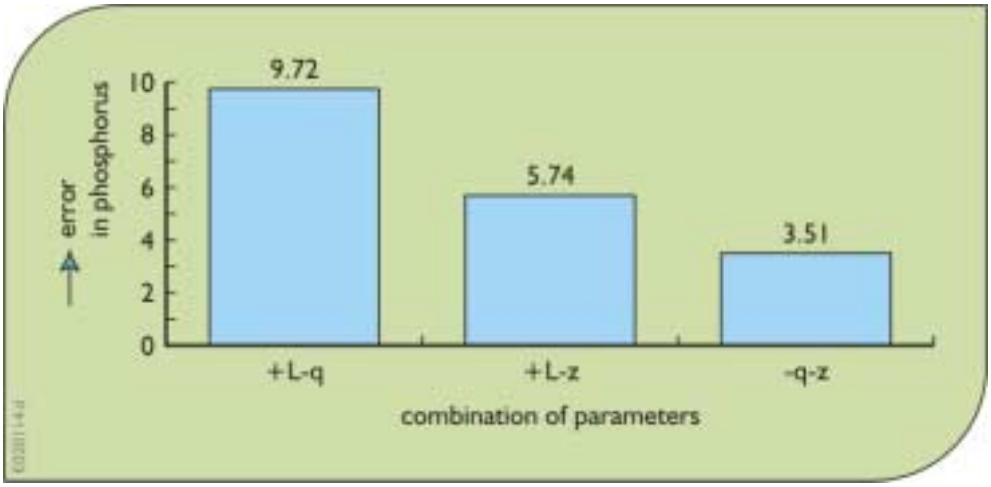

Figure 16. Pareto diagram showing worst error combinations for each pair of input parameters. A '+' indicates a high value, and a '–' indicates a low value for indicated parameter.

Here we see, as is no surprise, that the worst error results from the most unfavorable combination of L and q values. If both parameters have their most unfavorable values, the predicted phosphorus concentration would be 27 mg/m^3.

Looking for non-linearities. One might also display in a Pareto diagram the maximum error for each pair as a percentage of the sum of the absolute values of the maximum error from each parameter separately. The ratio of the joint error to the individual errors would illustrate potentially important nonlinear interactions. If the model of the system and the physical measure or economic metric were strictly linear, then the individual ratios should add to one.

4.2.4 First-order sensitivity analysis

The above deterministic analysis has trouble representing reasonable combinations of errors in several parameter sets. If the errors are independent, it is highly unlikely that any two sets would actually be at their extreme ranges at the same time. By defining probability distributions of the values of the various parameter sets, and specifying their joint distributions, a probabilistic error analysis can be conducted. In particular, for a given performance indicator, one can use multivariate linear analyses to evaluate the approximate impact on the performance indices of uncertainty in various parameters. As shown below, the impact depends upon the square of the sensitivity coefficients (partial derivatives) and the variances and covariances of the parameter sets.

For a performance indicator $I = F(Y)$, which is a function $F(\bullet)$ of model outputs Y, that are in turn a function $g(P)$ of input parameters P, one can use a multivariate Taylor series approximation of F to obtain the expected value and variance of the indicator:

$$E[I] = F(\text{ based on mean values of input parameters}) + (1/2)\ \{\Sigma_i\Sigma_j\ [\partial F^2/\partial P_i \partial P_j]\ \mathrm{Cov}\ [P_i, P_j]\ \} \quad (6)$$

and

$$\mathrm{Var}[I] = \Sigma_i\Sigma_j\ (\partial F/\ \partial P_i)(\partial F/\ \partial P_j)\ \mathrm{Cov}\ [P_i, P_j] \quad (7)$$

where $(\partial F/\partial P_i)$ are the partial derivative of the function F with respect to P_i evaluated at the mean value of the input parameters P_i, and $\partial F^2/\partial P_i \partial P_j$ are the second partial derivatives. The covariance of two random input parameters P_i and P_j is the expected value of the product of differences between the values and their means.

$$\mathrm{Cov}[P_i, P_j] = E[(P_i - E[P_i])(\ P_j - E[P_j])] \quad (8)$$

If all the parameters are independent of each other, and the second-order terms in the expression for the mean $E[I]$ are neglected, one obtains

$$E[I] = F(\text{ based on mean values of input parameters}) \quad (9)$$

and

$$\mathrm{Var}\ [I] = \Sigma_i\ [\partial F/\ \partial P_i]^2\ \mathrm{Var}\ [P_i] \quad (10)$$

(Benjamin and Cornell, 1970). Equation 6 for $E[I]$ shows that in the presence of substantial uncertainty, the mean of the output from nonlinear systems is not simply the system output corresponding to the mean of the parameters (Gaven and Burges, 1981, p. 1523). This is true for any nonlinear function.

Of interest in the analysis of uncertainty is the approximation for the variance $\mathrm{Var}[I]$ of indicator I. In Equation 10 the contribution of P_i to the variance of I equals $\mathrm{Var}[P_i]$ times $[\partial F/\partial P_i]^2$, which are the squares of the sensitivity coefficients for indicator I with respect to each input parameter value P_i.

4.2.4.1 An example of first-order sensitivity analysis

It may appear that first-order analysis is difficult because the partial derivatives of the performance indicator I are needed with respect to the various parameters. However, reasonable approximations of these sensitivity coefficients can be obtained from the simple sensitivity analysis described in Table 3, as shown below. In that table, three different parameter sets, P_i, are defined in which one parameter of the set is at its high value, P_{iH}, and one is at its low value, P_{iL}, to produce corresponding values (called high, I_{iH}, and low, I_{iL}) of a system performance indicator I.

Table 3. Approximate parameter sensitivity coefficients.

parameter set	value low	value high	sensitivity coefficient
1	I_{1L}	I_{1H}	$[I_{1H}-I_{1L}]/[P_{1H}-P_{1L}]$
2	I_{2L}	I_{2H}	$[I_{2H}-I_{2L}]/[P_{2H}-P_{2L}]$
3	I_{3L}	I_{3H}	$[I_{3H}-I_{3L}]/[P_{3H}-P_{3L}]$

It is then necessary to estimate some representation of the variances of the various parameters with some consistent procedure. For a normal distribution, the distance between the 5 and 95 percentiles is 1.645 standard deviations on each side of the mean, or 2(1.645) = 3.3 standard deviations. Thus, if the high/low range is thought of as approximately a 5-95 percentile range for a normally distributed variate, a reasonable approximation of the variance might be

$$\mathrm{Var}[P_i] = \{ [P_{iH}-P_{iL}]/3.3 \}^2. \qquad (11)$$

This is all that is needed. Use of these average sensitivity coefficients is very reasonable for modeling the behavior of the system performance indicator I over the indicated ranges.

As an illustration of the method of first-order uncertainty analysis, consider the lake quality problem described above. The "system performance indicator" in this case is the model output, the phosphorus concentration P, and the input parameters, now denoted as $X = L$, q, and z. The standard deviation of each parameter is assumed to be the specified range divided by 3.3. Average sensitivity coefficients $\partial P/\partial X$ were calculated. The results are reported in the table below.

Table 4. Calculation of approximate parameter sensitivity coefficients.

variable X	units	$\delta P/\delta X$	St Dev[X]	$(\delta P/\delta X)^2$ Var[X]	%
L	$mg/m^2 \cdot a$	0.025	121.21	9.18	75.7
q	m/a	-1.024	1.67	2.92	24.1
z	m	-0.074	1.82	0.02	0.2

Assuming the parameter errors are independent:

$$\mathrm{Var}[P] = 9.18 + 2.92 + 0.02 = 12.12 \qquad (12)$$

The square root of 12.12 is the standard deviation and equals 3.48. This agrees well with a Monte Carlo analysis reported below.

Note that 100*(9.18/12.12), or about 76% of the total parameter error variance in the phosphorus concentration P is associated in the phosphorus loading rate L and the remaining 24% is associated with the hydrologic loading q. Eliminating the uncertainty in z would have a negligible impact on the overall model error. Likewise, reducing the error in q would at best have a modest impact on the total error.

Due to these uncertainties, the estimated phosphorus concentration has a standard deviation of 3.48. Assuming the errors are normally distributed, and recalling that ± 1.645 standard deviations around the mean define a 5-95 percentile interval, the 5-95 percentile interval would be about

$$16.8 \pm 1.645\ (3.48)\ \mathrm{mg/m^3} = 16.8 \pm 5.7\ \mathrm{mg/m^3} = 11.1 \text{ to } 22.5\ \mathrm{mg/m^3}. \qquad (13)$$

These error bars indicate there is substantial uncertainty associated with the phosphorus concentration P, primarily due to uncertainty in the loading rate L.

The upper bound of 22.6 mg/m^3 is considerably less than the 27 mg/m^3 that would be obtained if both L and q had their most unfavorable values. In a probabilistic analysis with independent errors, such a combination is highly unlikely.

4.2.4.2 Warning on accuracy.

First-order uncertainty analysis is indeed an approximate method based upon a linearization of the response function represented by the full simulation model. It may provide inaccurate estimates of the variance of the response variable for nonlinear systems with large uncertainty in the parameters. In such cases Monte Carlo simulation (discussed below and in Chapter VII) or the use of higher-order approximation may be required. Beck (1987, p. 1426) cites studies that found that Monte Carlo and first-order variances were not appreciably different, and a few studies that found specific differences. Differences are likely to arise when the distributions used for the parameters are bimodal (or otherwise unusual), or some rejection algorithm is used in the Monte Carlo analysis to exclude some parameter combinations. Such errors can result in a distortion in the ranking of predominant sources of uncertainty. However, in most cases very similar results were obtained.

4.2.5 Fractional factorial design method

An extension of first-order sensitivity analysis would be a more complete exploration of the response surface using a careful statistical design. First consider a complete factorial design. Input data are divided into discrete "levels'. The simplest case is two levels. These two levels can be defined as a nominal value, and a high (low) value. Simulation runs are made for all combinations of parameter levels. For *n* different inputs, this would require 2^n simulation runs. Hence for a three-input variable or parameter problem, 8 runs would be required. If 4 discrete levels of each input variable or parameter were allowed to provide a more reasonable description of a continuous variable, the three-input data problem would require 4^3 or 64 simulation runs. Clearly this is not a useful tool for large regional water resources simulation models.

A fractional factorial design involves simulating only a fraction of what is required from a full factorial design method. The loss of information prevents a complete analysis of the impacts of each input variable or parameter on the output.

To illustrate the fractional factorial design method, consider the two-level with three-input variable or parameter problem. Table 5 below shows the 8 simulations required for a full factorial design method. The '+' and the '–' show the upper and lower levels of each input variable or parameter P_i where i = 1, 2, 3. If all 8 simulations were performed, seven possible effects could be estimated. These are the individual effects of the three inputs P_1, P_2, and P_3, the three two-input variable or parameter interactions, $(P_1)(P_2)$, $(P_1)(P_3)$, and $(P_2)(P_3)$, and the one three-input variable or parameter interaction $(P_1)(P_2)(P_3)$.

Table 5. A three-input factorial design.

simulation run	value of input P_1	P_2	P_3	value of output - variable Y
1	-	-	-	Y_1
2	+	-	-	Y_2
3	-	+	-	Y_3
4	+	+	-	Y_4
5	-	-	+	Y_5
6	+	-	+	Y_6
7	-	+	+	Y_7
8	+	+	+	Y_8

Consider an output variable Y, where Y_j is the value of Y in the jth simulation run. Then an estimate of the effect, denoted $\delta(Y|P_i)$, that input variable or parameter P_i has on the output variable Y, is the average of the four separate effects of varying P_i:

For i = 1:

$$\delta(Y \mid P_1) = 0.25\ [\ (Y_2-Y_1)+(Y_4-Y_3)+(Y_6-Y_5)+(Y_8-Y_7)\ ] \qquad (14)$$

Each difference in parentheses is the difference between a run in which P_1 is at its upper level and a run in which P_1 is at its lower level, but the other two parameter values, P_2 and P_3, are unchanged. If the effect is equal to 0, then, in this case, P_1 has no impact on the output variable Y.

Similarly the effects of P_2 and P_3, on variable Y can be estimated as:

$$\delta(Y \mid P_2) = 0.25\ \{\ (Y_3-Y_1)+(Y_4-Y_2)+(Y_7-Y_5)+(Y_8-Y_6)\ \} \qquad (15)$$

and

$$\delta(Y \mid P_3) = 0.25\ \{\ (Y_5-Y_1)+(Y_6-Y_2)+(Y_7-Y_3)+(Y_8-Y_4)\ \} \qquad (16)$$

Consider next the interaction effects between P_1 and P_2. This is estimated as the average of the difference between the average P_1 effect at the upper level of P_2, and the average P_1 effect at the lower level of P_2. This is the same as the difference between the average P_2 effect at the upper level of P_1 and the average P_2 effect at the lower level of P_1:

$$\delta(Y \mid P_1, P_2) = (1/2)\ \{\ [\ (Y_8-Y_7) + (Y_4-Y_3)]/2 - [\ (Y_2-Y_1) + (Y_6-Y_5)]/2\ \}$$

$$= (1/4)\ \{\ [\ (Y_8-Y_6)+(Y_4-Y_2)] - [\ (Y_3-Y_1) + (Y_7-Y_5)]\ \} \qquad (17)$$

Similar equations can be derived for looking at the interaction effects between P_1 and P_3, and between P_2 and P_3 and the interaction effects among all three inputs P_1, P_2, and P_3.

Now assume only half of the simulation runs were performed, perhaps runs 2, 3, 5 and 8 in this example. If only outputs Y_2, Y_3, Y_5, and Y_8 are available, for our example:

$$\delta(Y \mid P_3) = \square(Y \mid P_1, P_2) = 0.5\ \{\ (Y_8 - Y_3) - (Y_2 - Y_5)\ \} \qquad (18)$$

The separate effects of P_3 and of P_1P_2 are not available from the output. This is the loss in information resulting from fractional instead of complete factorial design.

4.2.6 Monte Carlo sampling methods

The Monte Carlo method of performing sensitivity analyses, illustrated in Figure 16, first selects a random set of input data values drawn from their individual probability distributions. These values are then used in the simulation model to obtain some model output variable values. This process is repeated many times, each time making sure the model calibration is

valid for the input data values chosen. The end result is a probability distribution of model output variables and system performance indices that results from variations and possible errors in all of the input values.

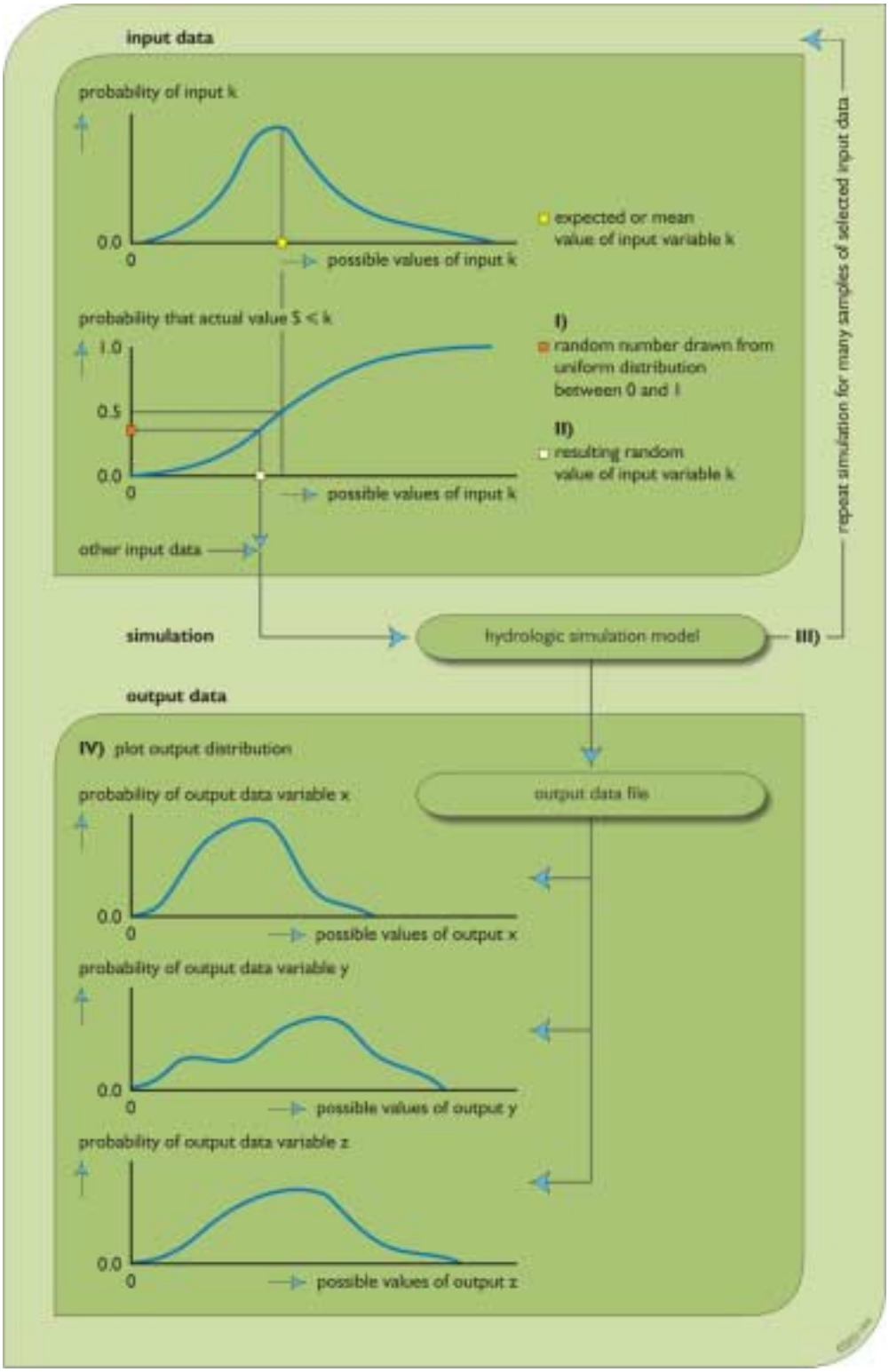

Figure 16. Monte Carlo sampling and simulation procedure for finding distributions of output variable values based on distributions, for specified reliability levels, of input data values. This technique can be applied to one or more uncertain input variables at a time. The output distributions will reflect the combined effects of this input uncertainty over the specified ranges.

Using a simple Monte Carlo analysis, values of all of the parameter sets are selected randomly from distributions describing the individual and joint uncertainty in each, and then the modeled system is simulated to obtain estimates of the selected performance indices. This must be done many times (often well over 100) to obtain a statistical description of system performance variability. The number of replications needed is generally not dependent on the number of parameters whose errors are to be analyzed. One can include in the simulation the uncertainty in parameters as well as natural variability. This method can evaluate the impact of single or multiple uncertain parameters.

A significant problem that arises in such simulations is that some combinations of parameter values result in unreasonable models. For example, model performance with calibration data sets might be inconsistent with available data sets. The calibration process places interesting constraints on different sets of parameter values. Thus, such Monte Carlo experiments often contain checks that exclude combinations of parameter values that are unreasonable. In these cases the generated results are conditioned on this validity check.

Whenever sampling methods are used, one must consider possible correlations among input data values. Sampling methods can handle spatial and temporal correlations that may exist among input data values, but the existence of correlation requires defining appropriate conditional distributions.

One major limitation of applying Monte Carlo methods to estimate ranges of risk and uncertainty for model output variable values, and system performance indicator values based on these output variable values, is the computing time required. To reduce the computing times needed to perform sensitivity analyses using sampling methods, some tricks and as well as stratified sampling methods are available. The discussion below illustrates the idea of a simple modification (or trick) using a "standardized" Monte Carlo analysis. The more general Latin Hypercube Sampling procedure is also discussed.

4.2.6.1 Simple Monte Carlo sampling

To illustrate the use of Monte Carlo sampling methods consider again Vollenweider's empirical relationship, Equation 5, for the average phosphorus concentration in lakes (Vollenweider, 1976). Two hundred values of each parameter were generated independently from normal distributions with the means and variances as shown in Table 6.

The table contains the specified means and variances for the generated values of L, q and z, and also the actual values of the means and variances of the 200 generated values of L, q, z and also of the 200 corresponding generated output phosphorus concentrations, P. Figure 17 displays the distribution of the generated values of P.

Table 6. Monte Carlo analysis of lake phosphorus levels.

parameter	L	q	z	P
	specified means and standard deviations			
mean	680.00	10.60	84.00	—
standard deviations	121.21	1.67	1.82	---
	generated means and standard deviations			
mean	674.18	10.41	84.06	17.07
standard deviations	130.25	1.73	1.82	3.61

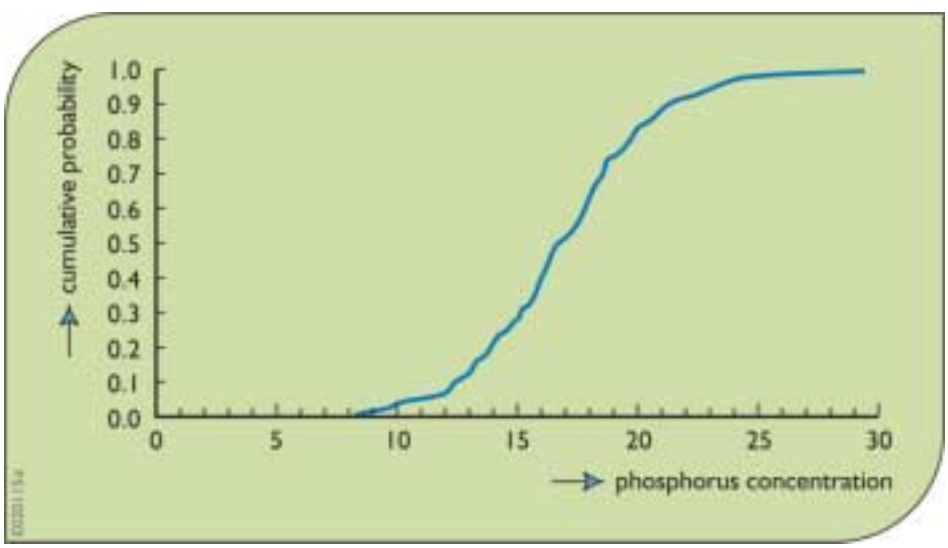

Figure 17. Distribution of lake phosphorus concentrations from Monte Carlo analysis

One can see that given the estimated levels of uncertainty, phosphorus levels could reasonably range from below 10 to above 25. The probability of generating a value greater than 20 mg/m^3 was 12.5%. The 5% to 95 percentile range was 11.1 to 23.4 mg/m^3. In the figure, the cumulative probability curve is rough because only 200 values of the phosphorus concentration were generated, but these are clearly enough to give a good impression of the overall impact of the errors.

4.2.6.2 Sampling uncertainty.

In this example, the mean of the 200 generated values of the phosphorus concentration, *P*, was 17.07. However a different set of random values would have generated a different set of *P* values as well. Thus it is appropriate to estimate the standard error, SE, of this average. The standard error equals the standard deviation □ of the *P* values divided by the square root of the sample size *n*:

$$SE = \square/(n)^{0.5} = 3.61/(200)^{0.5} = 0.25. \qquad (19)$$

From the central limit theorem of mathematical statistics, the average of a large number of independent values should have very nearly a normal distribution. Thus, 95% of the time, the true mean of *P* should be in the interval 17.1 ± 1.96 (0.25), or 16.6 to 17.6 mg/m^3 . This level of uncertainty reflects the observed variability of *P* and the fact that only 200 values were generated.

4.2.6.3 Making sense of the results.

A significant challenge with complex models is to determine from the Monte Carlo simulation which parameter errors are important. Calculating the correlation between each generated input parameter value and the output variable value is one way of doing this. As Table 7 below shows, based upon the magnitudes of the correlation coefficients, errors in *L* were most important, and those in *q* second in importance.

Table 7. Correlation analysis of Monte Carlo results.

variable	*L*	*q*	*z*	*P*
L	1			
q	0.079	1		
z	0.1297	-0.139	1	
P	0.851	-0.434	0.144	1

One can also use regression to develop a linear model defining variations in the output based on errors in the various parameters. The results are shown in the Table 8. The fit is very good, and R^2 = 98%. If the model for *P* had been linear, a R^2 value of 100% should have resulted. All of the coefficients are significantly different from zero.

Note that the correlation between *P* and *z* was positive in Table 7, but the regression coefficient for *z* is negative. This occurred because there is a modest negative correlation between the generated *z* and *q* values. Use of partial correlation coefficients can also correct for such spurious correlations among input parameters.

Table 8. Results of Regression Analysis on Monte Carlo Results

	coefficient	standardized error	ratio *t*
intercept	18.605	1.790	10.39
L	0.025	0.000	85.36
q	-1.068	0.022	-48.54
z	-0.085	0.021	- 4.08

Finally we display a plot, Figure 18, based on this regression model illustrating the reduction in the variance of *P* that is due to dropping each variable individually. Clearly *L* has the biggest impact on the uncertainty in *P,* and *z* the least.

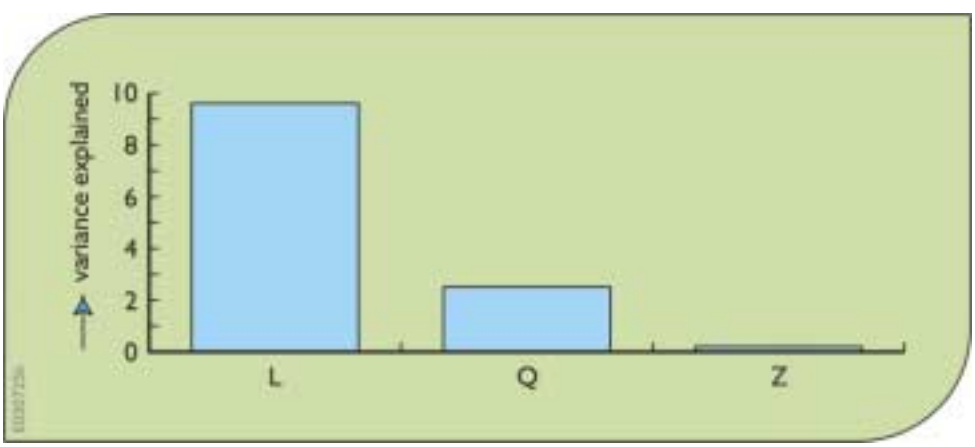

Figure 18. Reduction in the variance of *P* that is due to dropping from the regression model each variable individually. Clearly *L* has the biggest impact on the uncertainty in *P*, and *z* the least.

4.2.6.4 Standardized Monte Carlo analysis

Using a "standardized" Monte Carlo analysis, one could adjust the generated values of *L*, *q* and *z* above so that the generated samples actually have the desired mean and variance. While making that correction, one can also shuffle their values so that the correlations among the generated values for the different parameters are near zero, as is desired. This was done for the 200 generated values to obtain the statistics shown in Table 9.

Table 9. Standardized Monte Carlo analysis of lake phosphorus levels

parameter	*L*	*q*	*z*	*P*
	specified means and standard deviations			
Mean	680.00	10.60	84.00	—
Standard deviations	121.21	1.67	1.82	---
	generated means and standard deviations			
Mean	680.00	10.60	84.00	17.03
Standard deviations	121.21	1.67	1.82	3.44

Repeating the correlation analysis from before (shown in Table 10) now yields much clearer results that are in agreement with the regression analysis. The correlation between *P* and both *q* and *z* are now negative as they should be. Because the generated values of the three parameters have been adjusted to be uncorrelated, the signal from one is not confused with the signal from another.

.

Table 10. Correlation analysis of standardized Monte Carlo results

variable	L	q	z	P
L	1.00			
q	0.01	1.00		
z	0.02	0.00	1.00	
P	0.85	-0.50	-0.02	1.00

The mean phosphorus concentration changed very little. It is now 17.0 instead of 17.1 mg/m^3.

Using control variates with a linear predictive model in conjunction with the standardized Monte Carlo variates, the standard deviation of the errors associated with the 200 observations is only 0.45. Thus the standard error for this estimate of the mean of P is $0.45/(200)^{0.5}$ or just 0.03. Thus this is a highly accurate result. The regressions were also repeated and yielded very similar results. The only real difference was that the parameter estimates had small standard errors and were more significant because of the elimination of correlation between the generated parameters.

4.2.6.5 Generalized likelihood estimation

Beven (1993) and Binley and Beven (1991) suggest a Generalized Likelihood Uncertainty Estimation (GLUE) technique for assessment of parameter error uncertainty using Monte Carlo simulation. It is described as a "formal methodology for some of the subjective elements of model calibration" (Beven, 1989, p. 47). The basic idea is to begin by assigning reasonable ranges for the various parameters and then to draw parameter sets from those ranges using a uniform or some similar (and flat) distribution. These generated parameter sets are then used on a calibration data set so that unreasonable combinations can be rejected, while reasonable values are assigned a posterior probability based upon a likelihood measure which may reflect several dimensions and characteristics of model performance.

Let $L(P_i) > 0$ be the value of the likelihood measure assigned to the ith parameter set's calibration sequence. Then the model predictions generated with parameter set/combination P_i are assigned posterior probability, $p(P_i)$.

$$p(P_i) = L(P_i)/\Sigma_j L(P_j) \qquad (20)$$

These probabilities reflect the form of Bayes theorem, which is well supported by probability theory (Devore, 1991). This procedure should capture reasonably well the dependence or correlation among parameters, because *reasonable* sequences will all be assigned larger probabilities, whereas sequences that are unable to reproduce the system response over the calibration period will be rejected or assigned small probabilities.

However, in a rigorous probabilistic framework, the L would be the likelihood function for the calibration series for particular error distributions. (This could be checked with available goodness-of-fit procedures; for example, Kuczera, 1988.) When relatively ad hoc measures are adopted for the likelihood measure with little statistical validity, the $p(P_i)$ probabilities are best described as pseudo probabilities or "likelihood" weights.

Another concern with this method is the potential efficiency. If the parameter ranges are too wide, a large number of unreasonable or very unlikely parameter combinations will be generated. These will either be rejected or else will have small probabilities and thus little effect on the analysis. In this case the associated processing would be a waste of effort. A compromise is to use some data to calibrate the model and to generate a prior or initial distribution for the parameters that is at least centered in the best range (Beven 1993, p. 48). Then use of a different calibration period to generate the $p(P_i)$ allows an updating of those initial probabilities to reflect the information provided by the additional calibration period with the adopted likelihood measures.

After the accepted sequences are used to generate sets of predictions, the likelihood weights would be used in the calculation of means, variances and quantiles, rather than the customary procedure of giving all the generated realizations equal weight. The resulting conditional distribution of system output reflects the initial probability distributions assigned to parameters, the rejection criteria, and the likelihood measure adopted to assign "likelihood" weights.

4.2.7 Latin hypercube sampling

For the simple Monte Carlo simulations described above, with independent errors, a probability distribution is assumed for each input parameter or variable. In each simulation run, values of all input data are obtained from sampling those individual and independent distributions. The value generated for an input parameter or variable is usually independent of what that value was in any previous run, or what other input parameter or variable values are in the same run. This simple sampling approach can result in a clustering of parameter values and hence both redundancy of information from repeated sampling in the same regions of a distribution and lack of information from no sampling in other regions of the distributions.

A stratified sampling approach ensures more even coverage of the range of input parameter or variable values with the same number of simulation runs. This can be accomplished by dividing the input parameter or variable space into sections and sampling from each section with the appropriate probability.

One such approach, Latin hypercube sampling (LHS), divides each input distribution into sections of equal probability for the specified the probability distribution, and draws one observation randomly from each range. Hence the ranges of input values within each section actually occur with equal frequency in the experiment. These values from each interval for each distribution are randomly assigned to those from other intervals to construct sets of input values for the simulation analysis. Figure 19 shows the steps in constructing a LHS for six simulations involving three inputs P_j (P_1, P_2, and P_3) and six intervals of their respective normal, uniform and triangular probability distributions.

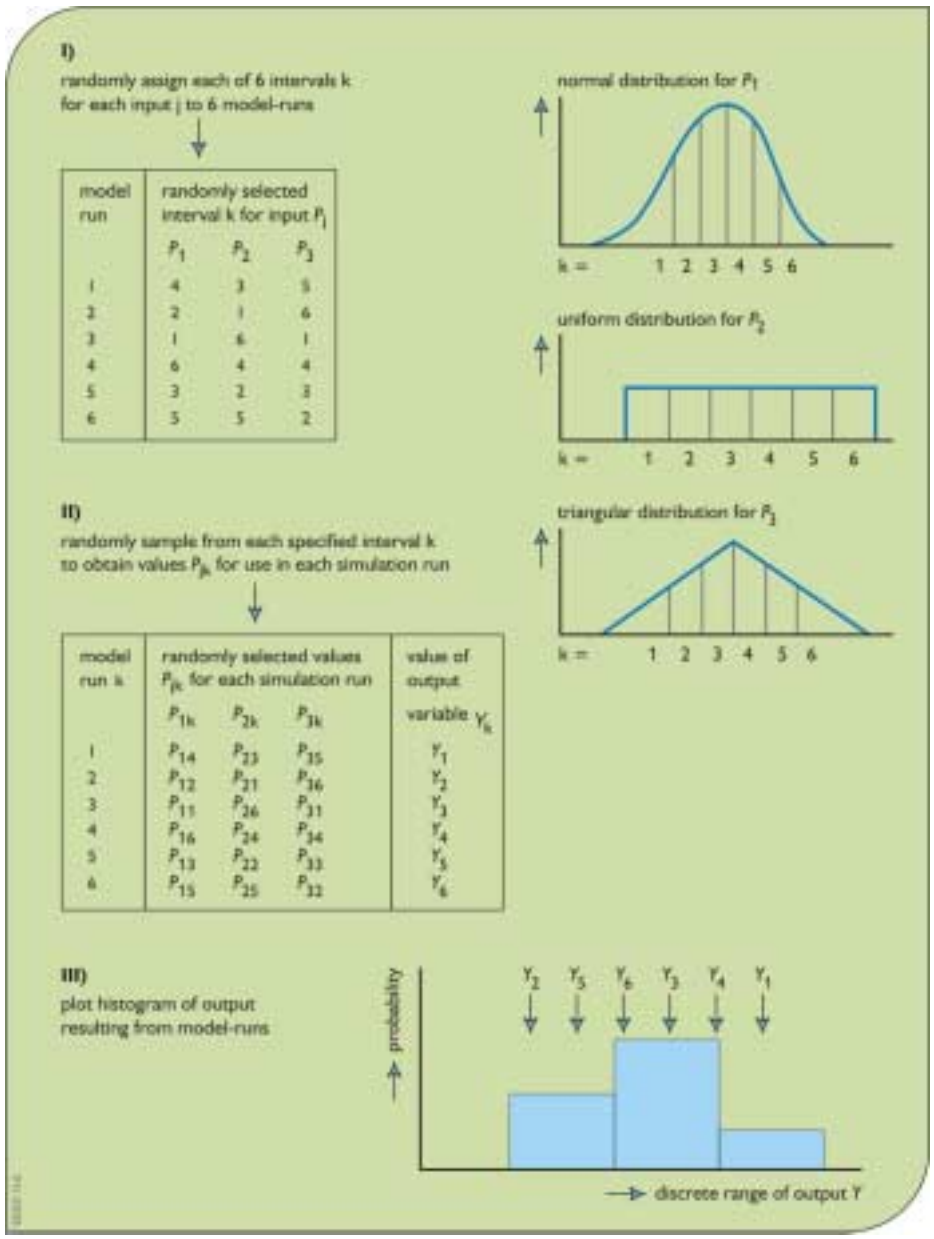

Figure 19. Schematic representation of a Latin hypercube sampling procedure for six simulation runs.

5. Performance indicator uncertainties

5.1 Performance measure target uncertainty

Another possible source of uncertainty is the selection of performance measure target values. For example, consider a target value for a pollutant concentration based on the effect of exceeding it in an ecosystem. Which target value is best or correct? When this is not clear, there are various ways of expressing the uncertainty associated with any target value. One such method is the use of fuzzy sets (Chapter VI). Use of 'grey' numbers or intervals instead of 'white' or fixed target values is another. When some uncertainty or disagreement exists over the selection of the best target value for a particular performance measure it seems to us the most direct and transparent way to do this is to subjectively assume a distribution over a range of possible target values. Then this subjective probability distribution can be factored into the tradeoff analysis, as outlined in Figure 20.

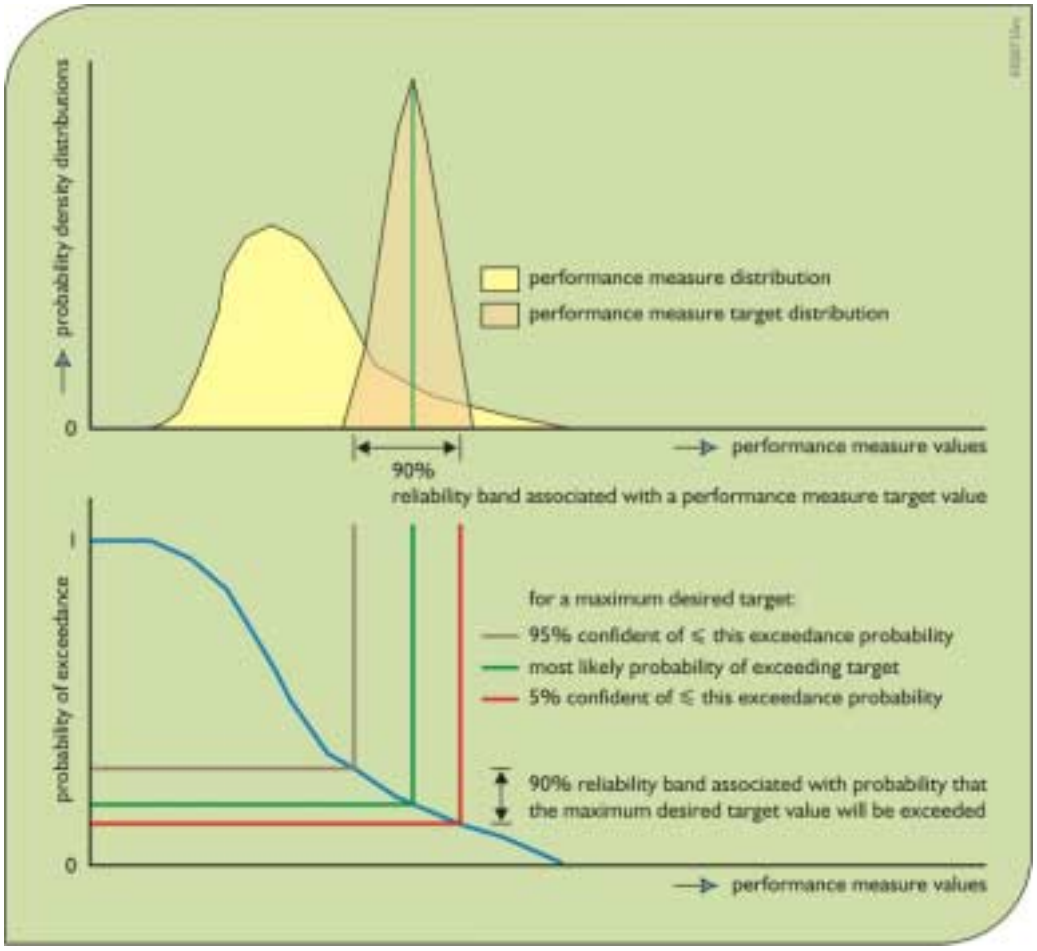

Figure 20. Combining the probability distribution of performance measure values with the probability distribution of performance measure target values to estimate the confidence one has in the probability of exceeding a maximum desired target value.

One of the challenges associated with defining and including in an analysis the uncertainty associated with a target or threshold value for a performance measure is that of communicating just what the result of such an analysis means. Referring to Figure 20, suppose the target value represents some maximum limit of a pollutant, say phosphorus, concentration in the flow during a given period of time at a given site or region, and it is not certain just what that maximum limit should be. Subjectively defining the distribution of that maximum limit, and considering that uncertainty along with the uncertainty (probability of exceedance function) of pollutant concentrations – the performance measure – one can attach a confidence to any probability of exceeding the maximum desired concentration value.

The 95% probability of exceedance shown on Figure 20, say $P_{0.95}$, should be interpreted as "we can be 95% confident that the probability of the maximum desired pollutant concentration being exceeded will be no greater than $P_{0.95}$." We can be only 5% confident that the probability of exceeding the desired maximum concentration will be no greater than the lower $P_{0.05}$ value. Depending on whether the middle line through the subjective distribution of target values in Figure 20 represents the most likely or median target value, the associated probability of exceedance is either the most likely, as indicated in Figure 20, or that for which we are only 50% confident.

Figure 21 attempts to show how to interpret the reliabilities when the uncertain performance targets are

- minimum acceptable levels that are to be maximized,
- maximum acceptable levels that are to be minimized or
- optimum levels.

An example of a minimum acceptable target level might be the population of wading birds in an area. An example of a maximum acceptable target level might be, again, the phosphorus concentration of the flow in a specific wetland or lake. An example of an optimum target level might be the depth of water most suitable for selected species of aquatic vegetation during a particular period of the year.

For performance measure targets that are not expressed as minimum or maximum limits but that are the 'best' values, referring to Figure 21, one can state that one is 90% confident that the probability of achieving the desired target is no more than B. The 90% confidence level probability of not achieving the desired target is at least A+C. The probability of the performance measure being too low is at least A and the probability of the performance measure being too high is at least C, again at the 90% confidence levels. As the confidence level decreases the bandwidth decreases, and the probability of not meeting the target increases.

Now, clearly there is uncertainty associated with each of these uncertainty estimations, and this raises the question of how valuable is the quantification of the uncertainty of each additional component of the plan in an evaluation process. Will plan evaluators and decision makers

benefit from this additional information, and just how much additional uncertainty information is useful?

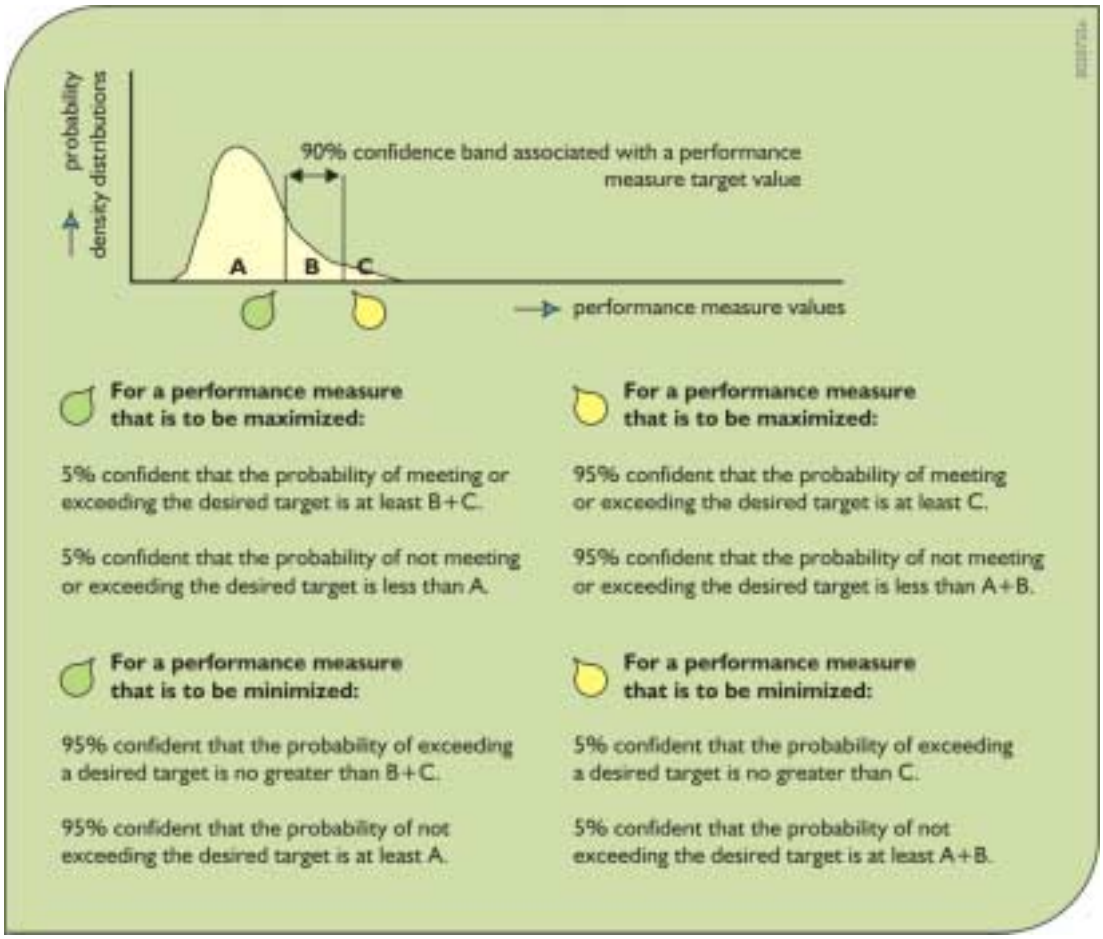

Figure 21. Interpreting the results of combining performance measure probabilities with performance measure target probabilities depends on the type of performance measure. The letters A, B, and C represent proportions of the probability density function of performance measure values. (Hence probabilities A + B + C = 1.)

Now consider again the tradeoffs that need to be made as illustrated in Figure 7. Instead of considering a single target value as shown on Figure 7, assume there is a 90% confidence range associated with that single performance measure target value. Also assume that the target is a maximum desired upper limit (e.g., of some pollutant concentration).

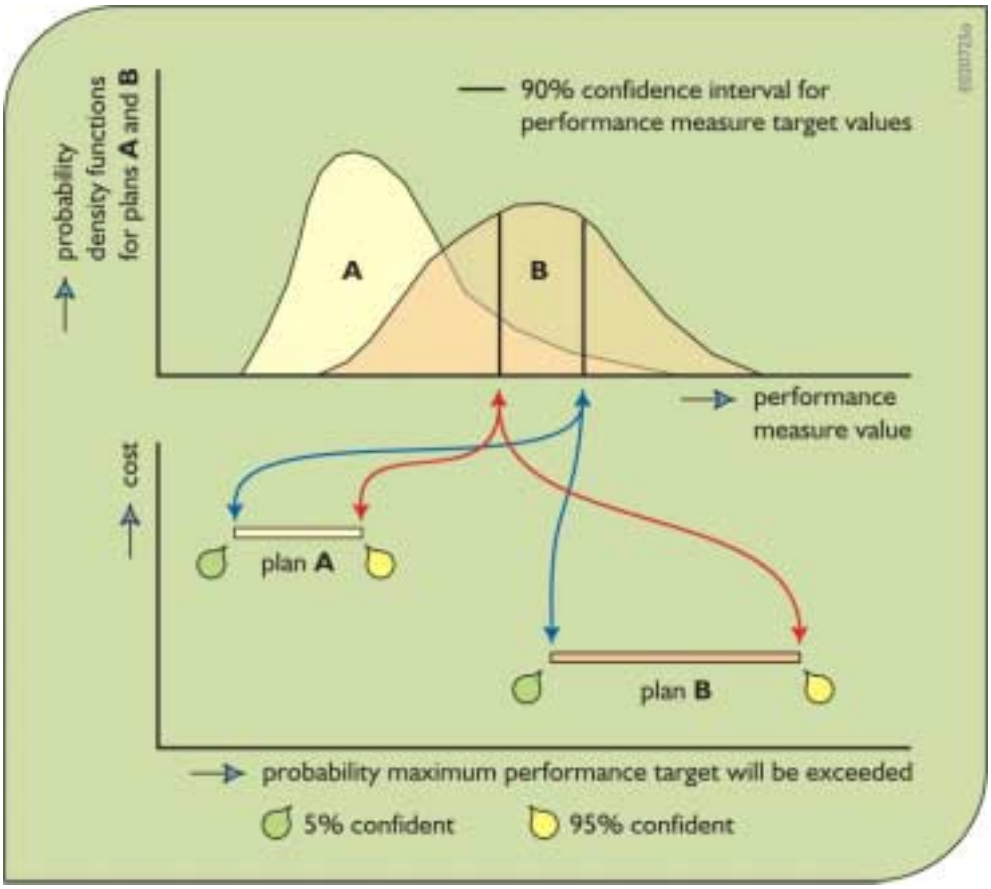

Figure 22. Two plans showing ranges of probabilities, depending on one's confidence, that an uncertain desired maximum (upper limit) performance target value will be exceeded. The 95% confidence levels are associated with the higher probabilities of exceeding the desired maximum target. The 5% confident levels are associated with the more desirable lower probabilities of exceeding the desired maximum target. Plan A with reduced probabilities of exceeding the upper limit costs more than Plan B.

In the case shown in Figure 22, the tradeoff is clearly between cost and reliability. In this example, no matter what confidence one chooses, Plan A is preferred to Plan B with respect to reliability, but Plan B is preferred to Plan A with respect to cost. The tradeoff is only between these two performance indicators or measures.

Consider however a third plan, as shown in Figure 23. This situation adds to the complexity of making appropriate tradeoffs. Now there are three criteria: cost, probability of exceedance (reliability) and the confidence in those reliabilities or probabilities. Add to this the fact that there will be multiple performance measure targets, each expressed in terms of their maximum probabilities of exceedance and the confidence in those probabilities.

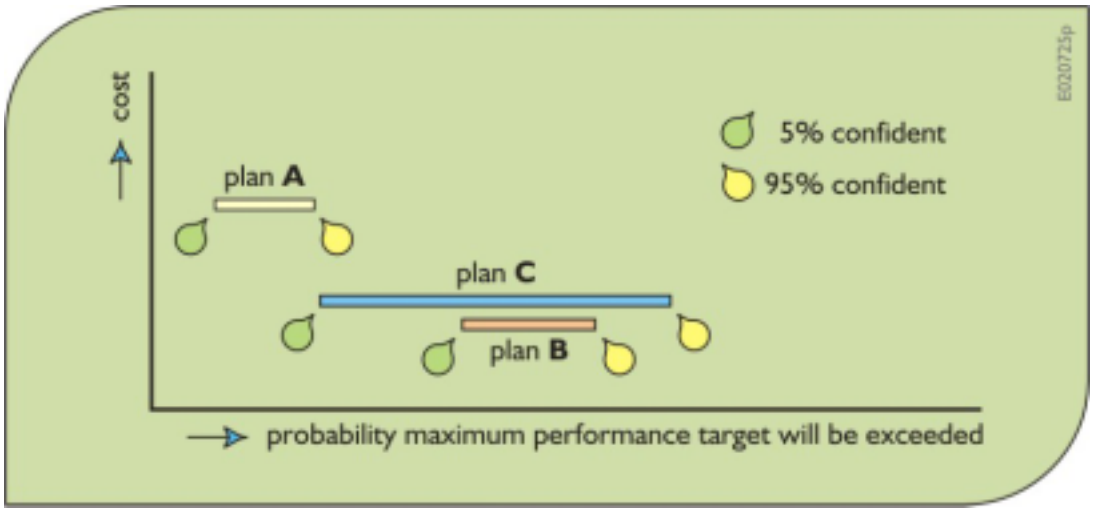

Figure 23. Tradeoffs among cost, reliabilities, and the confidence level of those reliabilities. The relative ranking of plans with respect to the probability of exceeding the desired (maximum limit) target may depend on the confidence given to that probability.

In Figure 23, in terms of cost the plans are ranked, from best to worst, B, C, and A. In terms of reliability at the 90 percent confidence level, they are ranked A, B, and C but at the 50 percent confidence level the ranking is A, C and B.

If the plan evaluation process has difficulty handling all this it may indicate the need to focus the uncertainty analysis effort on just what is deemed important, achievable, and beneficial. Then when the number of alternatives has been narrowed down to only a few that appear to be the better ones, a more complete uncertainty analysis can be performed. There is no need nor benefit in performing sensitivity and uncertainty analyses on all possible management alternatives. Rather one can focus on those alternatives that look the most promising, and then carry out additional uncertainty and sensitivity analyses only when important uncertain performance indicator values demands more scrutiny. Otherwise the work is not likely to affect the decision anyway.

5.2 Distinguishing differences between performance indicator distributions

Simulations of alternative water management infrastructure designs and operating policies require a comparison of the simulation outputs – the performance measures or indicators – associated with each alternative. A reasonable question to ask is are the observed differences statistically significant. Can one really tell if one alternative is better than another or are the observed differences explainable by random variations attributable to variations in the inputs and how the system responds?

This is a common statistical issue that is addressed by standard hypothesis tests (Devore, 1991; Benjamin and Cornell, 1970). Selection of an appropriate test requires that one first resolve what type of change one expects in the variables. To illustrate, consider the comparison of two

different operating policies. Let Y_1 denote the set of output performance variable values with the first policy, and Y_2 the set of output performance variable values of the second policy. In many cases, one would expect one policy to be better than the other. One measure might be the difference in the mean of the variables; for example is $E[Y_1] < E[Y_2]$?. Alternatively one could check the difference in the median (50 percentile) of the two distributions.

In addition, one could look for a change in the variability or variance, or a shift in both the mean and the variance. Changes described by a difference in the mean or median often make the most sense and many statistical tests are available that are sensitive to such changes. For such investigations parametric and non-parametric tests for paired and unpaired data can be employed.

Consider the differences between "paired" and "unpaired" data. Suppose that the meteorological data for 1941-1990 is used to drive a simulation model generating data as described in Table 11:

Table 11. Possible flow data from a 50-year simulation

1941	Y_1 (1)	Y_2 (1)
1942	Y_1 (2)	Y_2 (2)
1943	Y_1 (3)	Y_2 (3)
1944	Y_1 (4)	Y_2 (4)
1989	Y_1 (49)	Y_2 (49)
1990	Y_1 (50)	Y_2 (50)

Here there is one sample, $Y_1(1)$ through $Y_1(50)$, for policy 1, and another sample, $Y_2(1)$ through $Y_2(50)$, for policy 2. However, the two sets of observations are not independent. For example, if 1943 was a very dry year, then we would expect both $Y_1(3)$ for policy 1 in that year and $Y_2(3)$ for policy 2 to be unusually small. With such paired data, one can use a paired hypothesis test to check for differences. Paired tests are usually easier than the corresponding unpaired tests that are appropriate in other cases. (For example, if one were checking for a difference in average rainfall depth between 1941-1960, and 1961-1990, they would have two sets of independent measurements for the two periods. With such data, one should use a two-sample unpaired test.)

Paired tests are generally based on the differences between the two sets of output, $Y_1(i) - Y_2(i)$. These are viewed as a single independent sample. The question is then are the differences

positive (say Y_1 tends to be larger then Y_2), or negative (Y_1 tends to be smaller), or are positive and negative differences are equally likely (there is no difference between Y_1 and Y_2).

Both parametric and non-parametric families of statistical tests are available for paired data. The common parametric test for paired data (a one-sample t test) assumes that the mean of the differences

$$X(i) = Y_1(i) - Y_2(i) \tag{21}$$

are normally distributed. Then the hypothesis of no difference is rejected if the t statistic is sufficiently large, given the sample size n.

Alternatively, one can employ a nonparametric test and avoid the assumption that the differences X(i) are normally distributed. In such a case, one can use the Wilcoxon Signed Rank test. This nonparametric test ranks the absolute values $|X(i)|$ of the differences. If the sum S of the ranks of the positive differences deviates sufficiently from its expected value, $n(n+1)/4$ (were there no difference between the two distributions), one can conclude that there is a statistically significant difference between the $Y_1(i)$ and $Y_2(i)$ series. Standard statistical texts have tables of the distribution of the sum S as a function of the sample size n, and provide a good analytical approximation for $n > 20$ (for example, Devore, 1991). Both the parametric t test and the nonparametric Wilcoxon Signed Rank test require that the differences between the simulated values for each year be computed.

6. Communicating model output uncertainty

Spending money on reducing uncertainty would seem preferable to spending it on ways of calculating and describing it better. Yet attention to uncertainty communication is critically important if uncertainty analyses and characterizations are to be of value in a decision making process. In spite considerable efforts by those involved in risk assessment and management, we know very little about how to ensure effective risk communication to gain the confidence of stakeholders, incorporate their views and knowledge, and influence favorably the acceptability of risk assessments and risk-management decisions.

The best way to communicate concepts of uncertainty may well depend on what the audiences already know about risk and the various types of probability distributions (e.g., density, cumulative, exceedance) based on objective and subjective data, and the distinction between mean or average values and the most likely values. Undoubtedly graphical representations of these ways of describing uncertainty considerably facilitate communication.

The National Research Council (NRC 1994) addressed the extensive uncertainty and variability associated with estimating risk and concluded that risk characterizations should not be reduced to a single number or even to a range of numbers intended to portray uncertainty. Instead, the report recommended managers and the interested public should be given risk characterizations that are both qualitative and quantitative and both verbal and mathematical.

In some cases communicating qualitative information about uncertainty to stakeholders and the public in general may be more effective than quantitative information. There are, of course, situations in which quantitative uncertainty analyses are likely to provide information that is useful in a decision-making process. How else can tradeoffs such as illustrated in Figures 10 and 27 be identified? Quantitative uncertainty analysis often can be used as the basis of qualitative information about uncertainty, even if the quantitative information is not what is communicated to the public.

One should acknowledge to the public the widespread confusion regarding the differences between variability and uncertainty. Variability does not change through further measurement or study, although better sampling can improve our knowledge about variability. Uncertainty reflects gaps in information about scientifically observable phenomena.

While it is important to communicate uncertainties and confidence in predictions, it is equally important to clarify who or what is at risk, possible consequences, and the severity and irreversibility of an adverse effect should a target value, for example, not be met. This qualitative information is often critical to informed decision-making. Risk and uncertainty communication is always complicated by the reliability and amounts of available relevant information as well as how that information is presented. Effective communication between people receiving information about who or what is at risk, or what might happen and just how severe and irreversible an adverse effect might be should a target value not be met, is just as important as the level of uncertainty and the confidence associated with such predictions. A two-way dialog between those receiving such information and those giving it can help identify just what seems best for a particular audience.

Risk and uncertainty communication is a two-way street, It involves learning and teaching. Communicators dealing with uncertainty should learn about the concerns and values of their audience, their relevant knowledge, and their experience with uncertainty issues. Stakeholders' knowledge of the sources and reasons for uncertainty needs to be incorporated into assessment and management and communication decisions. By listening, communicators can craft risk messages that better reflect the perspectives, technical knowledge, and concerns of the audience.

Effective communication should begin before important decisions have been made. It can be facilitated in communities by citizen advisory panels. Citizen advisory panels can give planners and decision makers a better understanding of the questions and concerns of the community and an opportunity to test its effectiveness in communicating concepts and specific issues regarding uncertainty.

One approach to make uncertainty more meaningful is to make risk comparisons. For example, a ten parts per billion target for a particular pollutant concentration is equivalent to 10 seconds in over 31 years. If this is an average daily concentration target that is to be satisfied "99 percent," of the time, this is equivalent to an expected violation of less than one day every three months.

Many perceive the reduction of risk by an order of magnitude as though it were a linear reduction. A better way to illustrate orders of magnitude of risk reduction is shown in Figure 24, in which a bar graph depicts better than words that a reduction in risk from one in a 1,000 (10^{-3}) to one in 10,000 (10^{-4}) is a reduction of 90% and that a further reduction to one in 100,000 (10^{-5}) is a reduction 10-fold less than the first reduction of 90%. The percent of the risk that is reduced by whatever measures is a much easier concept to communicate than reductions expressed in terms of estimated absolute risk levels, such as 10^{-5}.

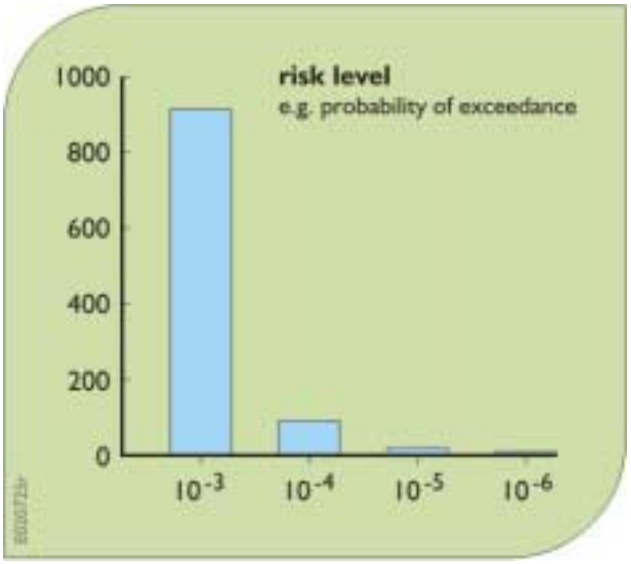

Figure 24. Reducing risk by orders of magnitude is not equivalent to linear reductions.

Risk comparisons can be helpful, but they should be used cautiously and tested if possible. There are dangers in comparing risks of diverse character, especially when the intent of the comparison is seen as minimizing a risk (NRC 1989). One difficulty in using risk comparisons is that it is not always easy to find risks that are sufficiently similar to make a comparison meaningful. How is someone able to compare two alternatives having two different costs and two different risk levels, for example, as is shown in Figure 7? One way is to perform an indifference analysis (Chapter X), but that can lead to different results depending who performs it. Another way is to develop utility functions using weights, where, for example reduced phosphorus load by half is equivalent to a 25 percent shorter hydroperiod in that area, but again each person's utility or tradeoff may differ.

At a minimum, graphical displays of uncertainty can be helpful. Consider the common system performance indicators that include:

- Time-series plots for continuous time-dependent indicators (Figure 25 upper left)
- Probability exceedance distributions for continuous indicators (Figure 25 upper right),
- Histograms for discrete event indicators (Figure 25 lower left), and
- Overlays on maps for space-dependent discrete events (Figure 25 lower right).

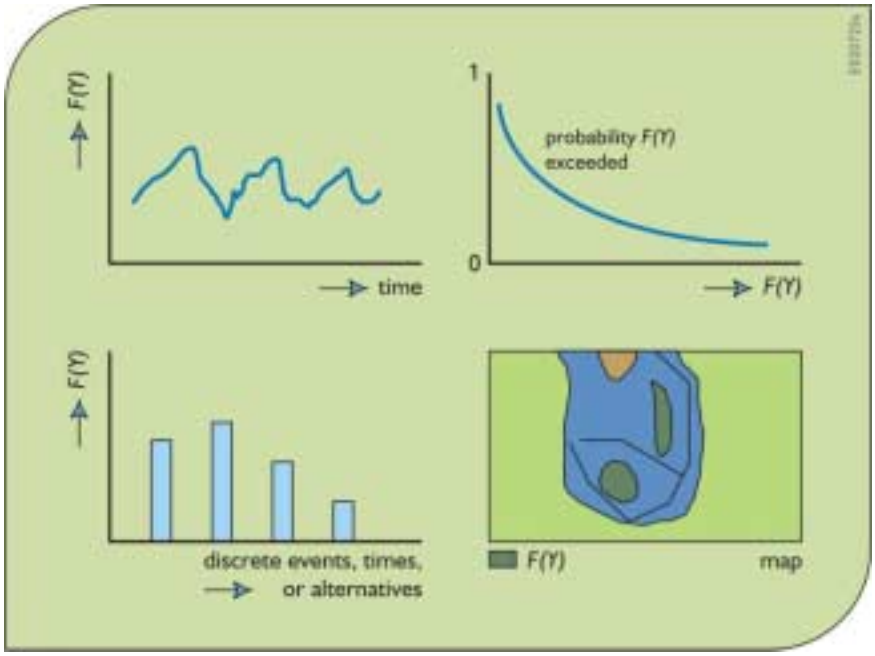

Figure 25. Different types of displays used to show model output *Y* or system performance indicator values *F*(*Y*).

The first three graphs in Figure 25 could show, in addition to the single curve or bar that represents the most likely output, a range of outcomes associated with a given confidence interval. For overlays of information on maps, different colors could represent the spatial extents of events associated with different ranges of risk or uncertainty. Figure 26, corresponding to Figure 25, illustrates these approaches for displaying these ranges.

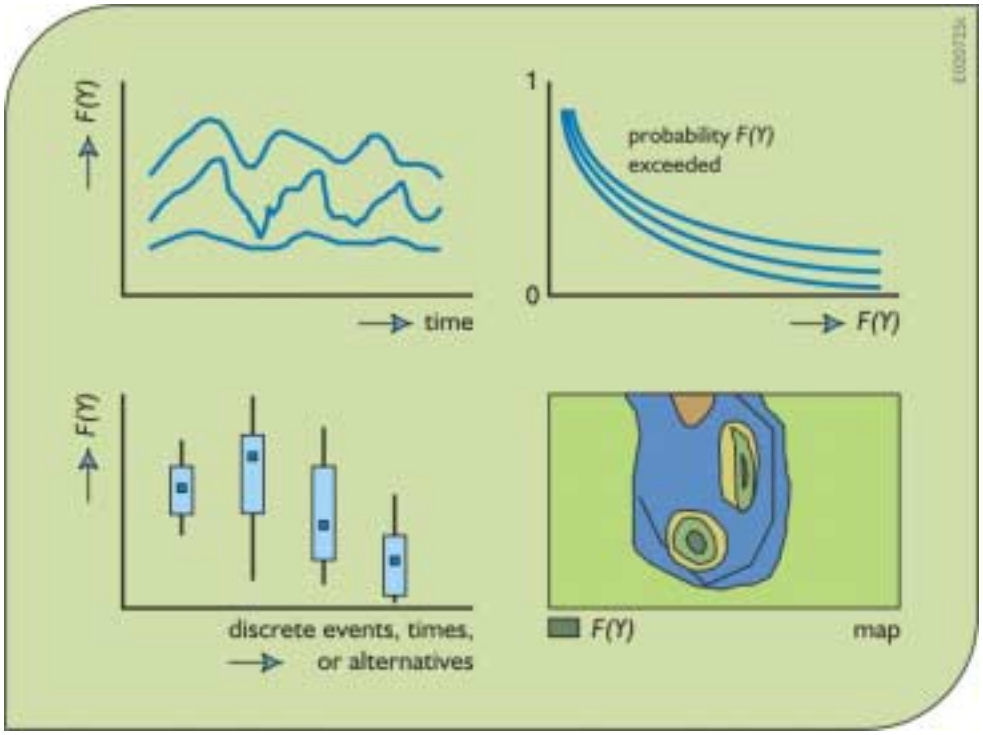

Figure 26. Plots of ranges of possible model output Y or system indicator values $F(Y)$ for different types of displays.

7. Conclusions

This chapter provides an overview of uncertainty and sensitivity analyses in the context of hydrologic or water resources systems simulation modeling. A broad range of tools are available to explore, display, and quantify the sensitivity and uncertainty in predictions of key output variables and system performance indices with respect to imprecise and random model inputs and to assumptions concerning model structure. They range from relatively simple deterministic sensitivity analysis methods to more involved first-order analyses and Monte Carlo sampling methods.

Because of the complexity of many watersheds or river basins, Monte Carlo methods for uncertainty analyses may be a very major and unattractive undertaking. Therefore it is often prudent begin with the relatively simple deterministic procedures. This coupled with a probabilistically based first-order uncertainty analysis method can help quantify the uncertainty in key output variables and system performance indices, and the relative contributions of uncertainty in different input variables to the uncertainty in different output variables and system performance indices. These relative contributions may differ depending upon which output variables and indices are of interest.

A sensitivity analysis can provide a systematic assessment of the impact of parameter value imprecision on output variable values and performance indices, and of the relative contribution of errors in different parameter values to that output uncertainty. Once the key variables are identified, it should be possible to determine the extent to which parameter value uncertainty can be reduced through field investigations, development of better models, and other efforts.

Model calibration procedures can be applied to individual catchments and subsystems, as well as to composite systems. Automated calibration procedures have several advantages including the explicit use of an appropriate statistical objective function, identification of those parameters that best reproduce the calibration data set with the given objective function, and the estimations of the statistical precision of the estimated parameters.

All of these tasks together can represent a formidable effort. However, knowledge of the uncertainty associated with model predictions can be as important to management decision and policy formulation as are the predictions themselves.

No matter how much attention is given to quantifying and reducing uncertainties in model outputs, uncertainties will remain. Professionals who analyze risk, managers and decision makers who must manage risk, and the public who must live with risk and uncertainty, have different information needs and attitudes regarding risk and uncertainty. It is clear that information needs differ among those who model or use models, those who make substantial investment or social decisions, and those who are likely to be impacted by those decisions. Meeting those needs should result in more informed decision making. But it comes at a cost that should be considered along with the benefits of having this sensitivity and uncertainty information.

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Appendix I: Model Calibration Examples

- *Calibration of models in the Murray-Darling Basin*

In the Murray-Darling Basin, in order to preserve water quality, water reliability and the environment, a decision was made in 1995 to restrict water use to the 1993/94 level of development. Computer models of the major tributary streams are now used at the end of each year to determine the annual use target for the previous season based on that level of development. Rules are in place to ensure that long term usage is maintained at the agreed level. Because the models now define the overall water rights of each valley, there are legal requirements to calibrate models and each model is independently audited and certified as being unbiased before being approved as fit for purpose. The key model output of interest is water use but emphasis is also placed on the modeling of downstream flow which impacts the rights of downstream regions. Each model must be calibrated over at least ten years and this often means that changes in infrastructure, operating rules and growth in demand have to be incorporated into the calibration run. Calibration reports contain plots of modeled and observed water use, storage behavior and flow and statistics such as mean error, correlation coefficients and standard errors. The aim of calibration is to ensure that the model is unbiased and to give confidence to stakeholders.

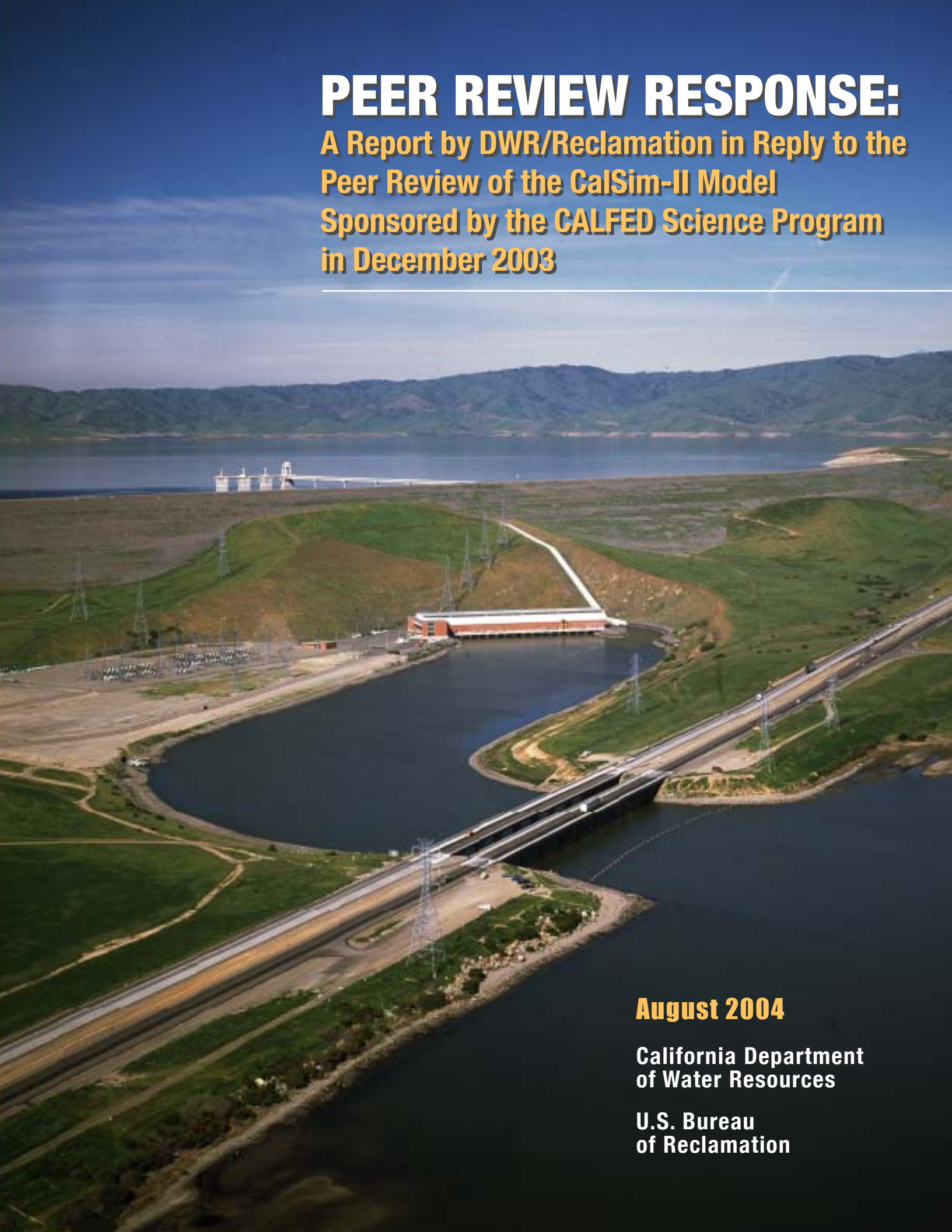
An issue that is sometimes raised with model development is the role of calibration, where the model is fine-tuned to match the observed data, and validation where the model is tested against data that was not used in the calibration process to get an independent assessment of the model's accuracy. For the Murray River, because of the variability of our climate, we like to calibrate our model against a long period of data including the most recent years when the current operating rules were being used and the historical data is generally the most reliable. Validation is considered to be less important and is typically carried out using the two or three years of data available following the completion of model calibration.

- *Use of models for Allocating Water in Texas*

Recent legislation in Texas revised the State Water Planning process and mandated the development of water allocation models for every river basin in the state (http://www.tnrcc.state.tx.us/permitting/waterperm/wrpa/permits.html). Similar to the Murray – Darling situation, these models are used to provide estimates of reliability for all permitted water diversions in the state as well as analysis of the effects of all permit applications. Naturalized, or predevelopment, time series of flows were constructed for the basins, and then the effects of developments were added in to achieve models of the current situation. The process of developing the basin models was an iterative, peer reviewed calibration process subject to stakeholder comment at several critical junctures. The naturalized flows and subsequent development of the basins now form an accepted and legal basis for future water allocations. Currently, similar activities are ongoing to provide calibrated and verified models of the state's groundwater aquifers and usage.

PEER REVIEW RESPONSE:

A Report by DWR/Reclamation in Reply to the Peer Review of the CalSim-II Model Sponsored by the CALFED Science Program in December 2003



August 2004

California Department of Water Resources

U.S. Bureau of Reclamation

Peer Review Response:

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This report was prepared jointly

By the

Department of Water Resources

And

U.S. Bureau of Reclamation

August, 2004

Contacts: **Sushil Arora / Department of Water Resources**
sushil@water.ca.gov

Lloyd Peterson / U.S. Bureau of Reclamation
lpeterson@mp.usbr.gov

Peer Review Response: ***A Report by DWR/Reclamation in Reply to the Peer Review of the CalSim-II Model Sponsored by the CALFED Science Program in December 2003***

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Table 1. Summary of Peer Review Comments
Table 2. Development Priorities

1. Introduction

The California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation) have jointly developed a computer model called CalSim-II that simulates much of the water resources infrastructure in the Central Valley of California and Delta region. CalSim-II provides quantitative hydrologic-based information to those responsible for the planning, managing and operating the State Water Project (SWP) and federal Central Valley Project (CVP).

CalSim-II is a particular application of software developed primarily by DWR called CalSim. CalSim is a generalized water resources tool that can be applied to most reservoir-river basin systems. CalSim was recently renamed by DWR and Reclamation to WRIMS (Water Resources Integrated Modeling System). For consistency, however, the name CalSim rather than WRIMS will be used throughout this report.

In 2003, the CALFED Science Program commissioned an external review panel to provide an independent analysis and evaluation of the strengths and weaknesses of CalSim and CalSim-II. Specifically the review panel was asked (Strategic Review, p3) to answer the following questions below: (note: The Strategic Review report used the upper case "CALSIM" for the engine and the upper case "CALSIM II" for the application. In the seven questions below, as extracted from that report, the word "CALSIM" appears to imply both the engine CALSIM and, more importantly, the application CALSIM II. For consistency in this report, the words CalSim will be used for the engine and CalSim-II for the application)

1. Is CALSIM a reasonable modeling approach for current and proposed applications and problems?
2. Do other modeling approaches show similar or greater promise and flexibility for such problems?
3. What are the major comparative strengths and weaknesses of the current CALSIM approach and alternate approaches?
4. What are the major scientific, technical, and institutional limitations, uncertainties, and impediments for current and proposed applications of CALSIM?
5. What model, software, and data developments, special studies or tests would be beneficial to improve CALSIM for current and proposed uses?
6. How might CALSIM development and applications be managed and overseen to improve the quality assurance of the model results for current and proposed applications?
7. What are the panel suggestions for long-term use, development, or replacement of the current suite of models and data available for the current and proposed uses of CALSIM?

The Peer Review was held November 13-14, 2003. The panel's responses to the above questions were published in "*A strategic review of CALSIM II and its uses for water planning, management, and operations in central California*" (Strategic Review, December 4, 2003), herein referred to as the Strategic Review. This report is a response from DWR and Reclamation to the Strategic Review. The following information clarifies issues raised by the Peer Review, outlines the priority of development, and addresses current and future development work.

2. Goals of CalSim-II Development

The Department of Water Resources (DWR) and U.S. Bureau of Reclamation (Reclamation) strive to develop, maintain, and apply CalSim-II as the simulation model of the State Water Project and Central Valley Project best representing the two projects for planning and management studies. It is intended to serve organizations with an interest in the CVP/SWP management with the goals of developing and maintaining the best available technical tools for planning and management studies.

3. Summary of Response Goals and Priorities

DWR and Reclamation share the view that our response priorities need to be steered by a philosophy for carrying out the goals of CalSim-II development. This philosophy begins with the overarching goal of maintaining trust and credibility of CalSim-II among the user community. A complimentary goal of equal priority is assuring quality of CalSim-II data, assumptions and results. With credibility maintained and quality assured, we adopt secondary goals of implementing obvious and feasible enhancements of CalSim-II and providing service to the evolving needs of the user community with advancements that go beyond the present application of CalSim-II.

Given this philosophy of meeting the goals of CalSim-II development, DWR and Reclamation suggest the following prioritization of response projects. Many of these projects have already been initiated (independent of this prioritization, see Table 2). Each response item is discussed in more detail in section 4 and the Appendices. Items are listed in order of priority:

1. Establish Credibility and Trust
    a. Uncertainty and Sensitivity Analysis (*section 4.4.2, 4.4.3)*
    b. Documentation (*section 4.2.13, 4.3.4.1, Appendix D*)
    c. Establish formal schedule of Training Classes and User Group meetings (*section 4.3.5.6)*

2. Hydrology Enhancement (priority order beginning after 1., implemented over a longer term)
    a. Sacramento Valley (*section 4.2.1, 4.2.2, 4.2.11, Appendix E, F*)
    b. West Side San Joaquin (*Appendix F)*

3. Software Development Needs – Part 1 (priority order after 2., although many of these projects have been initiated (Table 2)).
    a. Version Control (*section 4.3.4.14)*
    b. (Meta) Data Control (*section 4.3.2, 4.3.3)*
    c. Error Checking (*section 4.3.4.2)*
    d. Solver Reliability/Infeasibility Handling (*section 4.3.1, 4.3.4.5*)
    e. Graphical Network Builder (*section 4.3.4.4)*

4. CalSim-II Module Enhancements (priority order after 3., although many of these projects have been initiated (Table 2))
    a. CalSim Allocation Module (CAM) (*section 4.2.8, 4.3.1, 4.3.4.8, Appendix B)*
    b. Water Quality Modules for the MWD-related facilities and the San Joaquin Valley (*section 4.2.7, 4.3.4.15, Appendix B)*

5. Software Development Needs – Part 2 (priority order after 4, although many of these projects have been initiated (Table 2)).
    a. Modularity (*section 4.3.4.7)*
    b. Runtime (*section 4.3.4.11)*
    c. Ability to Link Linear Optimization and Non-Linear Extensions (*section 4.3.4.12)*

6. Application/Software Extensions (priority listed in order after 5, although many of these projects have been initiated (Table 2)).
    a. Modular Application of CalSim (*section 4.2.6)*
    b. Demand Management and Supply Augmentation Schemes (Conjunctive Use) (*section 4.2.9).*

DWR and Reclamation plan to explore partnerships with stakeholder groups and outside resources to support implementation of some of these priority items in a comprehensive manner.

4. DWR/Reclamation Response to Specific Issues

4.1. Summary of Comments and Responses

Table 1 is a matrix of the various comments raised in the Strategic Review. The comments have been grouped into categories. The column on the far right-hand side of Table 1 refers to DWR and Reclamation's response to each individual comment as summarized below:

1 DWR and Reclamation do not agree with the comment stated.

2 DWR and Reclamation agree with the comment stated.

2a DWR and Reclamation agree with the comment stated and staff is currently working on it as part of our immediate needs for CalSim-II. A work plan is being developed by both DWR and Reclamation and will be shared with the public in the very near future.

2b DWR and Reclamation agree with the comment stated and consider it important to address in the short term with a target date of January 2007.

2c DWR and Reclamation agree with the comment stated but considers it should be addressed on a longer term with a target date of January 2011.

Where there is agreement (i.e., 2) then DWR and Reclamation attempt to fit the response within their projected timelines. Sometimes there is agreement and disagreement on an issue (e.g., 1, 2) indicating disagreement with portions of the comment but agreements on other parts.

4.2. Conceptual Level

The scope of a model should be defined in relation to its intended purpose. CalSim-II was originally conceived as a model of the CVP-SWP system to be used for planning purposes and comparative analysis of *project* alternatives. CalSim-II is now being advocated for analysis of more general water management issues. The Strategic Review (p2) states that:

"*As the official model of those projects, CalSim-II is the default system model for any inter-regional or statewide analysis of water in the Central Valley of California.*"

"California needs a large-scale relatively versatile inter-regional operations planning model and CalSim-II currently serves that purpose reasonably well."

Clearly, CalSim-II has evolved from being a CVP-SWP specific model. Yet, its wider role and purpose has not been clearly stated. The Strategic Review contains many recommendations relating to the wider (non CVP-SWP) role of the model. DWR/Reclamation agrees in principal to most of these recommendations. Any planner would wish for additional capabilities. However, implementation of these recommendations is constrained by the limited resources available to DWR and Reclamation.

It is necessary to examine the applicability of CalSim-II to a wider range of water related questions and to plan how further model development can support future planning activities associated with California water. The following is a set of modeling policy statements that DWR/Reclamation support and advocate to help direct future model development.

- Model users and decision-makers need to have confidence in CalSim-II for both absolute and comparative analysis (Strategic Review, p9)

- CalSim-II should evolve toward a more consistent representation of the rules that govern annual and real-time operations planning (Strategic Review, p8)
- CalSim-II needs to evolve from a model of the CVP-SWP system to a model of California's inter-connected water system (Strategic Review, p24)
- CalSim-II needs to explicitly represent a wide range of water management options, that include water conservation, reuse, water transfers, and groundwater conjunctive use management (Strategic Review, p21)
- Groundwater needs to be more fully represented in CalSim-II (Strategic Review, p19)

The Strategic Review (p2) agrees that CalSim is an appropriate approach for the modeling of the CVP-SWP-Central Valley system. The following sub-sections discuss particular issues raised in the Strategic Review that would broaden the model's applicability.

4.2.1. Geographical Scope

Development of CalSim-II beyond the needs of the SWP/CVP systems and the Sacramento-San Joaquin drainage area may go further than the current purpose of the model. Widening the geographic scope encompassing the Tulare Basin and Southern California would require considerable additional resources and greater support and involvement of local agencies. DWR, however, is currently working on the calibration of CVGSM2 (an application of IGSM2 to the Central Valley which includes Tulare Basin). DWR and Reclamation expect to use CVGSM2 or an alternative tool as the principal tool for developing the hydrology, modeling surface water – ground water interaction, and modeling ground water flow.

DWR and Reclamation support the development of CalSim models of the upstream watersheds, and the integration of these models with CalSim-II. An example of this cooperation is the development of the CalSim Yuba model that is supported by Yuba County Water Agency, and development of a daily time-step model of Upper American River operations (above Folsom Lake), commissioned by Reclamation. DWR and Reclamation support the vision of CalSim providing a common platform for water resources analysis in California.

4.2.2. Groundwater

Modeling groundwater in CalSim has evolved from the simpler Depletion Analysis approach to the current multiple-cell approach used in the Sacramento Valley. As part of its short-term goals, DWR is working on enhancing the modeling of groundwater flow and the surface water – groundwater interaction through the use of CVGSM2 (Central Valley Groundwater – Surface water Model) or its variants. CVGSM2 is the application to the Central Valley of the IGSM2 (Integrated Groundwater – Surface water Model) model. IGSM2 is currently developed and supported by DWR. A brief description of IGSM2 is given in Appendix F. One clarification: Page 8 of the Strategic Review lists a series of weaknesses model users would like addressed. These concerns were identified in a survey of stakeholders conducted by the University of California at Davis, prior to the Peer Review during the summer 2003. One of the concerns is stated as:

> *"Groundwater resources are assumed infinite, i.e., there is no upper limit to groundwater pumping"*

This is a mischaracterization of the model. Groundwater pumping *is* constrained in CalSim-II, and is also only available to meet local agricultural or urban demands. A full description of how groundwater pumping is modeled is given in Appendix A.

4.2.3. Hydropower

Reclamation has incorporated project hydropower generation and use directly into a version of CalSim-II, but hydropower is not included as an objective. Reclamation and DWR are currently using post-processing spreadsheets to analyze hydropower operations in CalSim-II. The Reclamation post-processing spreadsheet was originally designed for and approved by the Western Area Power Authority (WAPA). The WAPA spreadsheet currently represents all the CVP facilities. DWR uses a spreadsheet that was originally designed for DWRSIM (predecessor to CalSim-II) and applies to all SWP facilities. In the near future, the SWP plans to adopt a methodology for approximating hydropower that is similar to the WAPA spreadsheet.

DWR may consider integrating hydropower as a decision variable or objective in SWP operations as part of its long-term planning for CalSim-II. This will also be dependent on the availability and/or development of trade-off curves between hydropower generation and surface water deliveries.

4.2.4. Local Projects

Similar to the geographical extension of CalSim-II, DWR and Reclamation welcome and support, as far as possible, the use of CalSim by local agencies to develop planning models of their local facilities. These detailed models should be 'collapsible' so that they can be included in CalSim-II in an aggregate form, and so that CalSim-II can provide the local boundary conditions for more detailed local planning. This approach is consistent with the modular approach advocated by the Strategic Review.

4.2.5. Analyzing Future Scenarios

The Strategic Review (p22) recommends that capability to analyze a greater range of future scenarios be enhanced. Long-term planning for California may be best served by considering the notion other than that of a certain future, and implementing plans that best position the State to respond to a range of possible futures. This approach has been adopted by the California Water Plan Update, and DWR is evaluating the use of CalSim-II for future quantitative analysis. DWR and Reclamation agree that this is a desirable approach. However, the current hydrology development process is too unwieldy to efficiently produce a suite of possible land use, water supply and demand scenarios. DWR and Reclamation agree that, as part of the near term future model development the agencies examine ways to streamline the development of alternate futures, and restructuring of code to allow users to quickly change key input assumptions.

4.2.6. Modular Approach

The Strategic Review (p2) identifies a '*common tension between those who wish for greater detail and those who want less detail from the model*.' The successful implementation of an expanded role for CalSim-II depends on the adoption of a modular approach to modeling. This should allow the quick construction of different CalSim-II versions, ranging from a very simple system representation for preliminary screening analysis or educational purposes, to a

detailed and complex model that includes many local project operations. Modularity can be addressed at three levels: hierarchical, spatial, and temporal. An example of hierarchical level is a screening version of CalSim (as compared to a detailed representation of the system). DWR and Reclamation are also considering that the CalSim-II code be restructured to implement the modular approach before more detail is added to the model to represent local project operations in the Sacramento and San Joaquin Valleys.

4.2.7. Operational Objectives

Operational objectives in CalSim-II are either flow or storage related (minimum instream flows, storage targets, deliveries). Although water quality in the Delta is a constraint on project operations, it is not an objective. The Strategic Review (p8) suggests the capability of CalSim-II to analyze economic, water quality and groundwater issues be improved. Reclamation has developed a San Joaquin River Westside Drainage module for CalSim-II that disaggregates electrical conductivity (EC) source components that contribute to simulated Vernalis EC, which is an integral first step of future San Joaquin water quality investigations involving the main stem of SJR, Westside irrigation activities, and Upper/Eastside San Joaquin tributary operations. DWR is currently working with the Metropolitan Water District of Southern California (MWD) to add water quality functionality to the CalSim software. Using economic drivers for initial screening analysis has been discussed. Reclamation has worked with UC Davis on the development of the CALVIN model, which uses prescriptive optimization techniques and economic drivers to manage California's water system. Both agencies remain interested in adding CALVIN-type capabilities to CalSim-II. This work would probably best be implemented by the University of California, supported by DWR and Reclamation as part of the long-term strategy.

4.2.8. Real-Time Operations

Both DWR and Reclamation share the modeling vision to narrow the gap between their respective operations models and CalSim-II. One key area where operations and planning tools overlap is that the former is used to set allocation targets and the latter must represent the *process* of setting allocation targets. In actual operations, the DWR and Reclamation spreadsheet operations models are applied by operators to establish annual allocation levels; these levels evolve through the snowmelt season. In planning application within CalSim-II (i.e. during a multi-year simulation), the *process* of setting annual allocations is currently emulated in a very simplified manner that considers stored-water inventory and forecast hydrology at the time of allocation setting.

This simplified representation stands to be improved greatly through the application of the CalSim Allocation Module (CAM), which is being developed by DWR in collaboration with Reclamation. CAM was developed to mimic the procedure used by operations staff. This includes using forecasted hydrology for a 12 month time horizon and a simplified representation of the system (as compared to CalSim-II). Operating guidelines are being developed in consultation with SWP/CVP operators to reflect the procedures used in real-time operations. Use of multi-period optimization simplifies the required simulation rules by relying on the MIP solver to optimize the monthly reservoir release/export decisions subject to the system constraints and operating guidelines of the project reservoirs. Linking CAM with CalSim-II

takes advantage of both model approaches and improves the ability of the planning tool to mimic real-time operations.

4.2.9. Water Management Options

The Strategic Review (p21 & 23) states that CalSim-II should more explicitly model many demand management and supply augmentation options. The demand management options require that CalSim-II represent demands in greater detail and more explicitly. DWR and Reclamation will consider if modeling of these options may best be achieved through better linkages of CalSim-II to its agricultural (CALAG) and urban (IWR-MAIN, LCPSIM) demand counterparts. This will include how data inputs and outputs can be more easily communicated between these models. Also for consideration is revising urban demands in CalSim-II so as to represent them in their entirety rather than limiting representation to outdoor (consumptive) urban demand.

4.2.10. Objective Function

The Strategic Review (p4) raises an important issue regarding the characterization of reservoir operators' behavior.

"*Most successful applications of optimization that attempt to simulate the behavior of a system have calibrated their objective function so that the model results correspond to what actually happens or would happen under a particular hydrologic and demand scenario*."

A good example of this approach is the positive mathematical programming technique used in DWR's agricultural production models CVPM and CALAG. The lack of calibration is one reason why the *CalSim-II Simulation of Historical SWP/CVP Operations* study was unable to mimic historical project carryover storage during drought conditions.

In the past, DWRSIM and CalSim-II had a prescriptive rather than a descriptive approach in defining reservoir operation rules. For example, carryover storage targets were developed that maintained minimum storage levels during a prolonged drought while trying to minimize shortages in any particular year. While this is a valid approach, it may lead to over-optimistic model results due to discrepancies between model and actual operators' decisions.

DWR and Reclamation are engaged with their respective project operators to reduce these discrepancies. The difficulty in calibrating CalSim-II to past behavior is that the behavior is dynamic. Reservoir operations continually evolve due to changing regulatory conditions, changing systems demands, and requests from project contractors. The agencies modeling staff, reservoir operators and contractors are working together to develop a CalSim-II module (CAM) that can be used to determine present month decision variables (e.g., allocation levels, expectations on future carryover or fill targets) based on foreseen operations determined through multi-period optimization and hydrologic foresight. If successful, this approach will be extended to other model rule curves, such as balancing north and south of Delta storage.

4.2.11. Land Use

Projected-level land-use in CalSim-II is assumed constant. It is an exogenous input derived from the Central Valley Production Model (CVPM). Land use projections result from assumptions regarding farmer's long-run response to long-term average annual surface water and

groundwater availability and associated cost. Evidently, farmer's planting decisions will vary in the short-run due to annual variation in supply. This short-term response is not modeled in CalSim-II, although it can be modeled using CVPM (or its successor CALAG). DWR has developed an internal memorandum on how such a response could be represented in CalSim-II. However, modeling land-use variation is considered secondary to a more general revision and update of the CalSim-II hydrology development (Appendix E).

4.2.12. Hydrologic Uncertainty

The Strategic Review states that there needs to be *'a better capacity to accommodate other approaches to representing hydrologic uncertainty and variability besides simply simulating 70-plus years of record.'* DWR and Reclamation believe that the use of explicitly stochastic techniques or the use of synthetic hydrologic data would not be a useful contribution at this time. Assembling a reasonable representation of auto- and cross-correlation of inflows for a large-part of California is a daunting task. Preservation of the persistence of drought phenomena is very difficult. Even harder would be gaining public acceptance of such an approach. Nonetheless, DWR and Reclamation do believe that there are alternatives to the reliance on a single hydrology. Underlying the use of historical flows is the belief that the past is a good indicator of the future. DWR and Reclamation are currently working with the Scripps Research Institute to develop alternate hydrologies that may be more likely to occur due to global climate change. DWR and Reclamation are also considering the use of rainfall-runoff models as part of the hydrology development, which offer a more flexible approach to modeling extreme events beyond the recent historical record.

4.2.13. Documentation

Over the last two years DWR and Reclamation have worked together to document the model system representation and logic. As part of the September 30, 2002 Benchmark release, the agencies issued a 156 page model description and a document summarizing the simulation output. Since the release, DWR and Reclamation have dedicated time and resources to the following documentation activities:

- Creation of the CalSim-II Review and Documentation Team
- Development of WRESL code commenting protocol
- Implementation of commenting protocol for the September 30, 2002 Benchmark (review and revision of existing comments)
- Development of CalSim reference manual outline
- Development of CalSim documentation management system strategy

Despite the coordinated effort, documentation activities have often been given second priority to the production of model studies. Both DWR and Reclamation acknowledge the need to prioritize and supplement the Review and Documentation Team effort with additional resources to complete the documentation task. A brief description of the proposed CalSim-II documentation management system is given in Appendix D.

4.3. Implementation Level

4.3.1. Numerical Approach

CalSim uses mixed integer linear programming (MIP) to route water through a network of nodes and links in accordance to a user-defined set of priorities and constraints. The Strategic Review states (p4) that this approach is similar to other state-of-the art modeling tools such as ARSP, MODSIM, OASIS, REALM, Riverware and WEAP. However, the peer review does warn that optimization "*has the potential to produce inaccurate and overly optimistic results.*"

The Strategic Review recommends (p5) that the current strategy of single-step optimization should be supplemented by:

- Multi-period optimization to guide decisions with impacts that stretch beyond the current time-step,
- Detailed simulation of some system elements, allowing modeling of non-linearities, and potential reduction in run time.

DWR and Reclamation are currently implementing these recommendations in various ways. These fall under categories for enhancing and streamlining the numerical procedure. Enhancements to the numerical procedure of CalSim will allow expanded functionality, including

- Iterative solution of a cycle. A cycle will repeatedly be solved until the user-specified convergence criteria are met (or maximum number of iterations). This will increase the ability to model nonlinear aspects of the system.
- Automation of writing decision variables and constraints for multi-period optimization. The CAM model (briefly described in Appendix B) uses a time-consuming manual process for defining the MIP for multi-period optimization. This may be automated by introducing arrays for decision variables and constraints.
- Dynamic computation of decision variable weights. This will allow increased flexibility of the MIP.

Streamlining of the numerical procedure of CalSim will reduce run-times and simplify software maintenance. Items include the following:

- Streamlining of cycling MIP solutions. Cycles will be streamlined to eliminate the need for separate "Single Study Runner" and "Multi-Study Runner". This will allow a single GUI to be used for all CalSim simulations.
- Expanded use of DSS pathnames. A single DSS output file may be used for all "multi-step" studies. Transfer files may be eliminated, reducing time-consuming reading/writing to hard drive.
- Allowing State Variables to be written to DSS. Currently only Decision Variables are written to the DSS output file. Allowing State Variables to be directly written to the DSS file will eliminate the current practice of sending these parameters through the MIP solver and unnecessarily increasing the overhead on the solver.

4.3.2. Data

Concern of the quality of data in CalSim-II, is one of the most recurrent themes of the Strategic Review. For example (p20): "*There has not been sufficiently systematic, transparent, and accessible approach to the development and use of hydrologic, water demand, capacity and operational data. The administration of data development is fragmented, disintegrated, and lacks a coherent technical or administrative framework*."

The validity of data inputs impacts both model results and model credibility. The greatest concern is the validity of the hydrologic inputs and parameters. Concern is compounded by the current lack of complete documentation. Over the last two years DWR and Reclamation have attempted to document model inputs. Reclamation is currently documenting the current CalSim-II hydrology procedures. This effort needs to be extended and updated.

It is worth noting that the restructuring of the CalSim software as part of release 2.0 allows metadata describing the source of model inputs to be stored with the actual data. A brief description of the proposed CalSim-II data and documentation management system is given in Appendix D.

4.3.3. Data Management

The Strategic Review (p.58) identified data management as a critical aspect for CalSim. A web-based version control software (Perforce) is used by DWR modelers for managing the text-file input files of the current version of CalSim (v1.2). Adoption of a public domain relational database management system is under development for the next version of CalSim (v2.0). This database will provide a central repository that will contain documentation in addition to the model input/output data (time series data may continue to be stored in HEC-DSS). This will provide a full-featured client/server database including version control, integrity of data, documentation (including metadata), and ease of dissemination.

4.3.4. Software

In general, DWR agrees with the recommendations of the Strategic Review regarding the CalSim software. Many of these recommendations have been adopted and are being implemented for the next version of CalSim (v2.0). Given the growing use of CalSim outside of the two agencies, DWR accepts the need for extensive discussion and input from the wider modeling community and extensive beta-testing before the release of the next version of CalSim (v2.0). New software developments must take into account the considerable familiarity represented by the body of existing software users. It is important that major changes to the structure and look of the CalSim software benefit from feedback from this user-pool.

The following sections answer specific points raised in the Strategic Review. A brief general description of the next version of CalSim (v2.0) is given in Appendix B. In general, DWR's goal is to cease development work on the current release of CalSim (v1.2), and to implement improvements discussed below for the next version of CalSim (v2.0).

4.3.4.1. <u>Documentation</u>

Three documents are currently available to the CalSim user: the CalSim User's Guide, the CalSim Manual, and the WRESL Language Reference. These documents offer the minimum required help to the CalSim novice. DWR accepts that these documents need to be updated and

expanded. Initially DWR supported a web-based software bug reporting and archiving system. This system needs to be reactivated. DWR and Reclamation intend to publish a list of frequently asked questions (FAQ). This will eliminate many wasted hours of model user's time due to minor software bugs and idiosyncrasies. DWR accepts the need to provide centralized support. Given the agencies current workload and resource constraints it seems that it may be best to contract this to a third party.

4.3.4.2. Error Checking

The Strategic Review identified automated error (p5) and input/output (p24) checking for increased productivity. Staff from DWR, Reclamation, and other agencies or consultants has developed several spreadsheets for such purposes. A short-term goal of DWR is to collect, refine, and develop such spreadsheets into a series of standard pre and post processors that become a standardized set of tools. In addition, development of the next version of CalSim (v2.0) software may include expanding the solvers capability to track potential errors in setting up input data.

4.3.4.3. Gaming

Stakeholder participation will be sought to develop a gaming interface for the next version of CalSim (v2.0).

4.3.4.4. GUI

A CalSim-II geo-referenced network schematic is under development by Reclamation. The primary purpose of this project is to provide a communication tool between CalSim-II users, agency management, project managers, and the public. Geo-referencing the network provides quality control and a spatial connection between the system and the topography. The general CalSim GIS toolbox can be applied in any geographic location and features drag and drop icons with connector linkages for easy modifications. CalSim-II network schematic developments also anticipate future integration options. GIS is capable of generating CalSim code based on the network representation to run an application, storing pertinent meta data and coverage information, and has online integrated mapping system capabilities. In addition, the CalSim GIS toolbox has been applied to the SWP and CVP system and is now under review. Alternative options (public domain) for schematic generation are also in discussion.

4.3.4.5. Infeasibilities

DWR recognizes that the solver report of an infeasible solution is a periodic, but potentially very time-consuming problem. Tools do exist currently in CalSim to identify the causal constraints, but they are not well documented. The current LP solver in CalSim is XA (by Sunsoft, Inc). Users may use the XA reporting options in CalSim to help identify the problem. In many cases XA will report which constraints it has not been able to satisfy, and by how much it would need to relax the constraint to find a solution. However, in some cases XA fails to identify the problematic constraints. The Strategic Review (p24) recommends overcoming the infeasibility problem, which adds slack and surplus auxiliary variables to each constraint. High penalty values assigned to the auxiliary variables would assure that they would be non-basic (i.e. have a value of zero) unless the solution would otherwise be infeasible. The auxiliary variables would only be added to the MIP problem if an infeasible solution were obtained, so as not to

increase run-time There is merit to this approach ,which is currently used in CalSim to assure that the continuity constraint for storage nodes can always be met.

DWR is working with Lawrence Berkeley Laboratories on an alternate approach to develop analysis tools for infeasible and non-unique solutions (Section 4.3.4.10).

4.3.4.6. LP Output

CalSim currently provides limited output from the MIP solver. For successful solutions, only final decision variable values are reported. These include Lagrange multipliers (a.k.a. dual variables, shadow prices, trade offs) which indicate the sensitivity of the objective function to each decision variable, slack variables which indicate the sensitivity of decision variable bounds on the solution, and basic and non-basic variables which are used internally by the solver. These output parameters may help users understand the complex nature of the multiple constraints on the system and how they interact with the MIP.

4.3.4.7. Modularity

The Strategic Review (p21) indicated modularity of data components will help to alleviate the conflicts of different users requiring both a less complicated and more details system representation (p21). Included in the next version of CalSim (v2.0) is the ability to store data in modules. This functionality may be used in several ways, which the CalSim user community should establish protocols for their use. Possibilities include various levels of geographic resolution (ranging from simple to complex), modularizing regulations into distinct packages and/or representing hydrologic processes in different levels of complexity. These various components may be linked together in a simulation to form various distinct models suitable to the user and purpose of simulation.

4.3.4.8. Multi-Period Optimization

CalSim-II uses the MIP to route water through the system on a single time step. Simulation rules are used to bind the optimization solver for monthly decisions. The Strategic Review suggested use of multi-period optimization may provide a useful platform to represent the system and interact with the simulation model (p5, 8, 38). The CalSim Allocation Module (CAM, Appendix B) uses this methodology for a remainder-of-Calendar-Year optimization window (e.g., twelve months if initiated in January). During the multi-month optimization window the solver is allowed to determine the optimal pattern of reservoir releases, channel flows, and exports relative to storage and release constraints that represent operator sensibilities during allocation planning, rather than specifying simulation rules. CAM was developed within the existing CalSim software by writing the system constraints manually. DWR will automate implementation of multi-period optimization by allowing the next version of CalSim (v2.0) GUI to essentially write and interpret arrays. This functionality will facilitate the exploration of multi-period optimization within the CalSim environment.

4.3.4.9. Post-Processing

The CalSim software has some limited functionality to analyze and interpret model results. This is primarily the viewing and comparison of base and alternate time series data using charts and tables. While DWR and Reclamation acknowledge the need for better post-processing tools, it is the belief of both agencies that this functionality is best provided by third-party tools such as Excel. There are currently many different post-processing tools used by CalSim users to import HEC-DSS data into Excel and subsequently to manipulate the data for interpretation.

DWR and Reclamation recommend that resources be invested into pooling the availability of these tools with further investment in their development. In addition to automated generation of charts and tables within Excel, it has been shown that for developed gaming models MS-Excel can be a good visualization tool.

4.3.4.10. Public Domain

DWR is following a policy of adopting public domain software for CalSim. This includes:

- Elimination of the FORTRAN compiler,
- Replacement of the XA proprietary MIP solver, and
- Search for a public domain GUI for the construction and editing of the river basin topology.

DWR is currently testing the public domain solver GLPK for use in CalSim. At this time, individual CalSim cycles have been solved by GLPK, and, so far, it reproduces the proprietary XA solver solutions. The next version of CalSim (v2.0) is being modified to use GLPK for further testing. Based on initial tests, GLPK is not as efficient in solving CalSim type problems as the XA solver. Solve time is approximately three times greater with GLPK. Lawrence Berkeley Laboratory (LBL) is working on improving the efficiency of GLPK. LBL has also been asked to add other utilities to GLPK such as analysis tools for infeasible and non-unique solutions.

4.3.4.11. Run Time

Advances in computer processing speeds are steadily reducing model run times. However long run time remains a problem, precluding for example sensitivity analysis on model inputs. Much of the problem relates to inefficient coding of the MIP problem in which large parts of the system are unnecessarily simulated multiple times in each time step. To reduce run times DWR and Reclamation are adopting the following strategy:

- Eliminate unnecessary variables from the LP problem (e.g. use of alias statements),
- Restructure the WRESL code to eliminate repetitive calculations,
- Optimize the reading and writing of data to HEC-DSS.

4.3.4.12. Simulation

The Strategic Review (p5) suggests that linking of linear multi-period optimization procedures to non-linear simulation models might both increase the accuracy of the model, and possibly decrease run time. The optimization module would be run each time some type of 'optimal' decision needs to be made e.g. annual allocations, reservoir releases or other management decisions. More detailed simulation at a shorter time step would subsequently implement these decisions, and define the consequences, routing water through the network according to a set of rules.

The peer review panel was not unanimous in this view. Most of the panel agreed that single time-step optimization is needed to reduce the dependence on operating rules. The use of multi-period optimization is discussed in Section 4.3.4.8. DWR, however, does agree that greater use of simulation might reduce run-time. The CalSim software should be modified to permit

simulation both at the end and beginning of each time-step. Subsequently the CalSim-II code should be reviewed so as to eliminate variables from the MIP problem that could be defined through simple arithmetic calculations.

4.3.4.13. Time-Step

CalSim-II is a monthly planning model of a geographically extensive system. Aggregation in time and space, by necessity, simplifies or omits many operational details. Of particular concern has been the error that a monthly time-step may introduce in representing the Delta.

- Project export capability may be over-estimated due to monthly averaging of Delta inflow,
- A monthly time-step may poorly represent regulatory requirements, such as X2, which may be met on the basis of 14-day running average EC, or 3-day running average Net Delta Outflow Index.

DWR has developed a daily time-step version of CalSim-II for the Sacramento Valley and Delta (Appendix B).

DWR and Reclamation heed the warnings of the Strategic Review (p24) that shortened time steps pose problems of run-time, data development and model interpretability, amongst others. DWR proposes to conduct a study to evaluate the errors introduced by using a monthly time-step. The study will compare project exports from CalSim-II to the daily Delta CalSim model. In the first part of the study the daily model will be run with the daily Delta inflow set equal to the average monthly inflow as determined by the monthly CalSim-II model, i.e. with no day-to-day flow variation. In the second part of the study the daily model will be re-run, but imposing a daily fluctuating flow pattern on the Delta inflow. This two-stage approach will distinguish between the impacts of modeling Delta regulations at a daily time scale to the impacts due to the varying daily flow pattern. A technical report of this evaluation will be published.

At this time DWR does not anticipate further extension of the daily-time step model or the introduction of routing into CalSim-II.

4.3.4.14. Version Control

Good quality control is essential given the complexity of CalSim-II, the enormous data requirements and the number of model developers. Good quality control is a key component to model credibility. Without it the accuracy or reliability of CalSim-II could quickly degenerate. The Strategic Review (p37 & 58) makes detailed recommendations relating to quality control. It cannot be achieved solely through software innovations. Protocols for data management and model development need to be written, published and adhered to.

Quality control needs to start with the central storing and sharing of data and the implementation of a version control system. This version control system should at a minimum:

- Keep track of model changes
- Facilitate the storage of metadata regarding those changes
- Allow any previous version of the model to be recovered

- Allow multiple developers to work simultaneously
- Alert model users to model changes

DWR and Reclamation have implemented a version control system for CalSim-II's text-based input files. The system allows model users web-based access to a central database. Model studies can be downloaded from the database, changes made locally to the model, and the revised data input stored back in the central location. The system has not been fully adopted, due in part to the lack of in-place model development/model management protocols. The current text-based version control system will be replaced by an analogous version-control feature with the release of the nexe version of CalSim (v2.0) that is centered on a relational database. DWR and Reclamation agree that it is a high priority to develop enterprise database capabilities for the next version of CalSim (v2.0), so that central data management and version control can be implemented.

4.3.4.15. Water Quality

DWR is currently working with MWD to develop a water quality module for CalSim. The first-phase of the project would permit the user to specify inflow concentrations, and concentrations for agricultural and urban return flows for various conservative constituents. CalSim would calculate the resulting water quality throughout the network using constituent mass balance. Water quality calculations would be post-processed at the end of each time-step. A second phase of development would allow the model user to specify water quality targets as drivers in the optimization procedure.

4.3.4.16. Weights

The objective function weights establish the priority for releasing water from storage and making deliveries to different parts of the network. DWR and Reclamation accept that the process of weight setting is as much an art as a science. Currently the creation of a successful set of weights requires a sophisticated model user or a very patient one that is willing to submit to a time consuming trial and error process. A systematic and standardized approach is needed to generate weights, once the user has defined relative priorities (Strategic Review, p24). The acceptability of CalSim-II results and ease of model use are subject to some debate and concern, partly due to the current difficulties in weight setting.

DWR and Reclamation support the idea of research into a method of automatically assigning values to individual weights to represent the underlying water right-based allocation rules, contractual and institutional requirements, regulatory policy layers and operating rules simulated in CalSim-II.

4.3.5. Administrative Issues

4.3.5.1. Resources

DWR and Reclamation will explore and work with other public agencies; at local, regional, state or federal level, to seek needed resources to continue the development work proposed in this response plan.

4.3.5.2. Model Management

DWR and Reclamation will also seek new opportunities and avenues, both private and public, to broaden the management base for the existing and future model developments. Currently there is an interagency team coordinating this effort.

4.3.5.3. Peer Review

DWR and Reclamation believe that peer review enhances the acceptability of the modeling tool. The agencies may suggest peer reviews of modeling components it deems necessary.

4.3.5.4. Public Involvement

DWR and Reclamation will work with all interested parties, both public and private, to seek technical input in developing and enhancing the current and future modeling components.

4.3.5.5. Sustainability

The proposed Model Management Team (DWR, Reclamation and others) will work to develop a strategy in this important area.

4.3.5.6. Training and Education

The agencies modelers will continue to support, to the extent resources permit, to broaden the model users' base for appropriate use of models. The Proposed Model Management Team may also be charged with this responsibility.

4.4. Model Testing

4.4.1. Calibration and Validation

Model calibration is the process of fine-tuning the value of various model parameters, so that model results match the observed data. Validation is the subsequent testing of the model against data that has not been used in the calibration to obtain an independent assessment of the model's accuracy.

The need for testing, calibration and validation of CalSim-II is one of the most controversial issues raised in the Strategic Review. Some of the peer review panel recommended that further validation of the model is required through the comparison of model results to recent historical data. However some in the modeling community express their doubts on the usefulness of such a comparison (CalSim-II in California's Water Community – Musing on a Model, p158). The Strategic Review (p129) notes that for the Murray-Darling Basin model, validation is considered to be less important. The Murray-Darling Basin model is calibrated using a long period of data. In contrast validation is carried out using only two to three years of data.

In discussing the merits of calibration it is important to distinguish between physical parameters that remain essentially constant (e.g. stream-bed conductance), and behavioral parameters that may change and adapt (e.g. reservoir operating policy). Water use parameters such as irrigation efficiency may fall somewhere in between these two extremes. Where possible the value of parameters should be determined from direct observation. This may not be possible for some parameters such as regional scale reuse of water.

DWR and Reclamation believe that model calibration to determine the value of physical parameters, and parameters such as irrigation efficiency, is a valuable exercise, and benefits model accuracy and model credibility. However, DWR and Reclamation suggest that a more reasonable approach to defining behavioral parameters is through discussions with system operators to define *current* operational policy or rules. California's water system, especially with regard to the Delta, has undergone many changes in the 1990s (Delta Water Quality Control Plan, CalFed, ESA actions, CVPIA (b)(2), Environmental Water Account) so that calibration to historical practice has limited value. It would appear more reasonable to define operating rules in conversations with operators and subsequently use a recent wet, normal and dry year in a validation exercise.

The debate on calibration stems partly from a misunderstanding of the hydrology development. The CalSim-II hydrology is tied to historical stream gage data. The following points explain what calibration has been undertaken for the Sacramento Valley:

- The accretions and depletions between the project reservoirs and the Delta *are* calibration terms. They have been determined so that at a historical level CalSim-II will exactly match historical gage data if reservoir releases are fixed at their historical level and groundwater pumping and stream-aquifer interaction are fixed at their assumed historical values.
- Calibration of groundwater use has not been carried-out due to the lack of historical data.
- The stream-aquifer model in CalSim-II is calibrated to the more sophisticated Central Valley Groundwater Surface Water Model (CVGSM).
- The CalSim-II hydrology is calibrated to net consumptive use rather than stream diversions and return flows. CalSim-II may therefore not simulate well diversions to particular irrigation districts.
- The hydrology adjustment to account for the impact of land-use change on rainfall-runoff has not been calibrated or validated.
- Calibration or validation of district-scale diversions in CalSim-II cannot be undertaken without increasing the resolution of the model.

DWR and Reclamation recommend the following approach to CalSim-II calibration and validation:

- DWR and Reclamation modeling staff continue to work with project operators to define operating rules that correctly capture current (rather than historical) operational policies.
- Following re-calibration of CVGSM[1], the CalSim-II groundwater model is refined and re-calibrated.
- DWR and Reclamation develop methods to validate assumptions regarding land use change impacts on rainfall-runoff.

[1] Major revisions to the underlying IGSM software and the input data sets to CVGSM have been made by DWR since the development and calibration of the CalSim-II groundwater module.

- DWR and Reclamation work with local irrigation districts and their consultants to refine the spatial scale of CalSim-II and calibrate/validate local projects operations through comparison of model output with historical data,
- Modeling groundwater pumping is modified to a land-use based approach. DWR has identified through land use surveys areas that are dependent on groundwater, areas that rely on surface water and areas that use groundwater as a contingent supply. The spatial resolution of CalSim-II should be refined to distinguish between these three land types.

After the completion of the above, CalSim-II should undergo a limited validation exercise using different recent year types.

Validation of local project operations has been shown to work well with the recent model enhancements to the San Joaquin Valley. Working with local districts has resulted in successfully calibrated hydrologic parameters so that CalSim-II has matched recent historical storage and flow data.

4.4.2. Sensitivity Analysis

The primary goal of CalSim-II sensitivity analysis is three-fold: (1) to verify if the key model input parameters are working properly within their reasonable range of variations; (2) to determine the impact of each parameter on selected model results; and (3) to set up priorities for potential refinements of model input parameters. Some of the parameters being evaluated are: SWP demands, target carryover storages, reservoir inflows, agricultural and urban water use, water use efficiencies, Delta water quality requirements etc. This sensitivity analysis had been undertaken by DWR and will be coordinated with Reclamation.

4.4.3. Uncertainty Analysis

Uncertainty analysis uses probabilistic descriptions of model inputs to derive probability distributions of model outputs and system performance indices (Strategic Review, p73). CalSim-II users need not only stand alone for absolute model results but also the degree of confidence they can place them. For example, what is the 95% confidence limit on the exceedence curve of project exports from the Delta? Hydrologic uncertainty is expressed through the use of a 73-year time series. There is currently no measure of data input uncertainty. Appendix H of the Strategic Review focuses on ways to identify and quantify uncertainty.

DWR and Reclamation agree that a method of implementing uncertainty analysis for CalSim-II needs to be defined. One approach is to simulate historical operations and use the statistics of goodness of fit to identify the uncertainty. An alternate approach is to identify plausible ranges of input parameters and to repeat model runs using high and low values of complimentary parameters (e.g. low efficiency in conjunction with high demands). This approach is more akin to the multiple future scenarios adopted by the California Water Plan Update.

4.4.4. CalSim-II Historical Operations Study

The primary purpose of the *CalSim-II Simulation of Historical SWP/CVP Operations Study* (DWR, 2003) was to evaluate the ability of CalSim-II to represent CVP and SWP operations, in general, and the delivery capability of the projects, in particular, when compared with a recent historical 24-year period. The following paragraphs discuss issues regarding this study raised in the Strategic Review.

4.4.4.1. Overestimation of Project Deliveries (Strategic Review, p68)

Comments in the Appendix E of the Strategic Report suggest that CalSim-II Historical Operations Study overestimates Project deliveries. The reviewers observe that CVP deliveries in the validation study are higher than historic; and the SWP deliveries taken from a model study conducted at 2001 level of development, are higher than the average of the last ten years. We do not believe this will be the case when compared with appropriate studies.

The Historical Operations Study was designed to simulate historical deliveries to evaluate how well other components of the system (such as reservoir storage, river flows, Delta outflow) compare with historical values. In this study, a simplistic demand assumption was made for the CVP. For each year of the simulation, CVP demands were fixed at the contractual amounts for north and south-of-delta contractors. It appears this assumption is the main reason for the overestimation of CVP deliveries. The historical data show that for most years during the study period of 1975-1998, especially during 1980s and early 1990s, CVP contractors received 100 percent of what was requested. If the CVP demand assumption could be refined for each year of the historical simulation, then, of course, the CVP overestimation is significantly reduced.

The reviewers observe the SWP deliveries also appear overestimated. This observation is not based upon the Historical Operations Study because the SWP demands in that study are artificially set at the values for historical deliveries during non-dry years when contractors received 100 percent of what was requested. The comment is based on comparing actual average annual deliveries for the last 10 years (2385 taf/yr) with the modeled 73-year average annual deliveries (3090 taf/yr) from a study conducted at 2001 Level of Development, based on current entitlement request. Note that this study was conducted for a different purpose for use in the *SWP Delivery Reliability Report, 2003.* DWR does not believe 2001 level study overestimates SWP deliveries. For dry periods, the results are very close to historical because the deliveries are limited by supply. The modeled average annual south-of-delta deliveries for the recent drought of 1987-1992 compare well with the actual values. The average annual values for SWP deliveries during this period are 1,930 taf/yr for the 2001 level study and 2,030 taf/yr historical. Similarly, the average south-of-Delta CVP deliveries are 2,340 taf/yr for 2001 level study and 2,320 taf/yr historical. In the wetter years, the demand (2001 level) is higher than the historical demand, so estimated deliveries are higher than the historical amounts.

When long term deliveries are compared among appropriate studies, the average annual values for SWP during the 23 year period are 1810 taf/yr for the Historical Operations Study and 1790 taf/yr actual historical deliveries for the same period. Similarly, the average south-of-Delta CVP deliveries are 2650 taf/yr for Historical Operations Study and 2490 taf/yr actual historical.

4.4.4.2. Allocation to Project Contractors (Strategic Review, p68)

Real-time allocation rules are moving targets that are year-specific and are based on entitlement requests, hydrology forecasts, initial storage conditions (both north and south of the Delta), and many other operational considerations. As such, allocation rules are very closely tied to each historical year's operation, and are not easily amenable to general mathematical formulations under a wide range of hydrologic conditions for use in the CalSim-II modeling studies. Knowing this, DWR does agree in general with the reviewers' observation that current allocation rules in the model tend to deliver water more uniformly over the dry period. Current allocation rules in CalSim-II have been designed to operate the system at a fixed level of development, present or future, which tend to maximize long-term deliveries while protecting the average annual deliveries during the historical dry periods of 1987-1992 and 1928-1934. This rule reduces the potential variability of deliveries from year to year. During the dry period of 1987-1992, more water was delivered by the SWP and the CVP during the first years of the drought and less during the latter part when compared to the delivery values of the Historical Operations Study. Although CalSim-II does not capture the potential variability of deliveries during dry periods, the simulations are useful for quantifying the total amount of deliveries over dry periods and providing information for more detailed analyses designed to address this variability. At this time, DWR will continue with the method currently used in CalSim-II for allocating water.

4.4.4.3. San Luis Reservoir Operations (Strategic Review, p69)

DWR acknowledges the reviewer's statement that San Luis Reservoir storage in the Historical Operations Study is consistently underestimated during the 1987 1992 drought when compared to the historically observed storage and that this can significantly effect the results for the pattern of flow in the Delta, opportunities for wheeling and pumping under Article 21, and accounting under the Coordinated Operations Agreement. It is also acknowledged that users of CalSim-II output need to be confident that the rules adopted by the model for determining how water is moved from north of the Delta to south of the Delta reflect the way San Luis Reservoir will be operated in the future.

DWR and Reclamation agree this component of the model merits additional review and plan to review CalSim-II's operation criteria for San Luis Reservoir with project operators and stakeholders.

4.4.5. Comparative vs. Absolute Predictions

CalSim-II and its predecessor models can be used in two ways. The first is in the comparative mode and the other is in the absolute mode. The comparative mode consists of comparing two model runs: one that contains a proposed action and one that does not. Differences in certain factors, such as deliveries or reservoir storage levels, are analyzed to determine the effect of the proposed action. In the absolute mode, the results of one model run, such as the amount of delivery or reservoir levels, are analyzed directly.

Traditionally both DWR and Reclamation have assumed that model assumptions are less significant in a comparative study than an absolute study. All of the assumptions are the same for

both the "with-action" and "without-action" model runs, except the action itself, and the focus of the analysis is the differences in the results. The Strategic Review (p9), however, suggests that the assumed relative accuracy of a comparative analysis may be incorrect as:

"*…it relies on the assumption that the model errors which render an absolute forecast unreliable are sufficiently independent of, or orthogonal to, the change being modeled that they do not similarly affect the forecast of change in outcome; they mostly cancel out*."

CalSim-II and its predecessors DWRSIM, PROSIM, and SANJASM were originally conceived for comparative analysis. However, for endangered species consultation, biological assessments, facility re-licensing efforts under FERC, or local planning efforts by project contractors and local agencies, absolute values of delivery reliability or other performance measures are required. DWR and Reclamation recognize the requirement of CalSim-II to provide absolute predictions, and consequently the need for further work in refining model inputs and quantifying the likely range of model error. Relying on analysis of long periods (anywhere from a few years to the period of record) through calculation of statistical parameters and development of exceedence data may be useful for absolute predictions. Reliance on individual monthly values or yearly averages is not recommended.

The relative accuracy of a comparative analysis can be demonstrated through sensitivity analysis. Sensitivity to model inputs can be compared between a stand-alone study and a comparative analysis. In the comparative sensitivity analysis, a unit change of input to both the “with” and “without” project model, results in a change in the difference in the model outputs.

CalSim-II is constantly improving. DWR and Reclamation will consider, through discussions with stakeholders, the relative priorities of (1) refining the current model to improve its accuracy, and (2) quantifying the level of accuracy of the current CalSim-II model.

5. Development Priorities

Table 2 summarizes current CalSim/CalSim-II development projects and recommends priorities for future development. These are categorized according to immediate needs, short-term priorities, and long-term priorities. The time frame for the short and long-term priorities is January 2007 and January 2011, respectively. Comments and references in Table 1 can be matched (in general) with those in Table 2.

6. Summary and Conclusions

6.1. Summary

6.1.1. Model Scope

The Strategic Review identified many areas in which the scope of CalSim-II could be extended to support a wider range of planning activities. In its current form it is predominantly a model of the CVP-SWP system. The coarse spatial resolution of the model and the limited integration of groundwater limit its usefulness in other planning forums. Nonetheless DWR and Reclamation believe that CalSim-II is an adequate model for planning studies for new storage and conveyance facilities in the CVP & SWP systems.

DWR and Reclamation support further development of CalSim-II to broaden its applicability to California water planning issues other than those relating to the CVP-SWP. DWR and Reclamation intend to work with stakeholders to produce a model strategy for future model development. In the near-term, DWR and Reclamation believe that the geographical and conceptual extension of CalSim-II to non-project areas and issues should be secondary to a technical audit/peer review of the existing model data input and logic, and completion of application documentation.

Future model extension should be modular. A more complete groundwater model for the Sacramento and San Joaquin valleys is an essential component. Other important modules that should be added include:

1) Water transfers
2) Groundwater banking, and conjunctive use
3) Water conservation options
4) Water quality
5) Economic drivers

Consideration should also be given to extending land use based demands to the west side of the San Joaquin Valley and to areas in the Tulare Basin served by the two projects.

DWR is evaluating the use of CalSim-II to analyze a broad range of future scenarios for the California Water Plan Update. DWR will examine ways to streamline the development of alternate water supply and demand input data. DWR and Reclamation will also examine ways to better integrate CalSim-II with the Department's other planning models (CVGSM, CALAG, LCPSIM) that would benefit both agencies.

6.1.2. Data and Documentation

Model credibility is viewed as the most immediate concern. Unless the credibility of CalSim-II stays above a certain threshold, the continued development and use of the model will be threatened. The issue of credibility stems partly from the complex representation of California's water system, exasperated by incomplete documentation. It also stems from the limited efforts to demonstrate that CalSim-II's water accounting is unbiased and reasonably

accurate. Many of the data concerns relate to the input hydrology. Priorities for the two agencies are:

1) Documentation of the CalSim-II's conceptual model and associated data inputs
2) Overhaul of the CalSim-II hydrology, with the development of updated hydrologic inputs supported by calibration and or validation
3) Integration of CalSim-II and CVGSM2 (or alternative) system representation and data set
4) Extension of hydrologic data to 2002 or beyond
5) Validation of CalSim-II using different year types
6) Uncertainty analysis

6.1.3. Software

Improvements to the CalSim software should focus on the release of the next version of CalSim (v2.0). This represents a major restructuring of the model, with the replacement of text input files with a relational database. This will provide the functionality to implement many of the Strategic Review recommendations: modularity, version control, and documentation (metadata). The database will allow users to quickly query constraint sets and decision variables, and more easily follow model coding logic. Elimination of the FORTRAN compiler and the use of a public domain solver will make the software more accessible. Other important software development goals are:

1) Development of a GUI for construction of reservoir river-basin topology and the input and output of data
2) Creation of a common post-processing utility (using third-party tools such as Micosoft Excel) that streamlines the comparison of model results across model runs
3) Update and expand the CalSim user's manual and provide centralized support to CalSim/CalSim-II users
4) Reduce model run times by implementing better data transfer efficiency, increased modularity, and a more efficient solver
5) Develop a stripped-down CalSim-II for training of new users
6) Develop and automated procedure for weight setting
7) Develop multi-period optimization capabilities

6.1.4. Long-term Development

Models take time to develop. Substantial thought should be given to the problems and type of analysis that CalSim will have to address in the next five to ten years, and the likely available resources within DWR and Reclamation. DWR and Reclamation will seek involvement from local agencies in model development. With modeling needs clearly defined, a strategy should then be devised for how to go from the current state of the model to the desired state of the model within the given timeframe.

6.2. Conclusions

The following remarks are extracted from the CalSim-II peer review panel

"A unique aspect of CALSIM II is the high degree of cooperation between federal (i.e. U.S. Bureau of Reclamation) and State (i.e. California Department of Water Resources) interests in its development. This kind of cooperation is rare, and in fact this may be the only such example of such coordination for a system of this scale and complexity…..CALSIM II can provide a showcase for other states as to what can be accomplished with Federal and state cooperation for river basin management." (Strategic Review, p18):

"We believe the use of an optimization engine for simulating the hydrology and for making allocation decisions is an appropriate approach and is in fact the approach many serious efforts of this kind are using." (Strategic Review, p2)

"…CALSIM II represents a state-of-the-art modeling system that is similar in general concept, while differing in specific details, to other data-driven river basin modeling systems such as ARSP, MODSIM, OASIS, REALM, RiverWare, and WEAP." (Strategic Review, p4)

DWR and Reclamation believe that CalSim-II is an adequate model for planning studies for new storage and conveyance facilities in the CVP & SWP systems. For certain applications of CalSim-II as described in section 4.4.5, absolute values of CalSim-II results are required as projected estimates of future system performance. For such applications of CalSim-II, full discussion of all pertinent assumptions and careful examination of input data must accompany presentation of CalSim-II results. Many enhancements described in this Response Plan, when properly implemented, will greatly improve the performance of CalSim-II, thereby expanding the applicable scope of the model and enhancing the level of public acceptance. Sustained effort will be required to accomplish the planned enhancements. Periodic review and updates of the planned enhancements will also be part of this sustained effort.

APPENDIXES

Appendix A. Representation of Groundwater Pumping

Modeling of Groundwater Resources

In CalSim-II, groundwater in the Sacramento Valley is used to meet both agricultural and urban demand. The volume of groundwater pumping varies according to the availability of surface water, and spring precipitation. In modeling groundwater, the developers of CalSim-II had a choice: (1) to restrict the volume of groundwater pumping in drier years to, for example, an estimate of the installed pumping capacity for a particular sub-basin; or (2) to assume groundwater pumping continues until demand is fully met. In either case, the impact of groundwater extraction can be measured by the impact on groundwater storage of each sub-basin, which is explicitly modeled in CalSim-II. Average annual groundwater pumping over and above the natural and artificial recharge will result in depletion of the basin. Once a groundwater basin is fully depleted, CalSim-II will no longer run. Model developers selected option (2) above, which gave rise to the concern of unlimited groundwater pumping voiced by the peer review. It is important to note, however, that CalSim-II does not include local ground water inventories. Currently the multiple-cell approach mimics the CVGSM model, which in itself is an "approximation" of built-in inventories (based on the historical calibration).

CalSim-II attempts to mimic farmers pumping decisions over the recent historical period. Groundwater extraction in CalSim-II is limited in several ways:

- The total of stream diversions and groundwater pumping must be less than the land use based demand. This demand is calculated from an assumed cropping pattern and monthly crop evapotranspiration, and takes into account the monthly and annually varying precipitation.
- The assumed cropping pattern used for CalSim-II is based on an agricultural economic production model that is calibrated to recent observed water use and cropped acreage. As such, CalSim-II implicitly accounts for the cost of groundwater pumping, which limits farmer's willingness to pump water.
- For areas that have access to both surface water and groundwater, groundwater is the secondary or contingent resource. Groundwater pumping occurs only after the model has tried to maximize service water deliveries given the various operational constraints (minimum instream flows, Delta water quality requirements, minimum reservoir levels and reservoir carryover storage targets).
- Groundwater pumping may only be used to satisfy the demands of overlying landowners. No groundwater is exported from the overlying watershed (except in the form of surface water return flow or tailwater that results from irrigation using groundwater).

The above bulleted items are discussed in more detail in the following sections.

Land Use Based Demands

Demands in the Sacramento River Basin (including the Feather and American River basins) and Delta are determined based on land use and vary by month and year according to hydrologic conditions. Land use-based demands are calculated using DWR's Consumptive Use

(CU) model. The CU model simulates soil moisture conditions for 13 different crop types over the historical period. Irrigation demand is triggered when soil moisture falls below a specified minimum. The CU model calculates the crop consumptive use of applied water. The consumptive use is subsequently multiplied by water use efficiency factors to obtain a regional water requirement to be met from stream diversions or groundwater pumping. Agricultural demands in the Delta are represented more simply as an overall mass balance between precipitation and crop evapotranspiration.

Central Valley Production Model

The Central Valley Production Model (CVPM) predicts cropping patterns, land use, and water use within the Central Valley by considering land availability, water availability and cost, irrigation technology, market conditions, and production costs. CVPM was used in the California Water Plan Update (Bulletin 160-98) to forecast future agricultural acreage. CVPM has recently been updated and extended into a statewide model, known as CALAG.

CVPM is a regional model of irrigated agricultural production and economics that simulates the decisions of agricultural producers (farmers) in the Central Valley. The model assumes that farmers maximize profit subject to resource, technical, and market constraints. Farmers sell and buy in competitive markets, and no one farmer can affect or control the price of any commodity. To obtain a market solution, the model's objective function maximizes the sum of producers' surplus (net income) and consumers' surplus (net value of the agricultural products to consumers).

The model is calibrated using recent historical irrigated acreage, applied surface water and groundwater pumping for 21 sub-regions in the Central Valley. The model includes information on pumping depth and pumping costs.

Matching of Demands and Supply

Within the Sacramento Valley CalSim-II always meets the land use based demand.

Groundwater Pumping Logic

In the Sacramento Valley demand is met by a mix of surface water and ground water. Farmers and urban municipalities may have access to either one or both of these supplies. In CalSim-II a minimum groundwater pumping is specified to represent those demands that only have access to groundwater. The CalSim-II code is written so that demands are first met by groundwater pumping, up to the minimum specified volume. It is subsequently met by surface water diversions up to the contract amount for project demands and up to its availability for riparian demands. Any difference between demand and supply is finally met by additional pumping. No shortages occur. Minimum groundwater pumping volumes are based on water years 1981-1993 of the historical CVGSM run.

Groundwater Export

There are a total of seven basins that represent the Sacramento Valley floor north of the Delta. There is no export of groundwater from the sub-basin. Groundwater is pumped only to meet the demands within each sub-basin. The CalSim-II logic allows a certain percentage of pumped groundwater applied as irrigation to flow to the stream network as return flow.

Results from CalSim-II Historical Operations Study

DWR recently released a report describing the results of a CalSim-II Historical Operations Study. The purpose of the Historical Operations Study was to evaluate the ability of

CalSim-II to represent CVP and SWP operations, in general, and the delivery capability of the projects, in particular, through the simulation of recent historical conditions (water years 1975-1998). The following is an extract from that report.

> *Does CalSim-II overestimate the availability of surface water in the Delta by meeting Sacramento Valley in-basin use through excessive groundwater pumping?*
>
> *The mix of surface water and groundwater used by the model to meet Sacramento Valley consumptive demands depends primarily on project water allocation decisions and levels of minimum groundwater pumping that are specified in the model. Over the 24-year period average annual net groundwater extraction in CalSim-II as compare to estimates based on the Central Valley Groundwater Surface water Model (CVGSM) is lower by 378 taf. The average annual net stream inflow from groundwater in CalSim-II is 190 taf greater than estimated by the CVGSM for the same period. The combined affect of dynamically modeling groundwater operations in CalSim-II (pumping, recharge and stream-aquifer interaction) leads to 188 taf/yr less water being available to the Delta. For the 1987-92 period the combined effect results in 46 taf/yr additional water being available to the Delta.*

Thus the Historical Operations Study concludes that the current representation of groundwater in CalSim-II results, on average, in an underestimate of the water available at the Delta.

Appendix B. Current CalSim / CalSim-II Development Projects

CalSim Software

Version Control

Good quality control is essential given the complexity of CalSim-II, the huge data requirements and the number of model developers. Good quality control is essential to model credibility. Without it, the accuracy or reliability of CalSim-II could quickly degenerate. The Strategic Review (p37 & 58) makes detailed recommendations relating to quality control. It cannot be achieved solely through software innovations. Protocols for data management and model development need to be written, published and adhered to.

Quality control needs to start with the central storing and sharing of data and the implementation of a version control system. This version control system should at a minimum:

- Keep track of model changes
- Facilitate the storage of metadata regarding those changes
- Allow any previous version of the model to be recovered
- Allow multiple developers to work simultaneously
- Alert model users to model changes

DWR and Reclamation have implemented a version control system for CalSim-II's text-based input files. The system allows model users web-based access to a central database. Model studies can be downloaded from the database, changes made locally to the model, and the revised data input stored back in the central location. The system has not been fully adopted, due in part to the lack of in-place model development/model management protocols. The current text-based version control system will no longer work with the release of the next version of CalSim (v2.0) that is centered on a relational database. DWR and Reclamation agree that it is a high priority to develop enterprise database capabilities for the next version of CalSim (v2.0), so that central data management and version control can be implemented.

Geographically Referenced Network Schematic

DWR and Reclamation are working cooperatively to develop a GIS based geo-referenced schematic of CalSim-II which would allow a user to interactively query attributes (e.g., reservoir or channel physical characteristics or all references to a node or link in the WRESL files), and time series data.

Public Domain Solver

DWR is currently working with the LBL to investigate the possibility of replacing the current XA solver in CalSim with a public domain solver.

CalSim-II Applications

Geographical Expansion

Over the last four years DWR and Reclamation have worked to develop CalSim models for the mountain watersheds in the Sacramento Valley. Models for Stony Creek, Yuba River, Bear River, and Upper American River have been successfully developed. These models require a technical peer review before being integrated into CalSim-II. The Yuba River model is currently being reviewed by Yuba County Water Agency's consultants, and is expected to be an integral part of the next CalSim-II benchmark study release.

Global Climate Change

CalSim-II is being used by a joint DWR-Reclamation Climate Change Work Team to investigate impacts of climate change on California's water resources. Currently downscaled projections of future climates are being used to generate reservoir inflow time series for use in CalSim-II to investigate impacts on water allocation and Delta water quality. The work is an extension of previous studies conducted at UC Berkeley. Future work will focus on incorporating probabilistic risk analysis. Initial assessments focus on potential climate change impacts on SWP and CVP yield, carry-over reservoir storage, Delta outflow and compliance with Delta water quality standards.

East-Side San Joaquin Operations/Hydrology

The representation of the east-side of the San Joaquin Valley has been substantially revised. Modifications include:

- Use of land use based demands
- Refine spatial resolution
- Revised reservoir operational logic for local projects
- Revised accretions and depletions

This effort is currently being extended to the Delta east-side streams.

CalSim-II Modules

Daily Time Step Model

DWR has created a daily time-step CalSim Delta Model as part of the evaluation of the proposed In-Delta Storage Project. This model was used in conjunction with the CalSim-II monthly model. The entire system's operation was simulated for a one month period with the CalSim monthly model and then the information on inflows to the Delta and south-of-Delta delivery amounts were passed on to the Daily Delta Model. The Daily Delta Model was used to re-simulate the operations in the Delta and the export facilities.

The monthly CalSim-II model provides monthly flows for various Delta locations. However, the daily model requires daily flow data as its input. Thus, a disaggregating model,

which was trained using historical observations, was used to generate the daily flows from the monthly flows. While the daily inflow hydrograph was patterned after the historically recorded inflow, the total volume of the inflow to the Delta provided by the monthly model was preserved. The results of the Daily Delta Model are provided to the monthly model as the initial conditions for the following month's simulation. The operation of the upstream reservoirs is re-simulated, and any gains or losses of water are reflected in Delta outflow and storage at San Luis Reservoir. The next month's simulation is then started with the modified end-of-month storage in San Luis Reservoir and the state of the Delta as simulated by the Daily Delta Model.

Since its use for evaluating the In-Delta storage Project, the daily model has been extended upstream to include the Sacramento Valley downstream of the major project reservoirs.

Water Quality Module

MWD is taking the lead to develop and implement a water quality mass- tracking algorithm in the CalSim-II model. The implementation will track water quality constituent mass through arcs and reservoirs with the assumptions that the constituent is conservative and that perfect and instantaneous mixing occurs over the time step. Linearization of the mass balance relationship, by using source concentrations from beginning of time step, may be necessary for efficient implementation in CalSim-II. Linkage of Delta flow-salinity results to the south-of-Delta water quality mass tracking will be included.

CalSim Allocation Module

The CalSim Allocation Module (CAM) was developed to help integrate the CalSim-II planning model with operational models used by the CVP and SWP. Specifically it was created to help operators:

- Define project reservoir carryover storage targets
- Define what hydrologic probabilities should be used in making projections
- Investigate how late the projects should make adjustments to annual allocations

CAM uses multi-period optimization to make annual allocation decisions based on imperfect hydrologic forecasts. By necessity this requires a much simpler representation of the system compared to CalSim-II. At the beginning of the contract year, CAM is run to define an initial annual allocation decision. The period of optimization is from the current month to the end of the September. The resulting allocation decision, based on maximizing deliveries for a given carryover storage target, is passed to the full CalSim-II model, which simulates in greater detail the response of the system for the current month. Updated forecasts and storage conditions from CalSim-II are subsequently passed back to CAM. CAM model is rerun to obtain an updated allocation. This process is continued until annual allocation decisions become firm, usually in the month of May.

On-going work for CAM includes the refinement of hydrologic forecasts, and developing better Delta required outflow projections.

San Joaquin River West-Side Drainage WQ Module

Reclamation is working with consultants and DWR to complete development of a water quality mass-balance module that maps source loads of electrical conductivity associated with

the San Joaquin River irrigation activities to electrical conductivity conditions in the main stem of the San Joaquin River. The purpose of the module is to improve the CalSim-II salinity estimate at Vernalis through: (1) San Joaquin River westside flow disaggregation; (2) salt balance along the San Joaquin River main stem (nodes between Lander Avenue and Vernalis) by assigning EC values to the disaggregated flows.

CalSim Water Transfers Tool (Screening Model)

The Water Transfers Tool (WTT) currently being developed for DWR will be a separate, smaller application from CalSim-II but will incorporate the major hydrologic, SWP/CVP system, and operational features of the larger model. Changes in the land use-based diversion requirements included in the model -by Depletion Study Area (DSA)- will serve as a surrogate for a variety of fallowing, crop change, conservation, and groundwater substitution transfers. Stored water transfers will be simulated through a surrogate reservoir concept at the location of the transfer and limited to upstream storage capacity availability. The WTT will be developed through a layering approach to allow for a large number of transfers at varying priorities for purchase and conveyance.

Appendix C. Software Development Proposed Plan

The original CalSim 1.0 program was initially released to the public in 1999. Since that time, updates have been made to refine the original software and add capabilities as required by users. In that time the manner in which CalSim based modeling has been used has grown in terms of the number of users, the complexity of the regulatory environment needed to be simulated, and an increase in the scope and detail of the system required to be modeled. These and a number of other concerns led to the recognition that in order to achieve a robust and fully acceptable model of the current CalSim (v1.2) program required improvement.

The development of the next version of CalSim (v2.0) is intended to create a more robust modeling environment for the increasing number of users and complexity of system representation. These improvements fall under three categories of data management, a graphical user interface, and the solution controller.

Data Management

Proper data management is an essential component for applications relying on large amounts of data. The text-based structure of the current CalSim application is sufficient for small numbers of users. However, as the complexity of the model and number of users increases, the greater the chances are for mismanagement of data. Integration of a relational database management system for CalSim's data storage formalizes the collection of data into a state-of-the-art management tool. Version control, integrity of data (validity of data is still required on the user side), reduction of duplicated data, and ease of linking with a graphical user interface are all advantages of using a relational database system.

Client/server functionality of the database provides for a central repository of benchmarked and finalized projects. Users may connect as a client to the database server to send and receive updates. The client may keep a local copy of the database on their computer and update with the server as desired.

Incorporation of metadata into the relational database is a significant step forward in automated documentation. As data is entered or manipulated the author and date is automatically recorded. A text area is also available for user comments and documenting the source of the data. Protocols on what users should record in this field have been developed by the CalSim-II Review and Documentation Team.

A tool will be developed that will ease the adoption of the next version of CalSim (v2.0) by automating the transfer of existing text files into the database.

Graphical User Interface

With the incorporation of a relational database management system there needs to be a user interface for entering, manipulating and viewing the information. An integrated graphical

user interface (GUI) is being developed for this purpose. All data required for running CalSim simulations is interfaced through this single menu-driven GUI using standard windows features.

A hierarchical visualization of the relation of Projects, Simulations, and Cycles is the main component of the GUI. Properties of these components are viewable/editable through a standard point-and-click window. WRESL and Lookup tables are viewable/editable through similar standard windows. Standard editing features such as searching and copy/paste will also be provided.

The next version of CalSim (v2.0) GUI controls the management of projects which encapsulate any number of simulations. User privileges defined in the database allow for management of projects and simulations by controlling who may modify such data.

Solution Controller

A JAVA based solution controller has replaced the current FORTRAN package. Adoption of object-oriented programming into the controller allows for more robust techniques. This increases not only the longevity of the management of source code but provides a simpler context for probable future modifications to the solution package.

Additional features of the new solution controller include the following:

- Elimination of the FORTRAN compiler. Reduces cost.
- Investigation of alternative MIP solvers. Potential cost reduction.
- Streamlining relationship of ‘projects’, ‘simulations’, and ‘cycles’.
- Embedded ‘cycles’. Replaces the Multi-Study Runner by allowing ‘cycles’ to contain other ‘cycles’.
- Introduction of ‘layers’. Collection of data (WRESL, tabular lookup, etc.) that allows for modularity of data across ‘projects’. Cycles may contain any number of ‘layers’. Layers are overlaid one on top of the other and may overwrite previously defined data. Protocols will be developed for sufficient need of using ‘layers’ (i.e. geographic subsystems, regulatory components, etc.).
- Iteration of a ‘cycle’. A single ‘cycle’ may iterate on its solution until convergence criteria is met.
- Increased use of DSS path names. Using the ‘cycle’ name in one of the DSS path names facilitates the use of embedded cycles and eliminates the need for the costly run-time transfer files.
- Pre/Post-MIP ‘state variables’. Some ‘state variables’ are functions of ‘decision variables’. These are evaluated after the MIP solver but remain on the current time step.
- Direct writing of ‘state variables’ to the results file. Eliminates the need to send unnecessary decision variables and constraints to the solver to get ‘state variables’ in the results file.
- Dynamic calculation of ‘decision variable’ weights. Increases ability to control the MIP for each ‘cycle’ and time step.

- Introduction of ‘watch variables’. Allows results from the simulation to be dynamically viewed while the simulation is running.
- Facilitation for an interactive schematic. Development of GIS or other tools is being investigated.
- Facilitation of multiple-period optimization. GUI-assistance in writing WRESL that will span multiple time periods

Appendix D. Documentation Proposed Plan

The most recent release of CalSim-II application documentation accompanied the September 30, 2002 benchmark. This literature is contained within the Benchmark Assumptions Document and Study Results, a summary of the simulation output. Criticisms to the documentation include a deficiency in: explaining how the model works, the underlying assumptions, limitations, and applicability to planning and management issues (Strategic Review, p 8). In addition, CalSim-II documentation is hampered by three factors: protocol has been mostly absent, maintenance is difficult and the knowledge of the vast SWP and CVP systems resides in many different individuals. Both DWR and Reclamation realize the importance of documenting information. However, more often than not, documentation has been placed at a lower priority or overlooked as an integral task to data and logic development or modification.

Despite the difficulties and challenges both agencies face to complete documentation of the CalSim-II application, a consorted effort has been initiated to remedy the deficiencies identified by both internal and external criticisms. DWR and Reclamation have proposed to develop a CalSim documentation management system. The purpose of the documentation management system is to

- Institute documentation protocol
- Provide a convenient method for documentation updates
- Flexible media products for users

This documentation system will become fully integrated within the next version of CalSim (v2.0) data management system and will be linked to the CalSim logic and data. The data management system will require a standardized set of documentation fields and meta data. Finally, the management system will be capable of generating a variety of media products with graphics, linking, indexing and searching options.

Documentation Management

The current documentation techniques are cumbersome for the CalSim-II modeling community to maintain. A variety of formats such as text documents, comments in the code, spreadsheets, supporting model reports, and PDFs are housed in several different locations. The formats and locations make it almost impossible to update all aspects of a modification with absolute certainty.

Therefore, a documentation management system is proposed that utilizes a database to organize and maintain the information. The system will be used as a “central-file” for all model documentation. The new system will track and maintain a documentation history similar to features in the next version of CalSim (v2.0) data management system. Existing documentation will also be rolled into the new management system.

The key features of the documentation management system include:

- Documentation linked to the code
- Tiered levels of detail
- New topics of documentation not yet covered
- Links to source documents (e.g. PDFs or spreadsheets)
- Documentation of state, initial, and decision variables
- Documentation of lookup tables
- Documentation of logic and system control files
- Data confidence rating
- Distinction between actual practice and implementation
- Flexible report templates
- Advanced query options
- Electronic, hard-copy and Help File applications

It is anticipated that the organized and centralized documentation management system will be the new standard for CalSim documentation procedures. Linkages between the documentation and the code will eliminate undocumented or overlooked topics. New documentation coverage will address deficiencies and multi levels of detail will support both the novice and expert. The document management system is also expected to be an integral and priority component of the CalSim work effort.

Appendix E. Surface Water Hydrology Enhancement Proposed Plan

The term hydrology development is used to describe: (1) the conceptual (node-link) model of the Central Valley, (2) the calculation of water supply and demand inputs and (3), water use parameters (efficiencies, losses, minimum groundwater pumping, etc.). Many of the methods used in the hydrology development were originally formulated in the 1960s and 1970s. This section proposes a major overhaul of the surface water hydrology, particularly for the Sacramento Valley, which provides approximately 80% of the inflow to the Delta.

The redevelopment of the surface water hydrology is to meet the following goals:

- Integrate the hydrology development with other statewide data collection and analysis efforts, in particular the land and water analysis carried-out by DWR's Division of Planning and Local Assistance (DPLA) regional offices
- Allow for spatial and temporal aggregation/disaggregation
- Provide a common approach for other agency planning models (CalSim-II, IGSM, CALAG)
- Easy to understand and implement
- Facilitate the use of CalSim-II to support other CalFed, DWR and Reclamation planning processes: e.g. Water Use Efficiency Program
- Refine estimate of Sacramento Valley 'in-basin use'
- Correct minor conceptual errors in existing methods

Both DWR and Reclamation agree on modifying and enhancing the hydrology development for CalSim-II. At this time, different proposals are being considered; but no agreement has yet been finalized (including the approaches discussed below).

Conceptual Model

Water supplies and demands are currently represented in CalSim-II in a very aggregate form. For example, in the Sacramento Valley floor water supplies (other than inflows from the surrounding foothills) and agricultural and urban demands are lumped into only seven Depletion Study Areas (DSAs). The typical representation for each DSA is shown in Figure 11-1. A single inflow arc typically represents total regional inflow from minor ungaged streams and direct runoff. This flow is an unimpaired inflow. Any irrigation demands associated with these minor streams are met by proxy by diversions from the principal stream running through the DSA (the Sacramento River, the Feather River and the American River). A single land use based demand is calculated for each DSA using DWR's Consumptive Use (CU) model[2]. This demand is subsequently disaggregated into project and non-project demands using a constant fraction or percentage. Project demands may be met from releases of stored water from project reservoirs, but are constrained by the annual project allocation/contract entitlement. Non-project demands

[2] The CU model estimates irrigation demands by simulating monthly soil moisture conditions in the root zone for 13 crop types.

are not constrained by contract, but are constrained by the availability of stream flow, unimpaired by project operations. Both project and non-project diversions are constrained by the land use based demand.

It is assumed that a certain percentage of demand must be met from groundwater pumping to represent areas that have no access to groundwater. Above a specified minimum pumping, demand is met from surface water supplies up to its availability or allocation. Supplemental groundwater pumping meets any unmet demand.

Land use based demands are at the resolution of the DSA. However, contract entitlements represented in CalSim-II are at a more disaggregated scale, typically at the level of the larger irrigation districts. To resolve this discrepancy in resolution, CalSim-II disaggregates demand by assuming it is proportional to the contract entitlement.

The aggregation of demand by DSA leads to assumptions about project and non-project water use that may not be entirely accurate.

- Project and non-project demands have identical efficiencies
- Project and non-project demands have the same monthly pattern of diversion requirements (implicitly the same cropping pattern)
- Project and non-project demands have similar dependency on groundwater (as represented by the assumed minimum groundwater pumping)

Non-project demands are predominantly located on the minor streams tributary to the Sacramento River. These supplies may be more restricted in dry years. The DSAs are currently not consistent with DPLA's proposed new Planning Areas used for land use planning and economic analysis. The boundaries of the DSAs make hydrologic mass balance calculations difficult in some areas (e.g. the Colusa Basin)

Spatial Representation

There is a proposal to replace the existing DSAs with new water management areas so that demand units are associated with their correct water supply sources. Demands would be distinguished according to:

- Source of water,
- Contract type,
- Cropping pattern, and
- Water use efficiency.

The proposed new water demand areas are shown in Figure 11-2. Both project and non-project demands may be present in one planning area. Different project demands in a single planning region may be differentiated according to their water source, type of contract (with the CVP, SWP or local project), type of use (M&I vs. agriculture), cropping pattern, and water use efficiency. However non-project demands within a planning region are represented as a single aggregated unit. This proposed refinement of CalSim-II's spatial resolution could lead to greater engagement of local irrigation districts and water agencies.

Water Use Efficiency

DWR's CU model calculates the irrigation water required to meet crop evapotranspiration while maintaining soil moisture above some minimum threshold. A 'basin efficiency' factor is subsequently used to calculate the water demand at a regional level. The basin efficiency factors are based on field measurements conducted by DWR during 1969-1974. These efficiencies were derived for use in DWRSIM (CalSim-II's predecessor). DWRSIM modeled groundwater as a net extraction from the aquifer, rather than explicitly modeling pumping and subsequent recharge from irrigation activities. The original basin efficiencies therefore had to be modified to account for losses from deep percolation. Use of a lumped efficiency factor, rather than explicitly representing losses at different scales, leads to assumptions and potential inaccuracies:

- Water use efficiencies are independent of the source of water, although most groundwater pumping is at farm/field level, and significant conveyance losses may be associated with stream diversions
- Project contractors and non-project diverters have identical water use efficiencies (conveyance losses, farm efficiencies, reuse, etc.)
- The project non-project demand split does not account for differences in water use efficiency so may be incorrect
- It is difficult to assess the impacts of on-farm and in-district water conservation measures due to the poor representation of efficiencies, losses and return flows
- The representation of demands in CalSim-II, CALAG/CVPM and CVGSM are difficult to reconcile since efficiencies and losses are represented in different ways
- CalSim-II demands are not related to applied water demands at the farm level and demands at the district level, although most of the available data is at these scales rather than at a regional level

It is also proposed to replace the existing representation of agricultural demand with an explicit representation of on-farm applied water demands, reuse (both intra-district and inter-district), conveyance losses, and operational spills. Different conveyance loss factors would be applied to the different contractors and non-project diverters according to their water source. The proposed approach is shown diagrammatically in Figure 11-3.

Rainfall-Runoff Modeling

CalSim-II uses the historical hydrology to represent the possible range of water supply conditions that could occur at a future point in time (level of development). This enables future water supply reliability to be expressed in probabilistic terms. DWR and Reclamation recognize that this approach poses several problems. The historical stream flow record is incomplete. Flow data, where it exists, is impaired by historical diversions and return flows. Lastly historical stream flows are affected by the stream-aquifer interaction, a process that CalSim-II models dynamically. The current hydrology development uses a 'depletion analysis' to estimate the historical and projected level flows. The aggregate stream inflow for each DSA is calculated as the closure term of a hydrologic mass balance. Subsequently, historical flows must be adjusted to account for the impact of land use change on runoff. While this approach has its advantages, there are also disadvantages:

- The need to define historical land use, and historical consumptive use resulting from irrigation
- The need to define historical groundwater pumping and recharge
- The need to define the historical stream-aquifer interaction
- The need to define historical water transfers (imports and exports) across the model boundary
- The absence of a good measure of the associated error (errors are encompassed in the closure term)

With increasing demands for details, the depletion analysis approach (while serving its original intent) is becoming more difficult to use, requiring a detailed knowledge of the basin. It is very time-consuming to develop new hydrologies for different levels of development or to extend the period of simulation. To model historical water use also imposes considerable constraints on modernizing the approach. For example, representing changes in rice irrigation requirements due to changes in planting dates, shorter-growing crop varieties, winter flooding for rice straw decomposition all have to be represented as phased changes over time rather than simply considering today's practices. Lastly, the current depletion analysis does not lend itself to the modular approach advocated by the Strategic Review (p21).

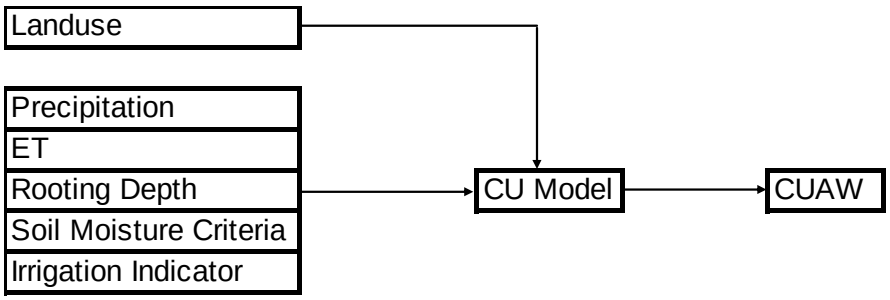
Under consideration is proposed work that a more modern and flexible rainfall-runoff approach to estimating local hydrology and rim inflows for use in CalSim-II would have considerable advantages. The rainfall-runoff approach has been successfully implemented for use in other planning models. The benefits of rainfall-runoff modeling include:

- Easier to field verify
- Easier to update hydrology for changing land use conditions (or climate conditions)
- Easier to document and sustain with personnel changes
- Easier for various model users and hydrologists to understand and use
- Easier for more groups of hydrologists (agencies and consultants) to contribute to model upgrades and refinements
- Easier to apply consistently across basins
- Provides a framework for keeping land use, water demand, surface hydrology, and groundwater hydrology assumptions consistent
- Provides consistency with CVGSM/IGSM (or alternative model) representation of groundwater hydrology
- Easier to change modeling time-step
- Easier to modify spatial coarseness
- Easier for state, regional, and local agencies to employ for a wider range of hydrologic, planning, and management studies (such as local water supply, flooding, and restoration problems)

Consumptive Use Model

The Consumptive Use (CU) model was originally developed by DWR to create input for the water resources planning model DWRSIM. Its role in CalSim-II is essentially unchanged. The CU model simulates monthly soil moisture conditions in the root zone using simple mass balance accounting. For a given land use, the model calculates:

- Monthly agricultural and outdoor urban water use (consumptive use of applied water)
- Monthly precipitation that is used consumptively through evapotranspiration.



The time series of CUAW is aggregated by DSA and multiplied by efficiency factors to obtain the land use based target demands used in CalSim-II. The consumptive use of precipitation on developed areas compared to pre-development is used to calculate the effects of land use change on runoff. These adjustments are required to estimate the local water supplies or accretions in CalSim-II.

A main limitation of the CU model is that it does not integrate soil moisture accounting with rainfall-runoff and deep percolation. The separate estimation of rainfall runoff, evapotranspiration and deep percolation in CalSim-II can lead to errors. One approach under consideration is:

- Replace CU model with a soil moisture accounting model (e.g., Sacramento Watershed Model framework, implemented by CA-NV RFC) that directly estimates runoff and deep percolation
- Structure new model so that it can be directly incorporated into IGSM or alternative model
- Integrate new model's current work on irrigation model development such as DPLA's CUP and SIMETAW

Modularity

The refinement of the CalSim-II spatial resolution should go hand-in-hand with implementation of the modular concept of modeling. For example, agricultural areas in the Sacramento and San Joaquin Valley could be represented as a black box with boundary flows linking the black box to the major stream and groundwater system. The boundary flows are:

- Diversion arc(s) from the stream network with associated monthly demands and monthly weights

- Return flow arc(s) to the stream network, with flow calculated as a piecewise linear function of the flow in the diversion arc
- A groundwater pumping arc, with flow calculated as a piecewise linear function of the flow in the diversion arc
- An inflow arc to the groundwater system representing recharge from deep percolation (given a fixed land use, flow in this arc could be constrained to a fixed time series)

Alternatively, a region may be represented in more detail, broken-down into constituent irrigation districts with arcs showing conveyance losses, reuse, and operational spills. This more detailed representation is required for defining the relationship between surface water deliveries, groundwater pumping and return flows. Once these relationships have been established, the detailed model can be switched to the 'black box' representation to simplify the CalSim-II model and reduce run-times. The more detailed model can be used for analyzing impacts of water conservation measures.

DWR is considering implementing this dual modular approach for a test area, such as the Feather River Basin, that has a very complex internal structure of diversions from different sources and reuse between irrigation districts.

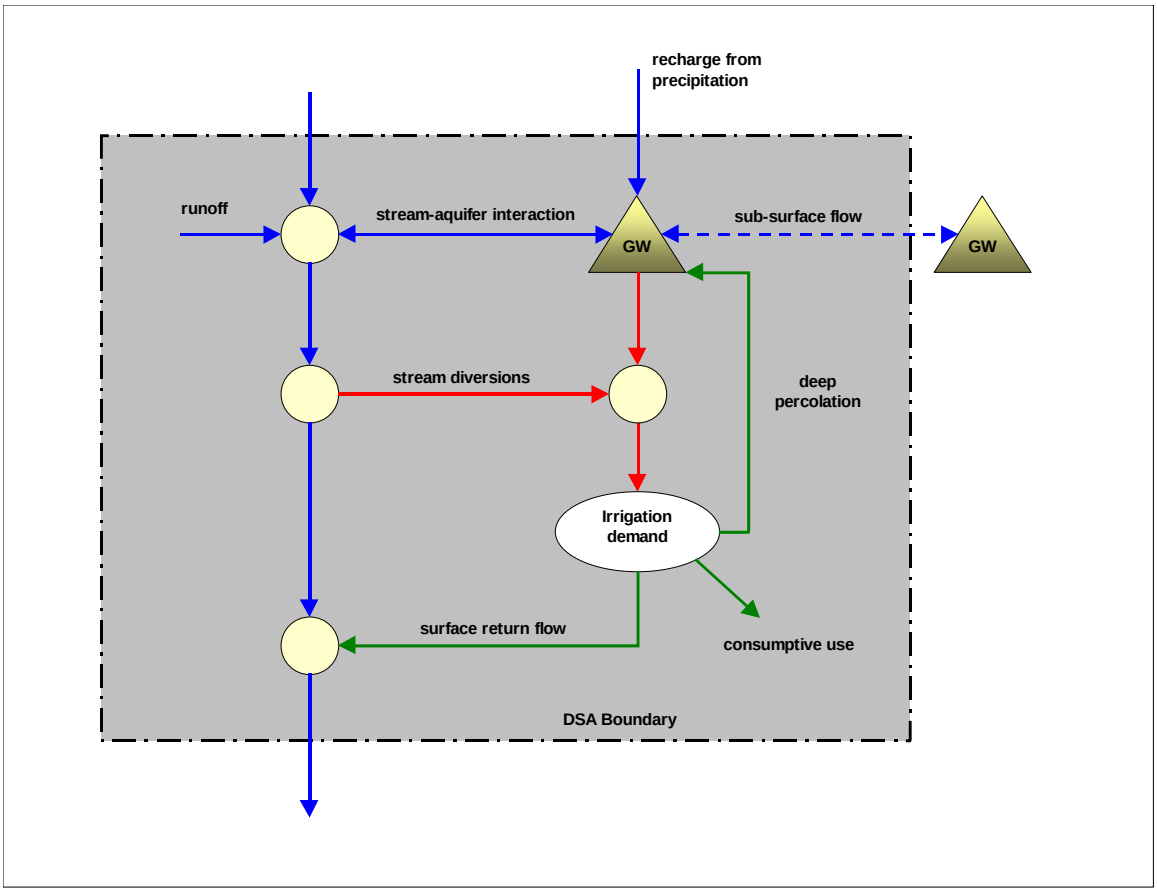


Figure E-1 Existing Conceptual Water Use Diagram

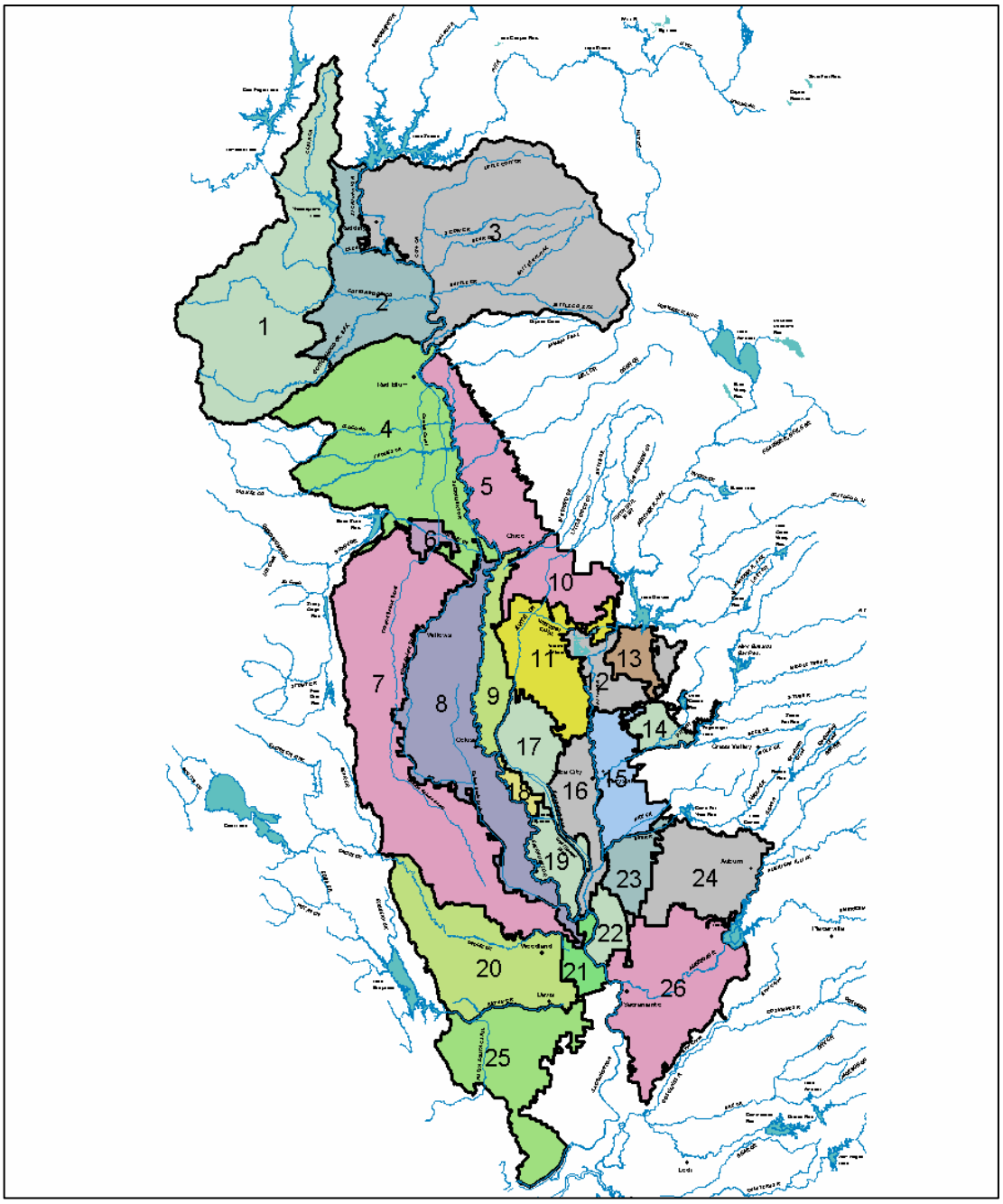


Figure E-2 Proposed New Water Management Areas

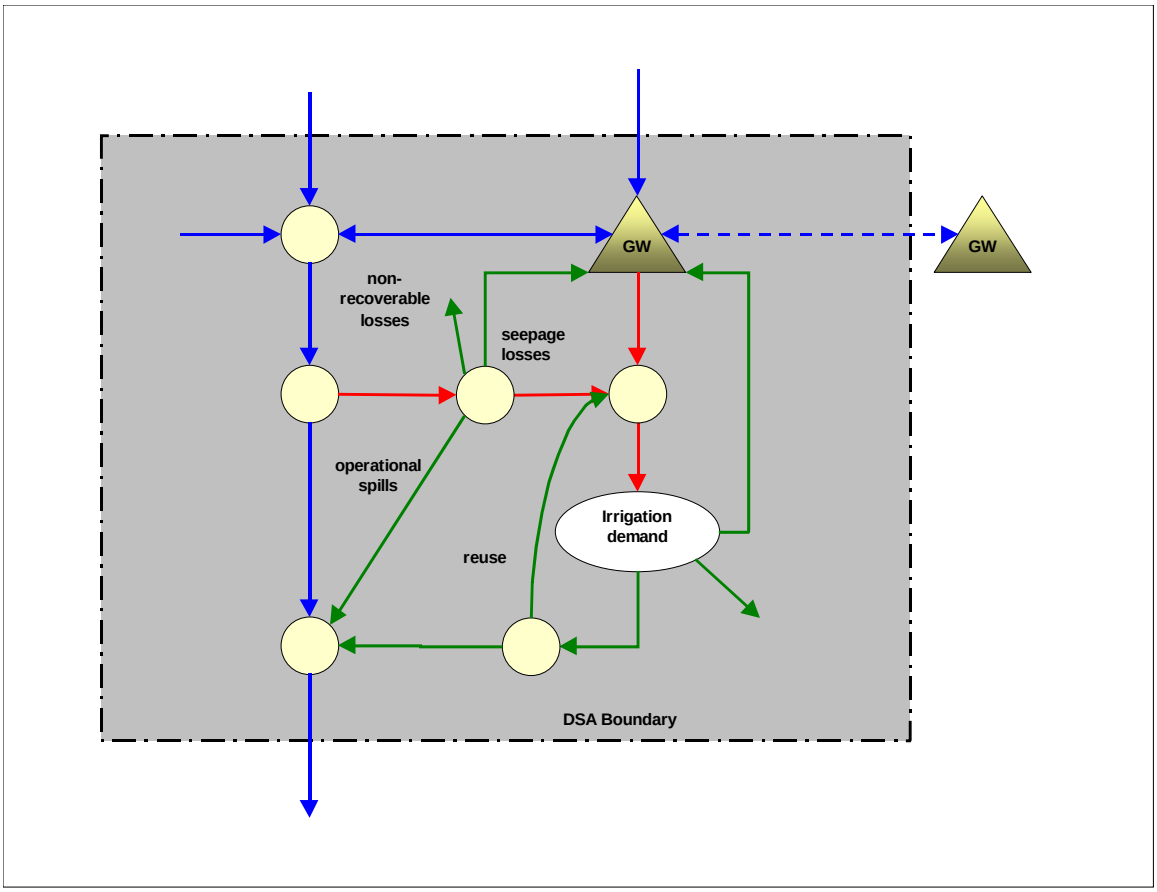


Figure E-3 Proposed Conceptual Water Use Diagram

Appendix F. Groundwater Modeling Proposed Plan

Current representation of groundwater (inventories and impacts) in CalSim-II is approximate and limited. Both DWR and Reclamation recognize the strong need to enhance the modeling of groundwater in CalSim-II and a more realistic impact of recharge and pumping on local ground water resources. One model under consideration is the Integrated Groundwater – Surface water Model IGSM2 (Figure 12-1) the latest version of which was developed and is supported by DWR. The application of IGSM2 to the Central Valley is called the Central Valley Groundwater – Surface water model CVGSM2 (Figure 12-2). However, other models will also be investigated, including how the model is used (e.g, directly, or mimicked through approximate methods such as response functions).

One approach for meeting such an objective is the coupling of CalSim-II and IGSM2/CVGSM2 (or alternative model or mimicked version) for hydrology development, ground water representation and assessment in future versions of CalSim-II. This new approach could be used calculating the hydrology input to CalSim-II, the accounting for surface water – ground water interaction, and the modeling of groundwater flow. The type of "linkage" between CalSim-II and CVGSM2 (or alternative) would depend on what hierarchical level of CalSim-II is being used. For example, at its simplest formulation CalSim-II as a screening model of the SWP/CVP system may use an emulation of CVGSM2 (or alternative) to account for the accretions and surface water – groundwater interaction (e.g, through the use of response functions that would be developed based on CVGSM2 or alternative model runs). At a different level, resolution at a planning area level may be sufficient. At another level, interactions at the finite element level of CVGSM2 may be important. This hierarchical approach of CalSim-II and the associated form of using CVGSM or alternative (direct, indirect, or by emulation) is still being investigated by DWR and Reclamation.

There are many benefits for linking CalSim-II with IGSM2 (or alternative):

- The hydrology at future levels of development would be integrated in the simulation and developed on-the-fly allowing for modifications to land use (especially during dry periods) and/or modifications for meeting demands from surface water and groundwater.

- The spatial resolution would be enhanced, and allow for GIS technologies for use in calculating water demands by element of CVGSM (or alternative), rather than DSA.

- The accretions calculations will be more physically based, and would eliminate the use of the CU model and the Depletion model and their limitations for the valley floor areas. Currently IGSM2 uses the NRCS (SCS) method for calculating rainfall/runoff components.

- There would be a marked theoretical improvement in modeling groundwater flow and the surface water - ground water interaction, and allow for carrying conjunctive use studies.

- The extent of the simulation areas would be extended to include Tulare Basin.

In modeling California's complex water resources, it is important that key elements reflecting hydrologic processes be accounted for either directly or indirectly in the model itself, its assumptions, or input. Key elements to consider in modeling surface hydrologic processes include: rainfall, snowfall, snowmelt, interception, retention, detention, infiltration, evaporation, surface runoff, return flows, artificial recharge, land and water use, water quality, and water rights. Key elements that need to be considered in modeling subsurface hydrologic processes include saturated flow, unsaturated flow in the

vadose zone, ground water pumping, evapotranspiration, water quality, and water rights. The interaction between the two processes occurs through streams, rivers, canals, lakes, reservoirs, and land surface. The IGSM2 incorporates most of the processes listed. Other models exist also, but the focus of this section is to use IGSM2 as a surrogate model.

IGSM2 is a regional scale model developed by DWR for the simulation of groundwater elevations, surface flows and surface-subsurface flow interactions. It is a completely revamped version of its predecessor IGSM version 5.0. IGSM was originally developed by consultants for Reclamation, DWR and other agencies. The first major public release of IGSM was in 1991. The first public release of CVGSM was also in 1991. Since its 1991 version, IGSM has undergone various upgrades by different groups based on specific applications to numerous basins in California, Colorado, Wisconsin, and Florida. In January 2001, DWR began the development of IGSM2 that included an extensive review and revamp of the theory, simulation methodologies and the source code used in IGSM. Based on this work, IGSM2 Version 1.0 that utilized enhanced/modified theory and simulation techniques was made available to public in December 2002. IGSM2 Version 2.0 was released in December 2003.

IGSM2 simulates groundwater elevations in a multi-layer aquifer system and the flows among these layers. The depth-integrated conservation equation is solved for horizontal flows in each layer and an approximate method is utilized to compute vertical flows among layers. The Galerkin finite element method is used to solve the non-linear conservation equation for each aquifer layer. A mixture of confined and unconfined aquifer layers that are separated by semi-confining layers can be modeled. The changing aquifer conditions (confined to unconfined and vise versa) as well as subsidence, and effect of tile drains, injection and pumping wells can also be modeled.

Stream flows, lake storages, and their interaction with the aquifer system are also modeled in IGSM2. Stream flow simulation is similar to that used in MODFLOW 2000. Conservation equations for streams, lakes and aquifer system are solved simultaneously to compute the interaction among these components accurately.

The distribution of four land use types (agricultural with specified crops, urban, native and riparian vegetation) dictate the evapotranspiration, surface runoff and infiltration characteristics (calculated using the NRCS method) as well as the demand for agricultural and urban water supply. The infiltrated water is routed vertically through root and vadose zones to compute the recharge to the groundwater. Stream diversions and groundwater pumping can be specified and distributed to meet agricultural and urban water requirements, and also adjusted dynamically to balance supply and demands. DWR staff also provides technical support of IGSM2.

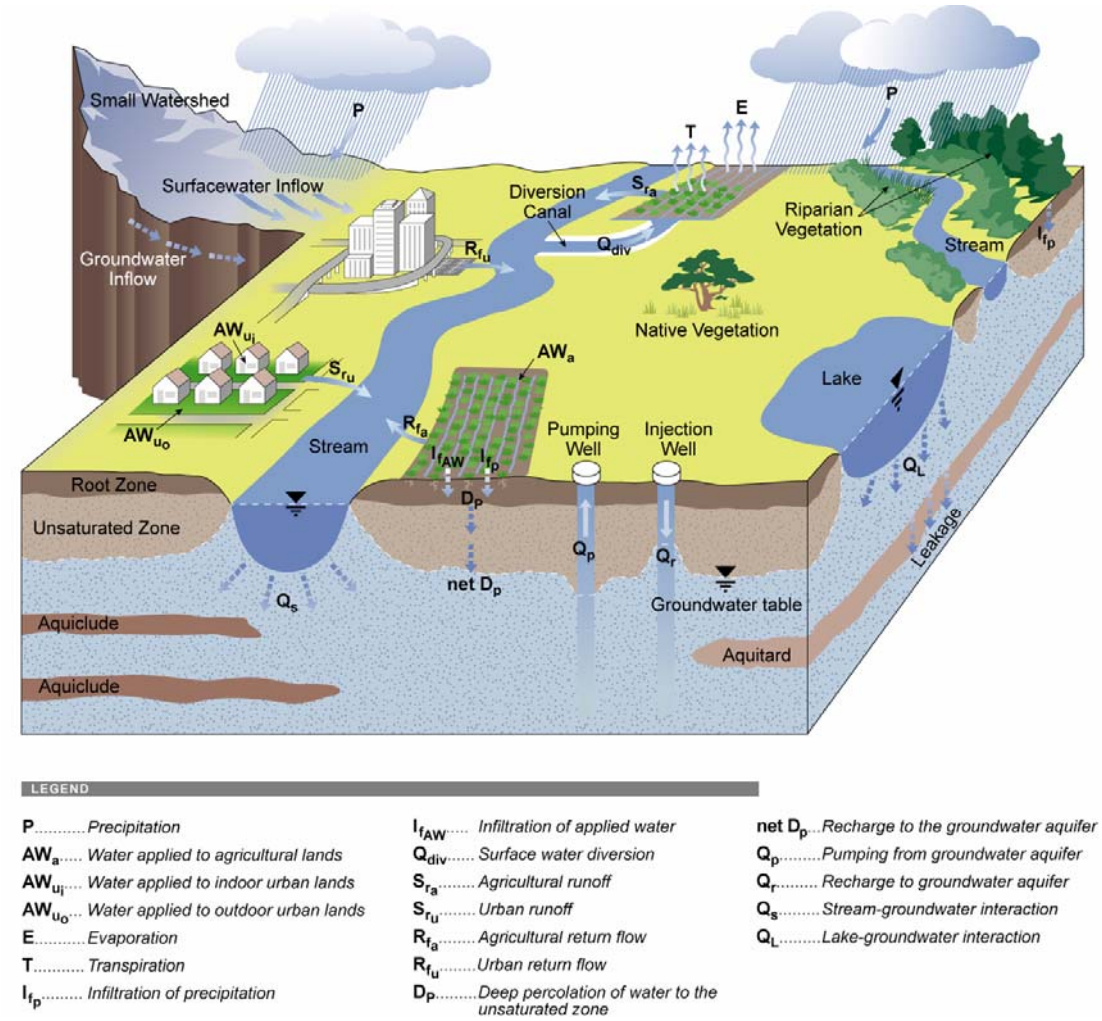
Hydrologic input to the CalSim-II model includes WY1922-1994 time series for reservoir inflows, local accretions, and projected land-use based demands. The land use based demands are using the Consumptive Use CU model, and local accretions and reservoir inflows are calculated using the Depletion Analysis approach. The CU model is a monthly soil moisture accounting model using known precipitation, crop and urban acreages, and crop soil moisture characteristics to calculate monthly demands (Diversion Requirements) by Depletion Study Area DSA. It calculates monthly demands for both historical (time-varying land use) conditions and projected (constant future land use) demands. Inflows into the reservoirs are calculated using the Depletion Analysis approach developed by both DWR and Reclamation. The procedure begins with measured historical outflows at gauged streams of a DSA which are unimpaired for historical conditions by adding back the historical calculated land-use based demands from the CU model, and re-impairing the flows by subtracting out the future level demands from the CU model. Local accretions are calculated using simple budget analysis, and the results are used as input to CalSim-II.

Local water supply computations (accretions) are currently pre-processed for CalSim-II. The CU model is used to calculate land-use based applied water demands at both historical and projected levels of

development. A simple water budgeting approach by DSA then allows for calculating local water supplies (accretions).

The accounting of groundwater in CalSim-II (and its predecessor DWRSIM) has undergone an evolutionary process. In the past the Depletion Model was used to calculate the additional groundwater pumping (above historical) required at a future level of development, along with future recharge of the past-pumped water using simple specified rules. This implicitly also fixed the historical surface-ground water interaction at future levels of development. In the current CalSim-II for the Sacramento Valley, a multiple-cell MC approach was used (each DSA represented by one cell), allowing for the interaction between cells and streams. The MC approach used actually emulated CVGSM in a very simple form, but allowed for ground water elevation accounting, and the stream-aquifer interaction.

With IGSM2/CVGSM2 (or alternative) it is possible to enhance the hydrology input and the modeling of groundwater resources in CalSim-II, by eliminating the use of the CU model and the depletion analysis approach. DWR and Reclamation will investigate the different options of how best to achieve this objective.



LEGEND

P.....*Precipitation*	**I_{fAW}**..... *Infiltration of applied water*	**net D_p**...*Recharge to the groundwater aquifer*
AW_a..... *Water applied to agricultural lands*	**Q_{div}**..... *Surface water diversion*	**Q_p**.....*Pumping from groundwater aquifer*
AW_{ui}.... *Water applied to indoor urban lands*	**S_{fa}**..... *Agricultural runoff*	**Q_r**..... *Recharge to groundwater aquifer*
AW_{uo}... *Water applied to outdoor urban lands*	**S_{ru}**..... *Urban runoff*	**Q_s**.....*Stream-groundwater interaction*
E.....*Evaporation*	**R_{fa}**..... *Agricultural return flow*	**Q_L**.....*Lake-groundwater interaction*
T..... *Transpiration*	**R_{fu}**.....*Urban return flow*	
I_{fp}..... *Infiltration of precipitation*	**D_P**.....*Deep percolation of water to the unsaturated zone*	

Figure F-1 Hydrologic Processes Modeled in IGSM2

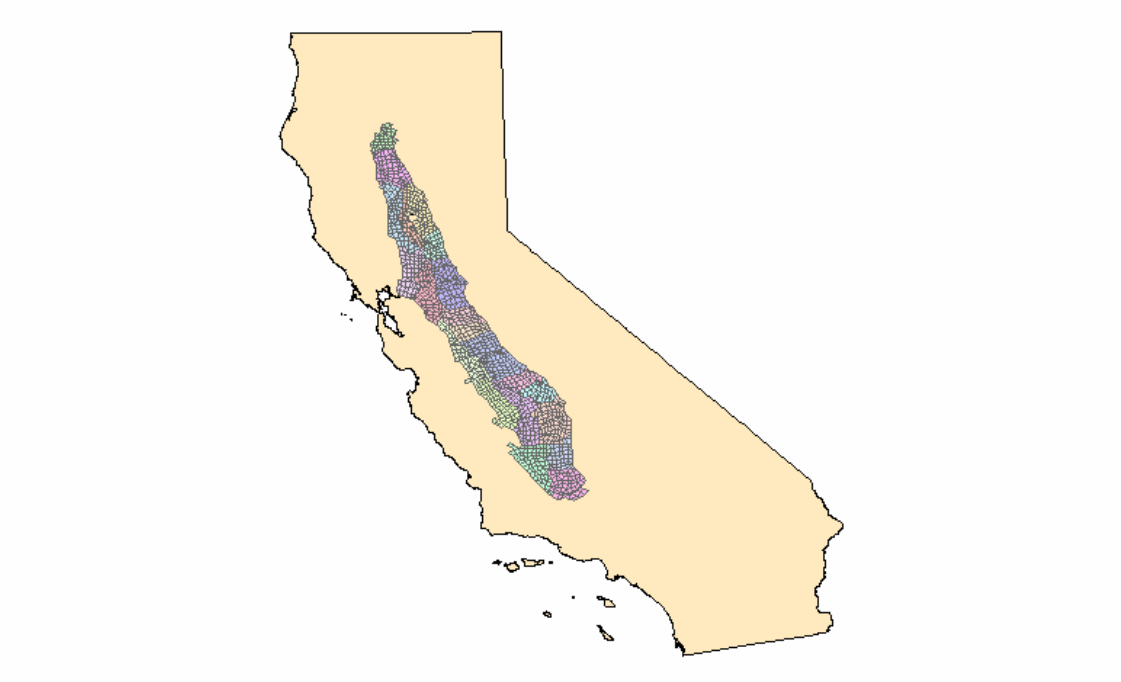


Figure F-2 CVGSM2 Finite Element Grid and Subregions

Table 1. Summary of Peer Review Comments

CONCEPTUAL LEVEL						
Type	***Comment***	***Pg***	***Sec***	***Prg***	***#***	***Resp-onse***
Local Projects	Efforts to model local projects should be continued and expanded	19	2.1	9	1	2b,2c
Geographic Scope	Include Friant System, Tulare basin, Southern California, Colorado River. Hierarchical decomposition approach would allow development of separate models that can be linked through iterative process.	27	3.7	2	2	2b,2c
	CalSim-II should be expanded to include major non-CVP/SWP areas, especially the Tulare Basin, the Colorado River, and Southern California.	21	2.2	4	3	2b,2c
Management Scope	CalSim-II does not explicitly represent many of the management options in which policy makers are interested	23	2.2	6	4	1,2
	CalSim-II should be expanded to include local management options such as water conservation, reuse, water transfers, groundwater and conjunctive use management.	21	2.2	4	5	2a,2b
Modular Approach	Common tension for those who wish for greater detail and those who want less detail from the model. Need for more flexible, modular approach to modeling.	2	1	2	6	2
	Too complex. Not sufficiently detailed. Develop linkable modules of different complexity.	7	5.2	2	7	2
	CalSim-II should be modular.	21	2.2	4	8	2b,2c
Real-time Operations	Improve capabilities for real-time operations, gaming, ag demands, water transfers, Delta storage, carryover contract rights, refuge water demands, updated operations for Feather, Stanislaus, Upper American, San Joaquin, Yuba.	8	5.2	3	9	2a,2b
Model Purpose	For CalSim-II to remain a model of only the CVP and SWP seems technically and politically untenable. California's water system asked to be operated in an increasingly integrated manner. Widen geographical and functional scope of model. Better parameterize local supplies and demands.	24	2.2	10	10	2a,2b,2c
Hydropower	CalSim-II should include risk-based power capacity evaluation and incorporation of indexed sequential hydrologic modeling. Hydropower should not be after-the-fact calculation, but explicitly included in system objectives.	25	3.3	1	11	2b
Groundwater	Efforts to include groundwater should be continued	19	2.1	9	12	2a,2b
Analyzing Future Scenarios	Need to examine greater range of long-term scenarios with respect to hydrology, demands, and operational uncertainty	22	2.2	4	13	2b
Operational Objectives	Better capabilities for analyzing economic, water quality and groundwater issues.	8	5.2	3	14	2a,2b,2c
Documentation	Documentation required that describes applicability of model to different problems.	8	5.2	3	15	2a,2b

Type	***Comment***	***Pg***	***Sec***	***Prg***	***#***	***Response***
Objective Function	Need to calibrate the CalSim-II objective function so that CalSim-II model decisions correspond to those operators would make. Unless calibrated the model may produce overly optimistic answers.	4	3	1	16	2b
Hydrologic Uncertainty	Need other approaches to representing hydrologic uncertainty and variability besides using historical record.	22	2.2	4	17	2b,2c
Groundwater	Limited representation. Infinite resource.	8	5.2	3	18	1,2
DWRSIM/PROSIM	Remove ties to DWRSIM and PROSIM	24	3.1	1	19	2
Rule Curves	Documentation required.	27	3.6	1	20	2a,2b
	CalSim-II rule curves should reflect operator's behavior.	29	3.9	1	21	2b,2c
Land Use	Consider a land use that changes over time or responds to hydrologic conditions	8	5.2	3	22	2b
Model Improvements	Develop protocols and records for identifying and correcting model errors and making model improvements.	40	6.10	1	23	2b,2c

Note: The keys to the "Response" column is on page F-10

IMPLEMENTATION LEVEL

Numerical Model

Type	Comment	Pg	Sec	Prg	#	Response
Daily Operations	Inclusion of routing requires look-ahead optimization ability. Daily releases are head dependent.	26	3.4	1	24	2a,2b,2c
Groundwater Model	Consider use of response functions. A dynamically linked CalSim-II -CVGSM is not necessary to obtain accurate groundwater predictions. It would also lead to greater run times.	27	3.5	9	25	2b,2c
	Possibility of using ANN for groundwater.	27	3.7	3	26	2b
Soil Moisture	Soil moisture is not dealt with in a realistic manner within the CU model.	27	3.5	10	27	1,2b

Data

Type	Comment	Pg	Sec	Prg	#	Response
Required Accuracy	Model developers should recognize the requirement that CalSim-II provide absolute values. Additional calibration required.	25	3.2	1	28	2a,2b
	Need to improve CalSim-II's comparative as well as absolute capabilities.	8	5.2	3	29	2a,2b,2c
Data Development	There has not been sufficiently systematic, transparent, and accessible approach to the development and use of hydrologic, water demand, capacity and operational data. The administration of data development is fragmented, disintegrated, and lacks a coherent technical or administrative framework. Needs to be greater coordination of data collection and analysis between different administrative units within DWR.	20	2.2	2	30	2a,2b
	Develop protocols for data documentation and development.	70	G	3	31	2a,2b
Groundwater	Details of GW calibration should be available. The San Joaquin system should be added to the multi-cell model. The accuracy of using a coarse representation should be assessed. Better historical groundwater pumping data is needed to confirm whether the use of groundwater in CalSim-II is accurate.	26	3.5	5	32	2a,2b
Hydrologic Data	Needs updating.	20	2.2	2	33	2a,2b
	Develop documentation and testing regime for developed data.	38	6.5	1	34	2a,2b
Agricultural Demands	Update data. Use of economic factors in estimation of water demands. Preferred spatial scale for economic modeling is irrigation district scale.	23	2.2	5	35	2b,2c
Documentation	Documentation required that describe assumptions and limitations.	8	5.2	3	36	2a,2b
Metadata	Provide metadata for data inputs	58	E		37	2a,2b,2c
DWRSIM/PROSIM	Remove ties to DWRSIM and PROSIM	24	3.1	1	38	2

Data Management System

Type	Comment	Pg	Sec	Prg	#	Response
Accountability and Quality Control	Need for quality control and documentation	2	1	2	46	2a,2b
	Need for version control, quality control, calibration, and verification.	8	5.2	3	47	2a,2b
	Develop an explicit quality control program.	37	6.2	1	48	2a,2b
Model runs	Input and output data sets from model runs should be archived in a central location.	58	E		49	2a,2b

Software

Type	Comment	Pg	Sec	Prg	#	Response
Error Checking	Create automated mass balance checking procedure.	5	4	2	50	2a,2b
	Automated input and output checking is needed.	24	2.2	10	51	2a,2b
Non-Linearity	Link linear optimization model with non-linear simulation models.	5	4	3	52	2b
Public Domain	Switch to public domain software for optimization, visualization, file management and data base support.	5	4	4	53	2a,2b,2c
	Eliminate FORTRAN compiler, use public domain MIP solver.	24	2.2	10	54	2a,2b
Multi-period Optimization	Introduce multi-period optimization for decision making based on uncertainty information.	5	4	3	55	2b,2c
	Multi-period optimization could replace rule curves.	8	5.2	3	56	2b,2c
	Performance based optimization should be added to WRIM's capabilities	38	6.7	1	57	2b,2c
Modularity	Ability to change geographic scope, spatial resolution, temporal resolution as required for the analysis.	8	5.2	3	58	2b,2c
Documentation	Improve software documentation.	8	5.2	3	59	2a,2b
GUI	Improved GUI for facilitating model input, setting of constraints and weights, operating the model, displaying and analyzing results.	9	5.2	3	60	2b,2c
	CalSim lacks a comprehensive, graphical user interface for constructing and editing the river basin system topology. The complexity of CalSim would be greatly reduced with development of an object-oriented graphical user interface.	18	1.1	5	61	2b,2c
	Develop GUI tied to databases with GIS display.	24	2.2	10	62	2b,2c
Time-Step	Consider use of shorter time-step for some aspects of the model.	24	2.2	10	63	2b,2c
Post-Processing	Need for better post-processing tools	24	2.2	10	64	2a,2b,2c
Version Control	Need for version control, and database management software and protocols.	24	2.2	10	65	2b
Weights	Need systematic and objective method of setting weights.	24	2.2	10	66	2b
	Need capability to dynamic vary weights, as a function of the state of the system.	27	3.6	1	67	2b
Run Time	Long run times preclude sensitivity analysis. Update solver to gain from efficiency improvements in the Branch and Bound algorithm and better sparse matrix analysis.	29	4.1	1	68	2b,2c
Gaming	Improve capabilities for gaming involving stakeholders.	8	5.2	3	69	2a
Output	Provide access to Lagrange multipliers, identification of binding constraints and value of slack variable	24	2.2	10	70	2a

	Develop output for a wider set of variables other than CVP_SWP e.g. groundwater depletion, water quality, supply reliability for non-project users, hydroelectric generation, indicators of ecological health.	28	3.8	1	71	2a,2b
Infeasibilities	Add capability for automated debugging of infeasibilities.	24	2.2	10	72	2a,2b

Administrative

Type	Comment	Pg	Sec	Prg	#	Response
Model Peer Review	Shortness of 2003 CalSim/CalSim-II Peer Review precluded technical analysis of CalSim-II. Such a technical review should be carried-out.	3	2	6	73	2b,2c
	A peer review is required for each separate element of the model	2	1	2	74	2a,2b,2c
	CalSim-II should be subject to a systematic and frequent review and testing program	21	2.2	4	75	2a,2b,2c
Sustainability	Develop strategy on how to sustain software development.	5	4	5	76	2a,2b
	Produce strategic document that outlines short-term and long-term efforts, budgets, and responsibilities for model and data improvements, with policy for local agency and stakeholder involvement.	70	G	3	77	2a,2b
Public Involvement	Local agencies, system operators, and consulting firms should be actively involved in the development and application of CalSim-II.	21	2.2	3	78	2a,2b
	Broaden the range of hydrologic expertise involved in hydrology data development.	38	6.6	1	79	2a,2b
Financing	The financing for CalSim/CalSim-II development should be wider than CVP/SWP projects. Funding should be forthcoming from local and regional agencies	21	2.2	4	80	2a,2b
Staff	Not enough knowledgeable modelers	23	2.2	7	81	2
Model Interpretation	Stakeholders and policy makers are poorly guided in how to interpret model results.	23	2.2	8	82	1,2
	Studies have not contained the kind of written discussion and interpretation of results that would demonstrate that the authors have thought about the results and drawn conclusions.	23	2.2	9	83	1,2
Model Management	CalSim-II should no longer be solely responsible to CVP-SWP managers but a broader range of technical managers from additional interests.	35	5	3	84	2
	Create a broader interagency modeling consortium for developing operations planning models. Might require steering committee or governing board.	36	6.1	1	85	2
Training & Education	Hold seminars on CalSim-II to increase public confidence in model.	29	4.2	3	86	2a,2b
	Develop a formal common regimen to train CalSim-II users.	37	6.3	1	87	2a,2b
	Provide centralized support.	8	5.2	3	88	2b
	Develop a users group	37	6.1	1	89	2a

MISCELLANEOUS

Type	Comment	Pg	Sec	Prg	#	Response
Supporting Models	Documentation, calibration, testing, peer review should be extended to other models that provide data input for CalSim-II.	38	6.4	2	90	2b,2c

CALIBRATION AND VALIDATION						
Type	***Comment***	***Pg***	***Sec***	***Prg***	***#***	***Response***
Calibration	CalSim-II should be calibrated, tested, and documented for absolute and comparative use.	40	6.9	1	39	1,2a,2b,2c
Validation Report	Evaluation of CalSim-II by comparison with historical operations should be more rigorous.	40	6.9	3	40	2a,2b
	Comparison of simulated and historical deliveries suggests that the model over-estimates project deliveries	68	F	3	41	1
	Model rules on carryover storage during drought should be examined so that they reflect the system will be managed in the future.	68	F	4	42	2a,2b
	Comparison of simulated and historical deliveries suggests that the model underestimates storage in San Luis Reservoir.	69	F	6	43	1,2
Sensitivity Analysis	Need for sensitivity and uncertainty analysis.	8	5.2	3	44	2a,2b,2c
Advisory Board	Create external technical advisory body as part of a quality control program.	37	6.2	1	45	2a

Keys to the "Response" column of Table 1:

1 DWR and Reclamation do not agree with the comment stated.

2 DWR and Reclamation agree with the comment stated.

2a DWR and Reclamation agree with the comment stated and staff is currently working on it as part of our immediate needs for CalSim. A work plan is being developed by both DWR and Reclamation and will be shared with the public in the very near future.

2b DWR and Reclamation agree with the comment stated and consider it important to address in the short term with a target date of January 2007.

2c DWR and Reclamation agree with the comment stated but considers it should be addressed on a longer term with a target date of January 2011.

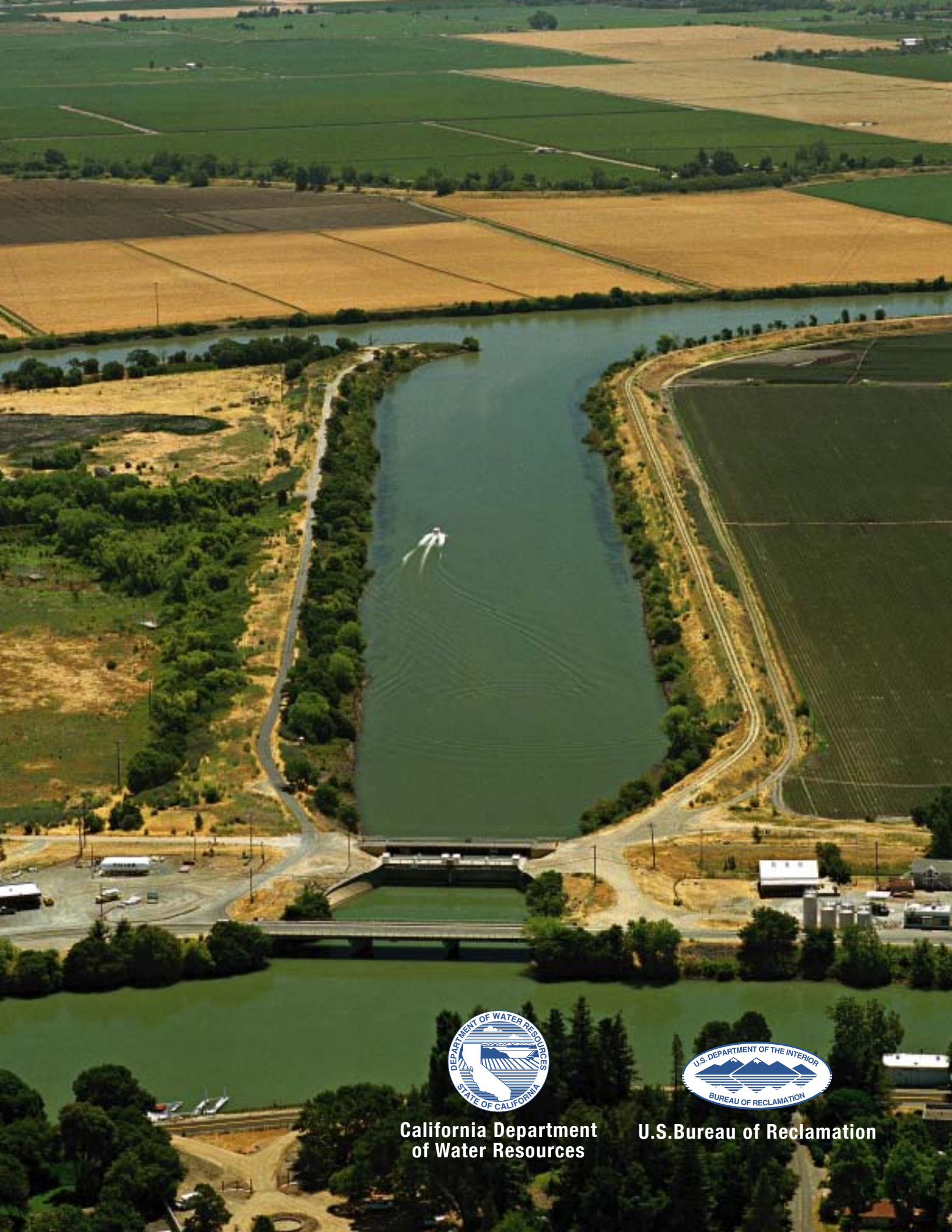
Table 2 Development Priorities

CONCEPTUAL LEVEL				
Task	Current Development	Immediate Needs	Short-Term Development Target January 2007	Long-Term Development Target January 2011
Representation of local projects	Explicitly represent major irrigation districts on the East-Side of the San Joaquin Valley	Explicitly represent major irrigation districts and water agencies in the Sacramento Valley		
Extended geographic scope	Model Friant System			Model Colorado River system
	Model Yuba River			Expand representation of southern California
	Model Bear River		Model Upper Feather River	
	Model Upper American			Tulare Basin
	Model Stony Creek			
Representation of water management options	Develop module for water transfers	Improve capability to model water conservation measures		
		Improve capability to model conjunctive surface water and groundwater operations		
Development of a modular approach		Develop modular approach for irrigation and urban demands in the Sacramento and San Joaquin Valley		
Real-time operations	Integrate planning and operational models	Develop gaming model		
Hydropower	Post-processing of hydropower operations		Add risk-based power capacity evaluation	
Groundwater	Calibration of CVGSM	Refine groundwater representation in the Sacramento Valley	Add groundwater model for the San Joaquin River Valley	
Analyzing Future scenarios			Develop alternate future demand and water use scenarios. Develop ulternate hydrologies	
Operational objectives	Water quality module for the lower San Joaquin River		Use of economic and water quality drivers and performance measures	
Documentation	.	Document applicability and limitations of CalSim-II		
Objective function	Work with operators to define current operating rules and objectives			
Hydrologic uncertainty	Model global climate change study		Develop alternate approaches to representing hydrologic uncertainty and variability	
Groundwater	Develop strategy to more comprehensively model groundwater			
Land use			Dynamic variation of agricultural land use (demand) in response to water supply	

Model improvements		Develop protocols and records for identifying and correcting model errors and making model improvements.		
Daily time step		Assessment of errors due to monthly time step		
Documentation	Document model logic	Document development of rule curves		
IMPLEMENTATION LEVEL				
Numerical Model				
MIP solver	Improve computational efficiency			
Daily operations			Add look ahead optimization functionality	Hydrologic routing
Groundwater model	Link of CalSim-II and CVGSM		Refinement of groundwater model in CalSim-II (unit response function, ANN, or multi-cell model)	
Soil moisture accounting			Replace CU model	
Data				
Required accuracy		Improve CalSim-II's absolute predictive capability		
Data development		Develop protocols for data documentation and development	Develop systematic, transparent and accessible approach to the development of hydrologic data	
Hydrologic Data		Update hydrologic data. Broaden range of expertise involved in hydrology data development. Develop testing regime for data.		
Spatial resolution		Gather data for finer spatial resolution		
Documentation		Document derivation of all data input		
Metadata		Provide metadata for data inputs		
Data Management System				
Accountability and Quality Control		Develop version control for model input data		
		Develop an explicit quality control program		
Model runs		Archive data sets from model runs in a central location		

Software				
Error checking			Automate mass balance checking procedure	
			Add automated algorithms for checking input and output	
Simulation			Improve simulation functionality	
Public domain software	Elimination of FORTRAN compiler			
	Adoption of public domain solver.			
Multi-period optimization		Add automated multi-period optimization functionality		
Modularity		Facilitate ability to change geographic scope, spatial and temporal resolution		
Documentation	Add ability to store metadata	Update and expand user's manual		
GUI	Create geo-referenced network schematic	Develop GUI for constructing and editing river basin system topology, facilitating model input, displaying results		
Time-step	Increase flexibility to switch between daily and monthly time steps			
Post-processing		Improve third-party post-processing tools		
Version control	Use version control for text based inputs	Create centralized database for version control management		
Weights	Add functionality for ynamic conditional setting of weights	Develop automated weight generating algorithm		
Run-time	Restructure WRESL code to eliminate redundant/repetitive calculations			
	Add capability to output intermediate of state variables (rather than their addition to MIP problem)			
	Improve solver computational efficiency			
Gaming		Create gaming model for stakeholder participation		
Output		Output of (Lagrange multipliers, basic and non-basic variables, including slack variables		
		Develop more comprehensive standard output of model variables		
Water quality		Add water quality input tables and post-processor	Add functionality to specify water quality objectives	
Infeasibilities	Automate debugging of solver infeasibilities			

Administrative				
Peer Review		Complete technical reviews of CalSim-II components		
Sustainability			Develop strategy on how to sustain software development.	
		Produce strategic document that outlines short-term and long-term efforts, budgets, and responsibilities for model and data improvements		
Public Involvement			Actively engage local agencies, system operators, and consulting firms in the development and application of CalSim-II.	
Financing			Seek wider financing for CalSim/CalSim-II development	
Model Management	CWEMF modeling strategic vision committee		Create broader interagency modeling consortium for developing operations planning models.	
Training &		Hold seminars on use and interpretation of CalSim-II for managers and policy staff		
Education		Develop a formal common regimen to train CalSim-II users.		
		Provide centralized support.		
		Develop a users group		
MISCELLANEOUS				
Supporting Models	Create documentation of model linkages (model map)	Documentation, calibration, testing, and peer review of supporting models		
	Facilitate communication between models (CalSim-II-CALAG translator)			
CALIBRATION AND VERIFICATION				
Calibration		Calibrate hydrologic parameters using historical data		
Sensitivity Analysis	Carry-out sensitivity analysis	Carry-out uncertainty analysis.		



California Department of Water Resources

U.S.Bureau of Reclamation

H. ANALYSIS OF PROPOSED PROJECT EFFECTS ON RIVER FLOWS (STUDY NO. 5)

Delta Inflow Analysis for Monterey Plus

The accompanying spreadsheets are an analysis of the effects of the proposed project (Monterey Amendment) on flow in the Feather and Sacramento rivers and on Delta inflow. The spreadsheet analysis used estimated deliveries to individual contractors obtained by post-processing CALSIM II output.

The delivery estimates used in this analysis are not identical to the latest delivery estimates that are contained in Appendix F. The differences are very small, however, and would have a negligible effect on the river flow estimates contained herein.

A similar analysis was begun for alternatives to the proposed project. The analysis was not completed because it became apparent that the effects of Monterey Amendment, small as they are, are greater than those of the alternatives.

Explanatory Notes

The changes to Plumas County allocations are excluded from the tables because the mechanisms for delivery to Plumas from Lake Davis affect Feather River flows in a different manner. That analysis is provided later in this section.

Tables 9-CS-1 and 9-CS-2 show the total deliveries of project water to the five upstream-of-Delta contractors and the 24 remaining contractors south of the Delta for 2003 and 2020, under the two baselines, and as defined for the Proposed Project and the alternatives.

Table 9-CS-3 shows deliveries under the 1994 baseline. Note that there is a slight increase from 1994 to 2003 due to increases in demands and other slight allocation changes.

Table 9-CS-4 shows the maximum and minimum total deliveries to the five upstream-of-Delta contractors in thousands of acre-feet for each year type without differentiating among alternatives.

Table 9-CS-5 shows the changes in total deliveries with respect to the 2003 and 2020 baselines. The table compares the maximum and minimum deliveries from Table 4 to the 2003 and 2020 baselines, respectively, to yield the maximum amount of delivery change, covering both increases and decreases.

Table 9-CS-6 provides baseline river flows for 2003 and 2020 for both rivers; uses the delivery increases from Table 9-CS-5 as estimates of possible river flow decreases due to greater deliveries; tabulates those potential flow increases as a percentage of the baseline river flows; presents a second analysis that used the greatest differences between any alternatives, including the baselines as if they were alternatives; and expresses those results as a percentage of river flows.

An additional analysis tabulates the monthly patterns of delivery to the upstream-of-Delta contractors and analyzes the magnitude of changes on a monthly basis by year type. The Proposed Project under 2020 conditions was used to approximate the maximum amount of change. Those results are shown in Table 9-CS-7. The differences do not exceed 0.13%.

An additional analysis looked at the amount of change that would occur to deliveries downstream of Banks Pumping Plant. Table 9-CS-8 shows the increases and decreases among alternatives relative to the 2003 and 2020 baselines. That analysis indicates that there would be delivery changes of less than 1%, with a maximum of 0.6% in critical years.

The flow changes in acre-feet were also computed in cfs to provide an additional measure of the impact of the changes. Table 9-CS-9 shows the flow changes by month and year type for the Proposed Project under 2020 conditions. The maximum flow decrease attributable to the Proposed Project is 0.7 cfs between Thermalito Afterbay and the north end of the Delta, and 19.1 cfs downstream of the North Bay Aqueduct intake. Most months the flow reductions are less than 1 cfs and 14 cfs, respectively.

Comparison of Annual Averages From Spreadsheet "MontereySWP Delivery Summary Tables 052206.xls"
Updated for 6,680 cfs Banks Based on data from Brian Van Lienden from April 21, 2007

Note: There is an issue with the sums provided from the prior sheet.
Sums recomputed here.

Total Average Annual Deliveries from 1922-94 (TAF/yr)

Table 7.3-16 **Table 9-CS-3**

Total Average Annual Deliveries Under 1994 Baseline, TAF

1994 Baseline	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.12	0.12	0.12	0.13	0.11	0.11
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.50	0.48	0.48	0.37	0.38	0.66
Subtotal	0.62	0.60	0.60	0.50	0.49	0.77
Napa County FC&WCD	6.31	7.90	6.58	6.54	5.28	4.42
Solano County	28.39	31.34	30.04	29.95	28.65	19.68
Cumulative Subtotal	35.32	39.84	37.21	36.99	34.43	24.87
All other contractors	2,812	3,275	3,195	3,069	2,789	1,414
Total	2,847	3,315	3,233	3,106	2,823	1,438

Table 7.3-14 **Table 9-CS-1**
(base, PP) **Total Average Annual Deliveries Under 2003 Baseline and Alternatives Under 2003 Conditions, TAF**

2003 Baseline	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.30	0.30	0.29	0.33	0.29	0.26
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.66	0.64	0.64	0.50	0.50	0.88
Subtotal	0.96	0.94	0.94	0.82	0.79	1.14
Napa County FC&WCD	7.36	8.76	7.40	7.47	7.13	5.03
Solano County	35.13	39.86	38.30	38.41	36.78	18.20
Cumulative Subtotal	43.45	49.56	46.64	46.70	44.71	24.37
All other contractors	3,045	3,540	3,582	3,508	2,831	1,476
Total	3,088	3,589	3,628	3,555	2,876	1,501

2003 Monterey Plus Project	Ann Avg	Wet	AN	BN	Dry	Crit	
County of Butte	0.30	0.28	0.30	0.35	0.29	0.26	
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a	
City of Yuba City	0.66	0.59	0.70	0.64	0.61	0.90	
Subtotal	0.95	0.88	1.00	0.99	0.90	1.15	
Change From Baseline	(0.01)	(0.07)	0.06	0.17	0.11	0.01	
Napa County FC&WCD	7.99	9.84	8.51	8.12	7.46	4.88	
Solano County	36.13	41.78	39.84	37.70	36.12	19.63	37.7
Cumulative Subtotal	45.08	52.50	49.35	46.81	44.48	25.67	
Change From Baseline	1.63	2.94	2.71	0.11	(0.23)	1.30	
All other contractors	3,011	3,471	3,520	3,430	2,809	1,519	
Total	3,056	3,523	3,569	3,477	2,853	1,545	

2003 No Project 1	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.30	0.30	0.29	0.33	0.29	0.26
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.66	0.64	0.64	0.50	0.50	0.88
Subtotal	0.96	0.94	0.94	0.82	0.79	1.14
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	7.21	8.38	7.24	7.39	7.03	5.20
Solano County	35.12	39.55	38.19	38.32	36.88	18.71
Cumulative Subtotal	43.29	48.87	46.36	46.54	44.69	25.05
Change From Baseline	(0.16)	(0.69)	(0.28)	(0.17)	(0.01)	0.68
All other contractors	3,044	3,527	3,566	3,499	2,833	1,513
Total	3,087	3,576	3,613	3,546	2,878	1,538

2003 No Project 2	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.30	0.30	0.29	0.33	0.29	0.26
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.66	0.64	0.64	0.50	0.50	0.88
Subtotal	0.96	0.94	0.94	0.82	0.79	1.14
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	7.43	8.91	7.40	7.56	7.14	5.08
Solano County	35.27	40.03	38.30	38.52	36.97	18.37
Cumulative Subtotal	43.66	49.89	46.64	46.90	44.90	24.59
Change From Baseline	0.21	0.33	0.01	0.20	0.20	0.21

Comparison of Monthly Table A Deliveries From Raw Model Output; Not Post-Processed

Feather River Region: Butte, Plumas, YC	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Monterey Plus 2020 Monthly Deliveries													
22-94 Avg	2.44	0.34	0.00	0.00	0.03	0.53	1.85	2.01	1.91	2.52	2.77	3.06	17.45
22-94 Wet	2.29	0.08	0.00	0.00	0.00	0.44	2.48	2.68	2.55	2.52	2.77	3.29	19.09
22-94 AN	2.23	0.49	0.00	0.00	0.00	0.13	2.26	2.51	2.35	3.58	3.53	3.59	20.67
22-94 BN	3.16	0.37	0.00	0.00	0.00	0.82	2.06	2.23	1.91	2.62	3.35	4.17	20.69
22-94 Dry	2.48	0.49	0.00	0.00	0.05	0.53	1.51	1.72	1.65	2.55	2.77	2.80	16.55
22-94 Crit	1.97	0.46	0.00	0.00	0.08	0.67	0.64	0.53	0.79	1.47	1.46	1.27	9.35
No Project A 2020 Monthly Deliveries													
22-94 Avg	2.43	0.34	0.00	0.00	0.03	0.52	1.84	2.00	1.90	2.50	2.76	3.04	17.35
22-94 Wet	2.28	0.08	0.00	0.00	0.00	0.44	2.47	2.68	2.55	2.52	2.77	3.29	19.09
22-94 AN	2.24	0.49	0.00	0.00	0.00	0.13	2.24	2.50	2.34	3.57	3.53	3.58	20.61
22-94 BN	3.16	0.37	0.00	0.00	0.00	0.81	2.03	2.21	1.88	2.57	3.30	4.11	20.43
22-94 Dry	2.45	0.49	0.00	0.00	0.06	0.53	1.50	1.70	1.64	2.54	2.77	2.79	16.46
22-94 Crit	1.95	0.45	0.00	0.00	0.08	0.66	0.63	0.52	0.78	1.45	1.44	1.25	9.22

North Bay Region: Solano, Napa													
Monterey Plus 2020 Monthly Deliveries													
22-94 Avg	5.99	5.02	5.13	2.79	3.16	3.92	5.12	5.63	5.77	5.98	5.96	5.77	60.26
22-94 Wet	6.89	5.82	6.03	4.31	4.68	5.32	6.42	6.93	7.10	7.36	7.36	7.15	75.37
22-94 AN	5.78	4.82	4.79	2.86	3.90	5.15	6.49	6.97	7.14	7.41	7.39	7.16	69.84
22-94 BN	6.55	5.52	5.69	2.62	2.91	4.07	5.65	6.53	6.69	6.93	6.91	6.69	66.78
22-94 Dry	5.12	4.28	4.30	2.07	2.29	2.90	4.37	4.85	4.97	5.14	5.10	4.93	50.34
22-94 Crit	5.07	4.21	4.29	1.25	1.36	1.65	2.06	2.24	2.30	2.39	2.36	2.27	31.44
No Project A 2020 Monthly Deliveries													
22-94 Avg	5.95	5.00	5.15	2.74	3.13	3.89	5.09	5.60	5.74	5.95	5.93	5.74	59.92
22-94 Wet	6.84	5.82	6.07	4.26	4.66	5.30	6.42	6.94	7.10	7.37	7.36	7.15	75.29
22-94 AN	5.78	4.83	4.81	2.79	3.84	5.09	6.46	6.94	7.11	7.38	7.36	7.14	69.54
22-94 BN	6.54	5.50	5.79	2.55	2.89	4.04	5.57	6.44	6.60	6.84	6.82	6.59	66.17
22-94 Dry	5.08	4.24	4.29	2.04	2.26	2.86	4.35	4.82	4.94	5.12	5.08	4.90	49.99
22-94 Crit	5.02	4.17	4.21	1.21	1.33	1.62	2.03	2.20	2.27	2.35	2.32	2.24	30.96

Percentage Distribution of Deliveries

Feather River Region: Butte, Plumas, YC	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Monterey Plus 2020 Monthly Deliveries													
22-94 Avg	14%	2%	0%	0%	0%	3%	11%	12%	11%	14%	16%	18%	17.45
22-94 Wet	12%	0%	0%	0%	0%	2%	13%	14%	13%	13%	15%	17%	19.09
22-94 AN	11%	2%	0%	0%	0%	1%	11%	12%	11%	17%	17%	17%	20.67
22-94 BN	15%	2%	0%	0%	0%	4%	10%	11%	9%	13%	16%	20%	20.69
22-94 Dry	15%	3%	0%	0%	0%	3%	9%	10%	10%	15%	17%	17%	16.55
22-94 Crit	21%	5%	0%	0%	1%	7%	7%	6%	8%	16%	16%	14%	9.35
No Project A 2020 Monthly Deliveries													
22-94 Avg	14%	2%	0%	0%	0%	3%	11%	12%	11%	14%	16%	18%	17.35
22-94 Wet	12%	0%	0%	0%	0%	2%	13%	14%	13%	13%	15%	17%	19.09
22-94 AN	11%	2%	0%	0%	0%	1%	11%	12%	11%	17%	17%	17%	20.61
22-94 BN	15%	2%	0%	0%	0%	4%	10%	11%	9%	13%	16%	20%	20.43
22-94 Dry	15%	3%	0%	0%	0%	3%	9%	10%	10%	15%	17%	17%	16.46
22-94 Crit	21%	5%	0%	0%	1%	7%	7%	6%	8%	16%	16%	14%	9.22

North Bay Region: Solano, Napa													
Monterey Plus 2020 Monthly Deliveries													
22-94 Avg	10%	8%	9%	5%	5%	7%	8%	9%	10%	10%	10%	10%	60.26
22-94 Wet	9%	8%	8%	6%	6%	7%	9%	9%	9%	10%	10%	9%	75.37
22-94 AN	8%	7%	7%	4%	6%	7%	9%	10%	10%	11%	11%	10%	69.84
22-94 BN	10%	8%	9%	4%	4%	6%	8%	10%	10%	10%	10%	10%	66.78
22-94 Dry	10%	9%	9%	4%	5%	6%	9%	10%	10%	10%	10%	10%	50.34
22-94 Crit	16%	13%	14%	4%	4%	5%	7%	7%	7%	8%	7%	7%	31.44
No Project A 2020 Monthly Deliveries													
22-94 Avg	10%	8%	9%	5%	5%	6%	8%	9%	10%	10%	10%	10%	59.92
22-94 Wet	9%	8%	8%	6%	6%	7%	9%	9%	9%	10%	10%	10%	75.29
22-94 AN	8%	7%	7%	4%	6%	7%	9%	10%	10%	11%	11%	10%	69.54
22-94 BN	10%	8%	9%	4%	4%	6%	8%	10%	10%	10%	10%	10%	66.17
22-94 Dry	10%	8%	9%	4%	5%	6%	9%	10%	10%	10%	10%	10%	49.99
22-94 Crit	16%	13%	14%	4%	4%	5%	7%	7%	7%	8%	7%	7%	30.96

All other contractors	3,030	3,508	3,550	3,497	2,819	1,495
Total	3,073	3,558	3,596	3,544	2,864	1,520
2003 No Project 3						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.30	0.30	0.29	0.33	0.29	0.26
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.66	0.64	0.64	0.50	0.50	0.88
Subtotal	0.96	0.94	0.94	0.82	0.79	1.14
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	7.22	8.39	7.24	7.35	7.03	5.24
Solano County	35.21	39.62	38.20	38.32	37.06	18.89
Cumulative Subtotal	43.39	48.96	46.38	46.50	44.88	25.28
Change From Baseline	(0.06)	(0.61)	(0.26)	(0.20)	0.18	0.90
All other contractors	3,034	3,506	3,541	3,491	2,824	1,532
Total	3,077	3,555	3,587	3,538	2,869	1,557
2003 No Project 4						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	0.29	0.28	0.30	0.35	0.29	0.25
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	0.65	0.58	0.70	0.64	0.60	0.89
Subtotal	0.94	0.86	1.00	1.00	0.88	1.14
Change From Baseline	(0.02)	(0.08)	0.06	0.17	0.09	(0.00)
Napa County FC&WCD	7.98	9.13	8.04	8.20	7.77	5.92
Solano County	31.19	37.76	37.18	35.09	26.82	15.94
Cumulative Subtotal	40.10	47.76	46.22	44.28	35.47	23.00
Change From Baseline	(3.35)	(1.80)	(0.41)	(2.42)	(9.23)	(1.37)
All other contractors	3,047	3,528	3,567	3,501	2,843	1,515
Total	3,087	3,576	3,613	3,546	2,878	1,538

Table 7.3-15 (base, PP)

Table 9-CS-2

Total Average Annual Deliveries Under 2020 Baseline and Alternatives Under 2020 Conditions, TAF

2020 Baseline						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Napa County FC&WCD	20.08	24.52	24.35	22.73	17.76	8.76
Solano County	33.79	41.37	41.08	38.29	29.79	14.55
Cumulative Subtotal	71.39	82.40	85.94	81.86	64.80	40.81
All other contractors	3,242	4,143	3,985	3,622	2,717	1,302
Total	3,313	4,225	4,071	3,704	2,782	1,342
2020 Monterey Plus Project						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.39	12.92	15.29	16.84	13.44	11.60
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.26	3.77	5.28	4.20	3.88	6.00
Subtotal	17.65	16.69	20.58	21.04	17.32	17.60
Change From Baseline	0.12	0.17	0.07	0.19	0.07	0.11
Napa County FC&WCD	23.12	29.60	28.49	25.92	19.25	9.20
Solano County	37.70	48.06	46.56	42.36	31.55	14.92
Cumulative Subtotal	78.46	94.35	95.63	89.32	68.12	41.73

Table 7.3-19 (revised)

Table 9-CS-7

Monthly Flow Changes for Proposed Project Compared to Baseline Under 2020 Conditions, in TAF and as Percentage of River Flows

Flow Differences Distributed Monthly According to Normal Delivery Pattern, TAF

Feather River Region: Butte, Plumas, YC	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Monterey Plus 2020 Monthly Delivery Increase													
22-94 Avg	(0.02)	(0.00)	0.00	0.00	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.12)
22-94 Wet	(0.02)	(0.00)	0.00	0.00	0.00	(0.00)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.17)
22-94 AN	(0.01)	(0.00)	0.00	0.00	0.00	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.07)
22-94 BN	(0.03)	(0.00)	0.00	0.00	0.00	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.19)
22-94 Dry	(0.01)	(0.00)	0.00	0.00	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.07)
22-94 Crit	(0.02)	(0.01)	0.00	0.00	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.11)
North of Delta Region: Feather, Solano, Napa													
Monterey Plus 2020 Monthly Delivery Increase													
22-94 Avg	(0.70)	(0.59)	(0.60)	(0.33)	(0.37)	(0.46)	(0.60)	(0.66)	(0.68)	(0.70)	(0.70)	(0.68)	(7.07)
22-94 Wet	(1.09)	(0.92)	(0.96)	(0.68)	(0.74)	(0.84)	(1.02)	(1.10)	(1.13)	(1.17)	(1.17)	(1.13)	(11.95)
22-94 AN	(0.80)	(0.67)	(0.66)	(0.40)	(0.54)	(0.71)	(0.90)	(0.97)	(0.99)	(1.03)	(1.03)	(0.99)	(9.69)
22-94 BN	(0.73)	(0.62)	(0.63)	(0.29)	(0.32)	(0.45)	(0.63)	(0.73)	(0.75)	(0.77)	(0.77)	(0.75)	(7.45)
22-94 Dry	(0.34)	(0.28)	(0.28)	(0.14)	(0.15)	(0.19)	(0.29)	(0.32)	(0.33)	(0.34)	(0.34)	(0.33)	(3.32)
22-94 Crit	(0.15)	(0.12)	(0.13)	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.92)

2020 Monthly Baseline River Flows, TAF

2020 Feather River Baseline Flows, TAF	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
22-94 Avg	153	130	222	284	317	368	189	224	280	431	293	125	3,015
22-94 Wet	171	175	389	621	653	738	413	456	338	445	232	101	4,733
22-94 AN	152	105	222	289	391	541	151	274	261	519	362	114	3,381
22-94 BN	155	119	148	164	211	189	80	105	329	515	406	140	2,560
22-94 Dry	142	103	138	93	90	133	94	101	257	420	314	143	2,030
22-94 Crit	132	119	128	82	91	101	81	82	165	248	183	132	1,545
2020 Sacramento River Baseline Flows, TAF													
22-94 Avg	754	924	1,530	2,009	2,186	2,102	1,462	1,180	1,038	1,130	880	770	15,965
22-94 Wet	898	1,296	2,824	3,427	3,402	3,226	2,531	1,992	1,406	1,246	950	1,003	24,201
22-94 AN	726	958	1,356	2,730	2,940	3,104	1,746	1,362	1,086	1,301	980	798	19,086
22-94 BN	720	798	1,098	1,520	1,969	1,611	1,112	948	1,049	1,213	969	741	13,749
22-94 Dry	686	774	927	978	1,295	1,383	830	734	827	1,077	838	688	11,039
22-94 Crit	657	592	716	875	872	829	606	470	623	758	626	480	8,103

Monthly Flow Changes as a Percentage of Monthly Baseline River Flows

Based on Monterey Plus 2020

2020 Change as % of Feather RiverFlow	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
22-94 Avg	-0.0114%	-0.0019%	0.0000%	0.0000%	-0.0001%	-0.0010%	-0.0070%	-0.0064%	-0.0049%	-0.0042%	-0.0068%	-0.0175%	-0.0041%
22-94 Wet	-0.0121%	-0.0004%	0.0000%	0.0000%	0.0000%	-0.0005%	-0.0054%	-0.0053%	-0.0068%	-0.0051%	-0.0108%	-0.0292%	-0.0036%
22-94 AN	-0.0053%	-0.0017%	0.0000%	0.0000%	0.0000%	-0.0001%	-0.0054%	-0.0033%	-0.0032%	-0.0025%	-0.0035%	-0.0113%	-0.0022%
22-94 BN	-0.0191%	-0.0029%	0.0000%	0.0000%	0.0000%	-0.0041%	-0.0242%	-0.0201%	-0.0054%	-0.0048%	-0.0077%	-0.0280%	-0.0076%
22-94 Dry	-0.0072%	-0.0020%	0.0000%	0.0000%	-0.0003%	-0.0016%	-0.0066%	-0.0071%	-0.0027%	-0.0025%	-0.0037%	-0.0081%	-0.0034%
22-94 Crit	-0.0169%	-0.0043%	0.0000%	0.0000%	-0.0010%	-0.0075%	-0.0090%	-0.0074%	-0.0054%	-0.0067%	-0.0090%	-0.0109%	-0.0069%
2020 Change as % of Sac River Flows													
22-94 Avg	-0.0931%	-0.0638%	-0.0393%	-0.0163%	-0.0170%	-0.0219%	-0.0411%	-0.0560%	-0.0652%	-0.0621%	-0.0795%	-0.0880%	-0.0443%
22-94 Wet	-0.1215%	-0.0711%	-0.0339%	-0.0200%	-0.0218%	-0.0261%	-0.0402%	-0.0552%	-0.0801%	-0.0937%	-0.1228%	-0.1130%	-0.0494%
22-94 AN	-0.1105%	-0.0698%	-0.0490%	-0.0145%	-0.0184%	-0.0230%	-0.0516%	-0.0710%	-0.0912%	-0.0790%	-0.1047%	-0.1246%	-0.0508%
22-94 BN	-0.1016%	-0.0772%	-0.0578%	-0.0193%	-0.0165%	-0.0282%	-0.0568%	-0.0769%	-0.0712%	-0.0638%	-0.0796%	-0.1007%	-0.0542%
22-94 Dry	-0.0494%	-0.0365%	-0.0306%	-0.0140%	-0.0117%	-0.0138%	-0.0348%	-0.0436%	-0.0397%	-0.0315%	-0.0402%	-0.0473%	-0.0301%
22-94 Crit	-0.0226%	-0.0208%	-0.0175%	-0.0042%	-0.0046%	-0.0058%	-0.0100%	-0.0139%	-0.0108%	-0.0092%	-0.0110%	-0.0139%	-0.0114%
				0.0000%									

Change From Baseline	7.07	11.95	9.69	7.45	3.32	0.92
All other contractors	3,219	4,090	3,943	3,626	2,700	1,308
Total	3,297	4,184	4,039	3,715	2,768	1,349
2020 No Project 1						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	20.09	24.47	24.34	22.63	17.70	9.09
Solano County	33.84	41.28	41.06	38.18	29.82	15.10
Cumulative Subtotal	71.45	82.26	85.91	81.65	64.78	41.68
Change From Baseline	0.06	(0.14)	(0.03)	(0.21)	(0.02)	0.87
All other contractors	3,240	4,116	3,967	3,608	2,729	1,353
Total	3,311	4,198	4,053	3,689	2,793	1,394
2020 No Project 2						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	22.85	28.35	27.92	25.76	19.84	9.64
Solano County	37.66	46.82	46.11	42.49	32.59	15.70
Cumulative Subtotal	78.03	91.69	94.53	89.09	69.68	42.83
Change From Baseline	6.64	9.29	8.60	7.23	4.88	2.02
All other contractors	3,235	4,134	3,976	3,615	2,713	1,300
Total	3,313	4,225	4,071	3,704	2,782	1,342
2020 No Project 3						
	Ann Avg	Wet	AN	BN	Dry	Crit
County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	19.37	24.22	23.64	21.40	16.55	8.70
Solano County	32.61	40.86	39.87	36.10	27.83	14.45
Cumulative Subtotal	69.50	81.60	84.00	78.35	61.63	40.64
Change From Baseline	(1.89)	(0.81)	(1.93)	(3.52)	(3.17)	(0.17)
All other contractors	3,160	3,950	3,909	3,632	2,615	1,330
Total	3,230	4,032	3,993	3,711	2,677	1,370
2020 No Project 4						
	Ann Avg	Wet	AN	BN	Dry	Crit

Table 7.3-21 (revised)

SEE TABLE 9-CS-8, LOWER LEFT

cfs x 1.98 x days = AF/Momth

Factor to convert monthly flows to cfs for text: AF / 1.98/days = cfs

2020 Feather River Baseline Flows, cfs	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
22-94 Avg	2,486	2,184	3,621	4,619	5,714	6,000	3,181	3,655	4,708	7,019	4,774	2,099
22-94 Wet	2,786	2,954	6,345	10,113	11,785	12,024	6,960	7,426	5,690	7,251	3,773	1,703
22-94 AN	2,471	1,765	3,611	4,713	7,056	8,809	2,536	4,466	4,393	8,463	5,893	1,925
22-94 BN	2,523	2,005	2,413	2,666	3,806	3,077	1,347	1,704	5,547	8,392	6,612	2,351
22-94 Dry	2,319	1,730	2,255	1,521	1,629	2,165	1,586	1,640	4,333	6,842	5,123	2,410
22-94 Crit	2,153	2,002	2,091	1,337	1,645	1,645	1,369	1,340	2,776	4,043	2,981	2,224
2020 Sacramento River Baseline Flows, cfs												
22-94 Avg	12,287	15,558	24,922	32,737	39,435	34,239	24,609	19,217	17,480	18,410	14,340	12,958
22-94 Wet	14,634	21,819	46,013	55,831	61,365	52,554	42,604	32,447	23,676	20,299	15,483	16,885
22-94 AN	11,823	16,133	22,086	44,485	53,022	50,563	29,386	22,192	18,289	21,199	15,960	13,429
22-94 BN	11,734	13,434	17,896	24,757	35,520	26,249	18,718	15,441	17,667	19,757	15,794	12,479
22-94 Dry	11,173	13,034	15,110	15,928	23,366	22,532	13,970	11,965	13,927	17,552	13,659	11,583
22-94 Crit	10,697	9,963	11,659	14,252	15,725	13,513	10,197	7,656	10,483	12,354	10,204	8,086

Table 9-CS-9

Monthly Flow Changes for Proposed Project Compared to Baseline

Under 2020 Conditions, in cfs

2020 Decrease in Feather River Flows and Sacramento River Fows Upstream of North Bay Aqueduct Intake, cfs

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
22-94 Avg	(0.3)	(0.0)	0.0	0.0	(0.0)	(0.1)	(0.2)	(0.2)	(0.2)	(0.3)	(0.3)	(0.4)
22-94 Wet	(0.3)	(0.0)	0.0	0.0	0.0	(0.1)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.5)
22-94 AN	(0.1)	(0.0)	0.0	0.0	0.0	(0.0)	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)
22-94 BN	(0.5)	(0.1)	0.0	0.0	0.0	(0.1)	(0.3)	(0.3)	(0.3)	(0.4)	(0.5)	(0.7)
22-94 Dry	(0.2)	(0.0)	0.0	0.0	(0.0)	(0.0)	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)
22-94 Crit	(0.4)	(0.1)	0.0	0.0	(0.0)	(0.1)	(0.1)	(0.1)	(0.2)	(0.3)	(0.3)	(0.2)

2020 Decrease in Sac River Flows at the Delta, Downstream of North Bay Aqueduct Intake, cfs

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
22-94 Avg	(11.4)	(9.9)	(9.8)	(5.3)	(6.7)	(7.5)	(10.1)	(10.8)	(11.4)	(11.4)	(11.4)	(11.4)
22-94 Wet	(17.8)	(15.5)	(15.6)	(11.1)	(13.4)	(13.7)	(17.1)	(17.9)	(19.0)	(19.0)	(19.0)	(19.1)
22-94 AN	(13.1)	(11.3)	(10.8)	(6.5)	(9.8)	(11.6)	(15.2)	(15.8)	(16.7)	(16.7)	(16.7)	(16.7)
22-94 BN	(11.9)	(10.4)	(10.3)	(4.8)	(5.9)	(7.4)	(10.6)	(11.9)	(12.6)	(12.6)	(12.6)	(12.6)
22-94 Dry	(5.5)	(4.8)	(4.6)	(2.2)	(2.7)	(3.1)	(4.9)	(5.2)	(5.5)	(5.5)	(5.5)	(5.5)
22-94 Crit	(2.4)	(2.1)	(2.0)	(0.6)	(0.7)	(0.8)	(1.0)	(1.1)	(1.1)	(1.1)	(1.1)	(1.1)

Feather Max:	0.0
Sacramento Max:	(0.6)

County of Butte	13.30	12.79	15.24	16.67	13.38	11.53
Plumas County FC&WCD	n/a	n/a	n/a	n/a	n/a	n/a
City of Yuba City	4.22	3.73	5.26	4.18	3.87	5.97
Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
Change From Baseline	0.00	0.00	0.00	0.00	0.00	0.00
Napa County FC&WCD	17.62	23.64	22.48	18.42	13.38	7.72
Solano County	29.34	39.78	37.70	30.54	21.91	12.61
Cumulative Subtotal	64.48	79.94	80.69	69.80	52.54	37.82
Change From Baseline	(6.92)	(2.47)	(5.25)	(12.06)	(12.25)	(2.99)
All other contractors	3,247	4,119	3,972	3,619	2,739	1,357
Total	3,311	4,199	4,053	3,689	2,791	1,395

(not used) **Table 9-CS-4**

Maximum and Minimum Annual Total Deliveries to Feather River Region and North Bay Contractors Among All Alternatives, Excluding Baselines; TAF per Year

2003 Comparison	**Ann Avg**	**Wet**	**AN**	**BN**	**Dry**	**Crit**
2003 Feather Basin Max Subtotal	0.96	0.94	1.00	1.00	0.90	1.15
2003 Feather Basin Min Subtotal	0.94	0.86	0.94	0.82	0.79	1.14
2003 North Bay Max Subtotal	45.08	52.50	49.35	46.90	44.90	25.67
2003 North Bay Min Subtotal	40.10	47.76	46.22	44.28	35.47	23.00
2020 Comparison						
2020 Feather Basin Max Subtotal	17.65	16.69	20.58	21.04	17.32	17.60
2020 Feather Basin Min Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
2020 North Bay Max Subtotal	78.46	94.35	95.63	89.32	69.68	42.83
2020 North Bay Min Subtotal	64.48	79.94	80.69	69.80	52.54	37.82
All Periods Incl 1994 (not used)	INCOMPLETE	DO NOT USE				
Feather Basin Max Subtotal	17.65	16.69	20.58	21.04	17.32	17.60
Feather Basin Min Subtotal	0.62	0.60	0.60	0.50	0.49	0.77
North Bay Max Subtotal	78.46	94.35	95.63	89.32	69.68	42.83
North Bay Min Subtotal	35.32	39.84	37.21	36.99	34.43	24.37

Table 7.3-17 **Table 9-CS-5**
(revised)

Change in Average Annual Total Deliveries to Feather River and North of Delta Contractors For Proposed Project Compared to Baselines; TAF

Feather River Contractors	**Ann Avg**	**Wet**	**AN**	**BN**	**Dry**	**Crit**
2003 Proposed Project vs. Baseline	-0.01	-0.07	0.06	0.17	0.11	0.01
2020 Proposed Project vs. Baseline	0.12	0.17	0.07	0.19	0.07	0.11
North of Delta Contractors						
2003 Proposed Project vs. Baseline	1.63	2.94	2.71	0.11	-0.23	1.30
2020 Proposed Project vs. Baseline	7.07	11.95	9.69	7.45	3.32	0.92

Table 7.3-18 **Table 9-CS-6**
(revised)

Flow Changes in Feather and Sacramento Rivers Due to Changes in Deliveries to Feather River and North of Delta Contractors For Proposed Project Compared to Baselines; TAF, and Percentages of River Flows

Annual Baseline River Flows, TAF	**Ann Avg**	**Wet**	**AN**	**BN**	**Dry**	**Crit**
2003 Baseline Feather River Flows	3,022	4,743	3,317	2,565	2,032	1,618
2020 Baseline Feather River Flows	3,015	4,733	3,381	2,560	2,030	1,545
2003 Baseline Sac River Flows	16,074	24,438	19,137	13,840	11,115	8,106
2020 Baseline Sac River Flows	15,965	24,201	19,086	13,749	11,039	8,103
Flow Change Due to Change in Delivery, TAF						
2003 Feather	0.01	0.07	-0.06	-0.17	-0.11	-0.01
2020 Feather	-0.12	-0.17	-0.07	-0.19	-0.07	-0.11
2003 North of Delta	-1.63	-2.94	-2.71	-0.11	0.23	-1.30
2020 North of Delta	-7.07	-11.95	-9.69	-7.45	-3.32	-0.92
Flow Change Due to Change in Delivery, as % of River Flow						
2003 Feather Basin Del./Feather River	0.0002%	0.0014%	-0.0018%	-0.0066%	-0.0054%	-0.0006%
2020 Feather Basin Del./Feather River	-0.0041%	-0.0036%	-0.0022%	-0.0076%	-0.0034%	-0.0069%
2003 North of Delta Del./Sacramento River	-0.0101%	-0.0120%	-0.0142%	-0.0008%	0.0020%	-0.0160%
2020 North of Delta Del./Sacramento River	-0.0443%	-0.0494%	-0.0508%	-0.0542%	-0.0301%	-0.0114%
Flow Change Due to Change in Delivery, as % of Delta Outflow						
2003	-0.0111%	-0.0105%	-0.0158%	-0.0011%	0.0036%	-0.0273%
2020	-0.0499%	-0.0444%	-0.0580%	-0.0789%	-0.0541%	-0.0193%

Used For Max Possible Difference Between any Alternatives

Formulas Including Baseline

2003 Comparison	Ann Avg	Wet	AN	BN	Dry	Crit
2003 Feather Basin Max Subtotal	0.96	0.94	1.00	1.00	0.90	1.15
2003 Feather Basin Min Subtotal	0.94	0.86	0.94	0.82	0.79	1.14
2003 North Bay Max Subtotal	45.08	52.50	49.35	46.90	44.90	25.67
2003 North Bay Min Subtotal	40.10	47.76	46.22	44.28	35.47	23.00
2020 Comparison						
2020 Feather Basin Max Subtotal	17.65	16.69	20.58	21.04	17.32	17.60
2020 Feather Basin Min Subtotal	17.52	16.52	20.50	20.84	17.25	17.50
2020 North Bay Max Subtotal	78.46	94.35	95.63	89.32	69.68	42.83
2020 North Bay Min Subtotal	64.48	79.94	80.69	69.80	52.54	37.82
All Periods (not used)						
Feather Basin Max Subtotal	17.65					
Feather Basin Min Subtotal	0.62	Void				
North Bay Max Subtotal	78.46					
North Bay Min Subtotal	35.32					

Table 7.3-20 (revised)

Table 9-CS-8

Change in Average Annual Total Deliveries to South of Delta Contractors

For Proposed Project Compared to Baselines

TAF, and Percentage of Delta Inflow

2003 and 2020 Delivery Comparisons	Ann Avg	Wet	AN	BN	Dry	Crit
2003 Baseline - All Other Contractors	3,045	3,540	3,582	3,508	2,831	1,476
2003 Proposed Project - All Other Contractors	3,011	3,471	3,520	3,430	2,809	1,519
2020 Baseline - All Other Contractors	3,242	4,143	3,985	3,622	2,717	1,302
2020 Proposed Project - All Other Contractors	3,219	4,090	3,943	3,626	2,700	1,308
Change in Deliveries to South of the Delta Contractors						
2003 Proposed Project vs. Baseline	(34.16)	(68.83)	(62.09)	(78.07)	(22.21)	42.80
2020 Proposed Project vs. Baseline	(22.96)	(52.91)	(42.20)	4.25	(17.14)	5.97
Annual Baseline Delta Inflow (Sacramento + San Joaquin)						
2003 Delta Inflow	18,880	29,340	22,190	16,233	12,654	9,209
2020 Delta Inflow	18,770	29,126	22,125	16,137	12,564	9,198
Total Delivery Change to South of Delta Contractors, as % of Sac and San Joaquin Delta Inflow						
2003 Proposed Project vs. Baseline	-0.1809%	-0.2346%	-0.2798%	-0.4809%	-0.1755%	0.4647%
2020 Proposed Project vs. Baseline	-0.1223%	-0.1817%	-0.1908%	0.0263%	-0.1364%	0.0649%

Note that delivery increases downstream of Banks may be met by San Luis Reservoir storage releases.
Increases and decreases in deliveries downstream of Banks do not necessarily imply greater Delta pumping in the current period.

ADDED Delivery Change to South of Delta Contractors, as % of Baseline S of Delta Deliveries

2003	-1.1220%	-1.9445%	-1.7335%	-2.2255%	-0.7845%	2.8987%
2020	-0.7084%	-1.2771%	-1.0591%	0.1173%	-0.6309%	0.4583%

ADDED Delta Outflow

2003 Baseline (from Table 7.1-14)	14,657	28,016	17,156	9,678	6,373	4,750
2020 Baseline (from Table 7.1-17) needs updati	14,180	26,920	16,699	9,448	6,147	4,772

ADDED Delivery Change to South of Delta Contractors, as % of Baseline Delta Outflow

2020	0.1619%	0.1965%	0.2527%	-0.0450%	0.2789%	-0.1250%

ADDED Net Change in Delta Outflow (Table A retirements and transfers, allocation procedures)

2020 Delta Inflow Change	(7.07)	(11.95)	(9.69)	(7.45)	(3.32)	(0.92)
2020 Diversion Change	(22.96)	(52.91)	(42.20)	4.25	(17.14)	5.97
2020 Delta Outflow Change (Inflow - Diversion)	15.89	40.96	32.51	(11.70)	13.82	(6.89)
Water mgmt provisions <guesses>	50	80	70	50	15	10
	(34.11)	(39.04)	(37.49)	(61.70)	(1.18)	(16.89)

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	129.9	140.0	264.3	331.2	358.1	409.8	202.6	229.1	268.8	337.0	239.1	101.5	3,011.5
22-94 Wet	149.8	206.9	522.2	706.1	699.4	781.2	417.6	454.3	311.6	288.2	168.5	97.0	4,802.8
22-94 AN	106.1	125.0	207.5	357.0	470.7	599.3	172.0	261.0	264.9	414.4	236.2	70.3	3,284.4
22-94 BN	146.3	115.7	180.2	218.1	257.7	224.8	95.0	107.4	294.5	426.3	334.6	88.4	2,489.1
22-94 Dry	120.6	96.5	120.5	104.1	117.8	194.8	119.4	120.1	271.4	363.1	313.7	115.3	2,057.4
22-94 Crit	108.2	121.6	150.5	88.3	104.8	104.1	88.1	95.5	163.9	219.2	154.5	131.9	1,530.6
STDEV													
22-94 Avg	66.5	117.0	296.8	415.1	343.6	434.1	221.9	259.1	114.3	124.0	140.8	55.0	1,453.6
22-94 Wet	79.2	194.8	415.6	561.5	341.4	521.1	305.1	324.2	155.1	118.0	141.4	66.2	1,148.7
22-94 AN	3.6	47.5	253.7	325.9	321.5	468.1	114.2	309.0	89.9	81.3	155.9	32.2	789.5
22-94 BN	76.4	44.0	116.8	175.8	222.2	145.3	61.9	65.1	83.1	104.9	125.6	42.8	518.1
22-94 Dry	65.0	33.9	52.1	54.9	85.1	119.6	69.3	86.6	65.9	65.9	104.2	49.2	358.4
22-94 Crit	50.9	47.4	83.9	51.7	84.3	83.8	54.3	42.7	68.1	121.3	55.7	55.8	414.0
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	727.5	944.5	1,573.5	2,050.7	2,236.8	2,126.4	1,468.1	1,220.6	1,069.2	1,074.4	830.3	784.0	16,106.1
22-94 Wet	885.1	1,346.2	2,990.6	3,464.1	3,420.7	3,224.3	2,519.3	2,059.5	1,477.4	1,186.0	934.8	1,085.2	24,593.1
22-94 AN	661.4	1,014.1	1,315.5	2,812.1	3,050.9	3,111.6	1,776.3	1,396.3	1,097.9	1,219.7	851.9	750.9	19,058.6
22-94 BN	700.7	774.8	1,133.4	1,607.9	2,050.5	1,633.5	1,124.7	981.8	1,028.7	1,162.2	895.3	736.3	13,829.9
22-94 Dry	662.6	782.3	908.1	986.1	1,350.1	1,468.2	840.8	767.0	872.7	1,044.1	844.6	671.9	11,198.5
22-94 Crit	624.7	597.7	709.5	879.1	886.2	836.6	608.7	489.6	640.0	695.9	534.5	489.9	7,992.3
STDEV													
22-94 Avg	277.5	668.6	1,300.2	1,432.5	1,304.9	1,266.7	1,096.3	812.7	485.2	205.8	180.5	251.1	6,876.5
22-94 Wet	405.1	942.5	1,325.3	1,321.9	1,025.9	1,215.1	1,276.0	927.6	652.0	106.3	119.4	233.0	4,719.7
22-94 AN	138.8	729.6	1,179.7	1,455.1	912.3	962.3	921.0	605.5	433.7	95.1	130.8	44.4	2,647.2
22-94 BN	184.8	249.4	912.4	682.8	970.0	488.7	587.4	312.9	128.0	65.6	130.3	89.1	1,285.1
22-94 Dry	183.7	436.7	278.3	275.9	769.1	703.5	226.1	94.8	94.9	91.2	114.1	61.7	916.8
22-94 Crit	183.6	152.5	211.5	362.3	420.5	406.9	106.4	68.1	66.7	149.9	114.3	89.7	1,140.6
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	186.1	118.7	185.4	272.7	353.3	387.0	361.5	336.3	248.6	140.7	103.1	112.5	2,805.8
22-94 Wet	255.4	160.4	319.5	531.0	623.6	750.7	628.7	597.0	520.9	226.8	133.7	154.3	4,902.1
22-94 AN	135.8	113.9	162.0	324.2	434.0	455.9	402.9	364.9	276.0	139.8	118.8	124.0	3,052.1
22-94 BN	190.2	108.7	165.1	192.9	343.3	298.9	325.0	293.6	133.8	119.1	112.2	108.8	2,391.5
22-94 Dry	164.9	97.5	112.2	110.3	147.3	154.3	197.5	183.4	103.9	99.3	81.9	87.5	1,540.1
22-94 Crit	130.2	89.7	91.5	87.2	99.5	105.9	121.0	109.7	76.0	71.0	53.8	67.6	1,103.2
STDEV													
22-94 Avg	148.7	97.0	223.0	300.1	354.4	425.4	277.6	276.3	338.8	131.3	33.2	48.3	2,166.7
22-94 Wet	217.1	171.4	364.7	406.5	459.9	608.3	351.6	367.2	516.8	220.1	12.0	65.1	2,854.3
22-94 AN	59.2	45.5	142.7	264.7	341.1	202.2	146.8	124.7	227.5	39.8	9.8	24.6	1,056.6
22-94 BN	118.4	25.2	104.5	117.2	214.4	187.2	106.5	106.4	29.1	16.9	15.2	11.8	693.1
22-94 Dry	122.4	16.2	30.5	35.2	85.8	59.0	69.1	61.2	17.2	18.8	27.1	15.2	429.6
22-94 Crit	59.7	16.5	14.5	12.7	21.3	23.9	23.0	24.6	7.8	11.1	13.0	4.2	165.0
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	203.1	220.3	312.2	352.1	289.1	275.6	178.5	168.1	205.3	227.7	245.2	267.8	2,945.0
22-94 Wet	216.6	289.7	374.2	393.6	321.4	307.1	235.2	253.8	303.2	243.7	332.8	357.6	3,628.8
22-94 AN	203.7	240.1	362.0	391.7	355.6	342.3	230.8	199.3	249.9	265.4	225.5	298.7	3,364.8
22-94 BN	218.5	227.9	285.6	345.4	286.0	303.4	213.4	174.2	204.9	294.5	274.3	276.2	3,104.2
22-94 Dry	191.8	188.2	279.5	325.7	280.1	270.2	126.3	115.0	159.5	255.3	250.3	231.2	2,673.2
22-94 Crit	176.4	116.3	236.6	289.3	193.0	139.7	64.6	55.8	58.4	53.6	67.5	123.9	1,575.3
STDEV													
22-94 Avg	99.1	121.9	112.6	112.5	124.1	115.7	85.5	94.3	110.7	128.7	134.2	96.3	822.5
22-94 Wet	101.1	109.4	90.3	114.9	95.4	59.7	60.5	75.5	91.6	139.8	93.8	56.7	595.0
22-94 AN	120.1	123.0	88.3	108.8	97.0	74.4	60.2	70.8	91.2	88.1	125.9	59.6	343.7
22-94 BN	76.5	106.8	102.9	92.2	147.1	102.3	59.3	74.7	55.5	114.1	128.7	61.4	303.8
22-94 Dry	103.2	124.1	122.8	88.9	117.7	125.2	56.7	46.7	62.4	61.8	98.3	46.8	253.8
22-94 Crit	104.3	75.7	102.1	135.1	125.7	125.3	37.6	36.6	50.2	66.1	75.3	59.9	501.9
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6

22-94 BN	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.6
22-94 Dry	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.7
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.6
STDEV													
22-94 Avg	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3
22-94 AN	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 BN	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.3
22-94 Dry	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.3
22-94 Crit	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.3
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	1.8	1.4	1.4	1.1	1.1	1.3	1.6	1.7	1.8	1.8	1.8	1.8	18.5
22-94 Wet	1.9	1.5	1.5	1.4	1.3	1.4	1.7	1.8	1.9	1.9	1.9	1.9	20.1
22-94 AN	1.7	1.4	1.3	1.1	1.3	1.4	1.7	1.8	1.9	2.0	1.9	1.9	20.1
22-94 BN	1.9	1.5	1.5	1.0	1.1	1.4	1.7	1.9	1.9	2.0	2.0	1.9	20.1
22-94 Dry	1.7	1.4	1.3	1.0	1.1	1.3	1.7	1.8	1.9	2.0	1.9	1.9	19.0
22-94 Crit	1.7	1.4	1.3	0.6	0.7	0.8	1.0	1.1	1.2	1.2	1.2	1.2	11.5
STDEV													
22-94 Avg	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.5
22-94 Wet	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
22-94 AN	0.5	0.4	0.4	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
22-94 BN	0.1	0.1	0.1	0.5	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.8
22-94 Dry	0.5	0.4	0.4	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	1.2
22-94 Crit	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	3.9
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	161.5	144.0	137.9	79.7	108.1	131.3	182.7	249.8	335.2	341.9	335.0	237.9	2,435.2
22-94 Wet	174.5	155.7	149.6	102.9	128.1	147.9	195.8	264.1	358.0	364.4	357.0	249.6	2,640.8
22-94 AN	151.8	135.4	129.8	88.6	130.3	155.6	204.6	276.2	372.8	379.7	372.4	261.9	2,716.9
22-94 BN	166.5	148.6	142.5	75.5	108.3	137.5	199.3	283.3	382.2	389.7	382.7	268.9	2,734.8
22-94 Dry	147.5	131.4	125.6	75.1	102.5	131.7	199.0	271.5	360.2	368.2	360.2	260.8	2,592.0
22-94 Crit	159.5	142.0	135.4	42.9	62.1	74.2	100.5	134.8	175.9	180.6	175.8	130.4	1,281.8

STDEV													
22-94 Avg	44.0	39.3	37.9	41.0	39.6	40.6	49.2	67.7	91.7	93.2	91.9	64.7	638.9
22-94 Wet	26.8	23.9	22.9	20.3	17.9	18.6	20.9	28.6	35.0	36.5	35.8	29.7	288.8
22-94 AN	59.3	52.9	50.8	47.5	23.2	20.5	23.3	32.1	39.7	41.4	40.8	33.0	296.2
22-94 BN	26.3	23.3	21.8	45.3	40.3	33.7	30.3	35.3	41.8	43.7	43.0	37.6	290.4
22-94 Dry	55.1	49.4	47.8	37.9	38.4	34.7	34.8	48.0	65.4	66.3	65.8	46.3	415.0
22-94 Crit	52.8	47.3	45.8	37.0	41.6	46.7	54.6	73.7	99.5	101.2	99.1	70.1	599.6
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	8.8	12.3	52.2	76.3	94.9	105.7	20.0	7.4	3.8	0.6	0.7	2.6	384.9
22-94 Wet	11.4	13.4	62.3	96.0	143.3	160.8	41.3	18.2	10.9	2.1	2.5	9.0	733.2
22-94 AN	7.8	8.4	57.3	87.5	114.5	166.7	31.9	7.4	4.6	0.0	0.0	0.0	514.1
22-94 BN	12.0	23.1	70.1	104.7	94.6	103.0	19.2	6.0	0.0	0.0	0.0	0.0	316.1
22-94 Dry	4.9	7.8	37.2	46.0	62.0	65.4	0.4	0.0	0.0	0.0	0.0	0.0	166.7
22-94 Crit	6.5	7.0	29.6	39.6	38.2	15.3	0.0	0.0	0.0	0.0	0.0	0.0	39.0
STDEV													
22-94 Avg	25.3	28.9	75.6	86.4	80.4	82.9	32.8	21.6	14.0	5.1	6.2	13.6	345.3
22-94 Wet	28.6	30.2	78.6	83.8	51.2	37.8	40.2	31.7	24.0	9.5	11.5	24.7	292.5
22-94 AN	24.7	26.6	77.3	87.4	80.0	35.2	32.5	17.8	9.8	0.0	0.0	0.0	236.9
22-94 BN	30.4	38.0	85.2	94.1	92.7	92.9	32.4	22.4	0.0	0.0	0.0	0.0	250.7
22-94 Dry	19.8	22.7	68.7	82.3	75.1	76.3	1.5	0.0	0.0	0.0	0.0	0.0	181.5
22-94 Crit	22.5	24.2	69.1	74.1	67.8	53.1	0.0	0.0	0.0	0.0	0.0	0.0	84.5
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	2,230.4	2,279.1	2,358.5	2,480.7	2,625.6	2,768.5	3,012.7	3,118.8	2,943.9	2,587.7	2,344.8	2,251.2	
22-94 Wet	2,460.4	2,549.6	2,704.1	2,816.6	2,925.7	2,953.7	3,298.5	3,491.4	3,447.4	3,212.3	3,083.1	3,029.6	
22-94 AN	2,173.5	2,261.5	2,352.7	2,591.1	2,752.4	2,943.2	3,270.8	3,403.8	3,232.9	2,805.3	2,571.2	2,514.2	
22-94 BN	2,311.2	2,329.5	2,358.9	2,473.9	2,638.3	2,816.7	3,162.5	3,340.2	3,100.7	2,639.4	2,290.1	2,179.4	
22-94 Dry	2,135.8	2,180.4	2,261.9	2,363.4	2,578.2	2,812.2	2,972.3	2,991.7	2,708.7	2,275.1	1,922.4	1,781.7	
22-94 Crit	1,907.1	1,893.0	1,887.1	1,964.9	2,043.1	2,184.3	2,176.4	2,140.5	1,952.4	1,669.6	1,490.8	1,379.7	
STDEV													
22-94 Avg	383.7	386.9	356.5	269.7	227.6	187.0	194.9	218.5	266.5	312.9	320.2	356.4	
22-94 Wet	393.6	340.8	222.9	72.9	0.0	0.0	10.3	48.8	121.2	243.5	237.0	224.2	

22-94 AN	383.5	410.5	358.4	175.3	24.6	0.0	18.2	84.0	198.1	307.7	270.5	337.2
22-94 BN	405.9	415.4	406.9	259.4	181.9	133.6	105.2	139.4	167.7	238.6	245.5	248.5
22-94 Dry	368.8	376.5	330.3	270.2	206.1	107.0	124.8	164.1	216.8	246.6	212.9	230.1
22-94 Crit	375.5	378.8	387.3	357.8	347.1	296.3	272.0	230.4	169.8	128.1	105.5	95.0
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
AVERAGE												
22-94 Avg	563.9	610.2	710.6	882.8	950.6	979.2	943.6	852.8	719.1	602.1	507.1	528.4
22-94 Wet	608.1	711.8	862.6	1,029.2	1,067.0	1,067.0	1,063.3	1,037.1	979.9	860.6	825.4	902.1
22-94 AN	549.3	631.2	771.7	961.6	1,057.0	1,067.0	1,058.4	976.7	845.1	733.4	582.6	616.6
22-94 BN	665.3	694.6	744.3	891.8	961.3	1,009.3	988.0	868.8	689.6	587.7	475.9	483.8
22-94 Dry	533.3	562.3	657.9	843.0	930.6	987.8	897.0	735.5	530.1	411.5	299.4	271.4
22-94 Crit	421.3	380.3	424.7	603.2	672.7	705.8	648.7	565.0	443.9	311.2	200.7	195.9
STDEV												
22-94 Avg	383.7	386.9	356.5	269.7	227.6	187.0	194.9	218.5	266.5	312.9	320.2	356.4
22-94 Wet	393.6	340.8	222.9	72.9	0.0	0.0	10.3	48.8	121.2	243.5	237.0	224.2
22-94 AN	383.5	410.5	358.4	175.3	24.6	0.0	18.2	84.0	198.1	307.7	270.5	337.2
22-94 BN	405.9	415.4	406.9	259.4	181.9	133.6	105.2	139.4	167.7	238.6	245.5	248.5
22-94 Dry	368.8	376.5	330.3	270.2	206.1	107.0	124.8	164.1	216.8	246.6	212.9	230.1
22-94 Crit	375.5	378.8	387.3	357.8	347.1	296.3	272.0	230.4	169.8	128.1	105.5	95.0

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	151.4	136.7	239.8	319.7	344.8	403.0	191.7	220.5	257.8	367.8	279.1	109.0	3,021.2
22-94 Wet	171.0	185.6	464.6	695.2	694.7	780.8	413.2	454.1	316.0	298.3	180.5	96.4	4,750.6
22-94 AN	153.7	128.6	185.8	336.9	416.2	575.8	140.5	259.9	241.4	462.0	317.7	74.8	3,293.3
22-94 BN	167.1	125.2	164.6	198.8	233.1	208.4	80.7	89.6	296.0	473.5	413.0	95.7	2,545.7
22-94 Dry	123.5	97.7	127.2	100.3	114.2	188.3	110.7	97.1	232.5	404.4	325.7	132.0	2,053.7
22-94 Crit	134.1	122.9	129.2	82.1	110.7	110.9	84.5	96.0	158.4	238.7	201.1	144.3	1,612.8
STDEV													
22-94 Avg	68.2	111.2	280.9	410.9	345.3	432.5	225.6	260.1	115.6	144.0	152.6	67.0	1,421.2
22-94 Wet	80.8	188.6	426.8	556.1	342.6	520.1	308.5	324.3	146.3	118.7	152.4	67.9	1,137.0
22-94 AN	45.5	60.8	184.3	315.8	357.3	457.8	109.6	305.1	108.5	99.2	125.5	36.8	783.2
22-94 BN	74.6	39.8	86.8	172.7	228.6	145.5	56.5	41.1	93.3	82.6	75.3	45.3	534.8
22-94 Dry	52.2	35.4	62.6	53.0	67.8	120.6	84.9	54.1	60.0	108.6	135.5	71.6	423.9
22-94 Crit	63.6	49.3	71.9	48.1	58.0	91.0	53.5	53.9	59.5	161.9	114.0	82.4	441.9
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	748.1	935.8	1,546.8	2,020.4	2,212.3	2,100.5	1,448.5	1,193.3	1,045.3	1,122.1	908.0	785.7	16,066.9
22-94 Wet	888.7	1,316.8	2,918.5	3,446.6	3,419.6	3,219.2	2,505.6	2,023.2	1,465.2	1,187.2	959.1	1,063.9	24,413.5
22-94 AN	706.5	1,011.6	1,323.2	2,786.3	2,976.5	3,073.1	1,735.0	1,383.7	1,074.6	1,275.6	986.5	778.3	19,111.0
22-94 BN	744.5	788.3	1,113.0	1,552.1	1,991.0	1,605.1	1,102.0	960.6	1,016.4	1,213.4	1,010.4	718.5	13,815.4
22-94 Dry	669.3	776.0	898.9	961.7	1,344.4	1,417.6	827.5	730.9	820.0	1,118.6	895.3	691.5	11,151.6
22-94 Crit	646.1	591.4	702.5	844.6	878.2	821.1	592.2	470.1	619.9	778.4	650.7	509.0	8,104.0
STDEV													
22-94 Avg	267.3	644.4	1,261.9	1,439.0	1,297.0	1,267.1	1,095.8	803.4	487.6	196.3	162.8	243.9	6,789.6
22-94 Wet	390.8	919.2	1,273.0	1,336.8	1,027.0	1,210.3	1,281.8	911.3	637.3	96.6	101.9	231.0	4,671.0
22-94 AN	157.5	696.2	1,179.6	1,443.7	938.6	964.6	915.9	599.5	444.6	75.7	67.8	45.4	2,573.2
22-94 BN	174.2	191.3	885.9	683.6	945.3	460.3	574.7	299.4	157.3	85.6	79.0	58.4	1,294.9
22-94 Dry	172.8	420.6	266.5	260.8	752.4	699.2	219.4	90.4	97.3	118.2	131.2	85.3	942.5
22-94 Crit	182.9	155.6	219.2	347.6	362.6	376.9	92.7	71.0	66.3	184.0	153.9	163.9	1,125.7
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	186.3	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.4	140.7	103.1	112.6	2,805.9
22-94 Wet	255.0	160.4	319.6	531.0	623.5	750.6	628.6	597.0	520.9	227.1	133.9	154.4	4,902.1
22-94 AN	136.6	113.8	162.3	324.2	433.7	455.9	402.9	364.9	275.3	140.1	119.1	124.1	3,052.7
22-94 BN	190.5	109.0	165.0	192.9	343.4	299.0	325.0	293.5	134.0	119.1	112.3	108.9	2,392.6
22-94 Dry	165.1	97.5	112.3	110.4	147.3	154.3	197.5	183.3	103.6	98.9	81.9	87.4	1,539.5
22-94 Crit	130.6	90.0	91.0	87.2	99.5	105.9	121.0	109.7	75.8	70.7	53.8	67.6	1,102.9
STDEV													
22-94 Avg	148.4	96.9	223.1	300.1	354.4	425.4	277.6	276.4	338.8	131.4	33.2	48.3	2,166.7
22-94 Wet	217.4	171.4	364.7	406.5	459.9	608.2	351.5	367.2	516.7	220.0	11.8	65.0	2,854.0
22-94 AN	58.6	45.3	143.7	264.7	341.0	202.2	146.8	124.7	227.8	39.6	9.7	24.5	1,056.0
22-94 BN	117.0	24.7	104.5	117.2	214.4	187.2	106.6	106.7	29.1	17.1	15.4	11.6	693.4
22-94 Dry	122.3	16.3	30.5	35.2	85.8	59.0	69.0	61.2	17.0	18.7	26.8	15.2	429.2
22-94 Crit	58.7	16.2	15.1	12.8	21.4	23.9	23.0	24.5	7.8	10.9	13.1	4.2	164.7
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	230.7	217.7	311.2	356.4	316.0	310.4	140.3	85.7	189.8	249.6	272.9	265.5	2,946.1
22-94 Wet	247.0	273.0	355.1	392.8	355.3	382.9	186.3	127.0	293.3	243.2	340.2	355.3	3,551.4
22-94 AN	240.3	254.5	345.7	449.6	385.6	386.4	180.2	100.7	212.8	307.1	291.0	302.8	3,456.7
22-94 BN	239.4	243.6	307.5	364.8	342.4	336.6	151.6	81.4	209.8	330.0	342.6	255.9	3,205.8
22-94 Dry	222.8	173.0	294.1	307.7	292.0	273.4	106.6	57.9	122.8	291.4	239.6	231.1	2,612.4
22-94 Crit	194.4	119.8	232.6	270.2	190.3	139.1	58.2	42.8	55.3	63.2	102.8	134.4	1,603.2
STDEV													
22-94 Avg	101.3	124.7	106.4	113.5	131.0	135.2	61.8	60.5	110.4	144.5	137.4	101.4	835.5
22-94 Wet	102.3	126.1	96.8	105.7	90.3	69.8	53.6	78.6	93.5	137.8	99.4	67.6	610.0
22-94 AN	118.0	134.1	82.3	45.7	83.5	74.0	28.0	52.5	76.7	121.9	120.4	62.5	312.6
22-94 BN	75.9	102.6	110.1	99.3	147.3	125.1	38.6	43.2	59.2	88.1	61.2	54.8	238.8
22-94 Dry	112.8	116.3	103.4	99.7	128.1	123.9	36.1	26.9	57.8	101.4	130.0	60.2	368.1
22-94 Crit	102.0	77.4	103.3	122.6	132.3	128.9	30.7	25.6	50.9	122.6	134.4	100.2	639.4
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	1.0
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	1.0
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	1.0

22-94 BN	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.0
22-94 Dry	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	1.0
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.2	0.1	0.8
STDEV													
22-94 Avg	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 Wet	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 AN	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.5
22-94 BN	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.4
22-94 Dry	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.5
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	4.0	3.3	3.1	2.3	2.4	2.8	3.6	3.9	4.0	4.1	4.1	4.0	41.4
22-94 Wet	4.4	3.6	3.4	3.2	3.0	3.3	3.9	4.2	4.3	4.5	4.4	4.3	46.6
22-94 AN	3.8	3.1	3.0	2.4	2.8	3.3	4.0	4.3	4.4	4.5	4.5	4.4	46.7
22-94 BN	4.3	3.5	3.4	2.1	2.3	3.0	3.9	4.4	4.5	4.7	4.6	4.5	46.2
22-94 Dry	3.7	3.0	2.9	2.1	2.2	2.7	3.7	4.0	4.1	4.2	4.2	4.1	41.0
22-94 Crit	3.7	3.0	2.9	1.3	1.4	1.6	2.1	2.2	2.3	2.4	2.4	2.3	22.5
STDEV													
22-94 Avg	1.0	0.8	0.8	1.2	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.9	9.8
22-94 Wet	0.2	0.2	0.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
22-94 AN	1.4	1.1	1.1	1.3	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.9
22-94 BN	0.5	0.4	0.4	1.5	1.0	0.8	0.5	0.3	0.3	0.3	0.3	0.3	2.5
22-94 Dry	1.2	1.0	0.9	1.1	0.9	0.8	0.6	0.6	0.7	0.7	0.7	0.7	6.1
22-94 Crit	1.2	1.0	0.9	1.1	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.1	8.5
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	198.8	174.6	164.0	90.1	119.2	150.8	187.2	252.2	320.1	337.4	326.2	243.2	2,550.7
22-94 Wet	209.0	183.4	172.4	120.6	146.8	170.9	195.6	256.6	327.0	347.3	335.2	244.7	2,724.0
22-94 AN	206.5	181.4	170.6	96.6	146.3	190.8	225.1	296.6	376.6	396.7	383.6	286.5	3,038.8
22-94 BN	219.6	193.0	181.6	84.2	115.8	165.1	216.0	306.9	389.3	410.0	396.5	296.7	3,040.2
22-94 Dry	174.6	153.2	143.5	82.1	106.9	137.4	189.7	256.3	325.4	340.9	330.0	248.4	2,509.6
22-94 Crit	182.9	160.6	150.6	48.8	68.5	83.6	104.2	138.1	173.1	181.5	175.6	135.2	1,324.6

STDEV													
22-94 Avg	59.0	52.0	49.3	51.3	50.8	53.4	56.2	75.7	96.7	101.1	98.0	73.6	732.4
22-94 Wet	30.7	27.4	26.4	24.1	21.5	23.6	29.1	41.7	52.0	53.5	51.9	42.4	393.2
22-94 AN	81.6	71.8	67.7	55.7	35.0	22.3	24.2	37.2	44.1	46.0	44.4	39.1	348.1
22-94 BN	47.2	41.8	39.6	62.8	56.6	49.1	39.6	30.0	34.0	36.3	35.3	31.7	232.5
22-94 Dry	67.6	59.5	56.1	46.0	50.1	45.9	43.6	59.2	78.9	80.3	78.4	57.0	534.8
22-94 Crit	69.4	61.2	57.9	47.6	51.8	62.1	64.6	86.4	110.5	114.0	110.8	84.8	674.7
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	6.4	6.9	25.1	52.5	73.6	93.5	12.5	4.4	1.2	0.1	0.4	2.2	278.7
22-94 Wet	7.4	11.1	52.2	74.0	119.4	151.3	32.5	15.0	4.2	0.4	1.3	7.5	587.5
22-94 AN	0.0	0.0	0.0	41.0	78.5	144.4	11.5	0.0	0.0	0.0	0.0	0.0	317.0
22-94 BN	11.1	11.3	26.3	71.3	67.2	84.1	8.4	0.4	0.0	0.0	0.0	0.0	172.0
22-94 Dry	4.9	2.2	11.5	31.6	50.3	52.4	0.0	0.0	0.0	0.0	0.0	0.0	111.4
22-94 Crit	6.5	6.5	15.3	30.3	27.8	15.3	0.0	0.0	0.0	0.0	0.0	0.0	54.2
STDEV													
22-94 Avg	21.6	21.9	59.1	79.0	78.2	80.3	25.6	18.1	6.2	0.9	3.1	12.9	294.8
22-94 Wet	23.5	28.0	72.4	89.3	67.7	49.7	37.1	31.8	11.2	1.8	5.9	23.7	316.7
22-94 AN	0.0	0.0	0.0	67.8	76.7	36.7	12.9	0.0	0.0	0.0	0.0	0.0	198.3
22-94 BN	28.3	28.7	66.8	86.3	86.0	88.3	19.5	1.4	0.0	0.0	0.0	0.0	145.4
22-94 Dry	19.5	8.9	46.0	67.1	71.6	69.5	0.0	0.0	0.0	0.0	0.0	0.0	128.6
22-94 Crit	22.5	22.5	53.1	70.7	63.3	53.1	0.0	0.0	0.0	0.0	0.0	0.0	114.9
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	2,121.6	2,173.4	2,277.3	2,410.8	2,569.1	2,718.8	2,973.8	3,088.6	2,924.8	2,537.9	2,255.2	2,154.4	
22-94 Wet	2,365.2	2,475.9	2,688.0	2,811.5	2,925.2	2,953.7	3,303.0	3,496.0	3,447.4	3,202.2	3,060.9	3,008.0	
22-94 AN	2,029.3	2,113.1	2,225.7	2,484.2	2,700.1	2,914.4	3,273.5	3,407.4	3,260.0	2,784.8	2,469.3	2,407.9	
22-94 BN	2,192.8	2,200.9	2,245.7	2,380.1	2,569.2	2,763.9	3,124.1	3,319.5	3,078.6	2,570.1	2,142.6	2,024.8	
22-94 Dry	2,033.8	2,077.0	2,151.7	2,256.9	2,475.2	2,715.7	2,884.5	2,927.3	2,683.3	2,208.7	1,844.3	1,687.4	
22-94 Crit	1,806.0	1,790.4	1,805.7	1,889.6	1,961.9	2,096.3	2,092.0	2,055.9	1,873.4	1,571.3	1,346.3	1,223.2	
STDEV													
22-94 Avg	354.1	352.4	343.4	279.3	241.6	209.9	204.7	209.5	261.1	305.4	303.3	336.3	
22-94 Wet	419.6	365.3	273.8	121.1	51.4	15.2	54.4	144.9	221.4	366.0	344.7	348.4	

22-94 AN	282.2	312.8	314.0	209.9	82.0	47.9	63.0	109.9	142.5	246.5	223.8	264.5	
22-94 BN	344.7	383.7	431.0	309.9	206.1	154.4	121.1	149.7	144.3	162.9	199.3	190.2	
22-94 Dry	339.9	328.2	294.6	264.9	247.7	166.7	162.9	170.0	222.3	225.9	189.7	206.6	
22-94 Crit	321.0	316.0	322.2	334.3	335.0	283.0	262.9	231.8	198.4	154.7	116.5	98.2	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	449.6	476.0	584.7	778.2	885.9	936.5	846.5	663.2	529.8	438.4	382.6	404.6	
22-94 Wet	540.2	606.5	747.7	942.2	1,018.0	1,061.0	989.9	827.8	787.8	680.6	656.9	745.0	
22-94 AN	343.8	408.0	560.4	840.9	980.9	1,032.0	954.4	756.3	581.1	493.9	410.7	443.3	
22-94 BN	470.8	499.4	580.4	756.8	899.9	976.0	865.1	630.2	429.6	347.4	303.4	268.8	
22-94 Dry	443.1	453.1	567.4	729.7	845.7	903.9	786.9	573.5	376.1	320.8	241.5	230.2	
22-94 Crit	363.2	307.3	347.5	528.5	612.7	636.1	563.0	455.9	357.4	231.4	159.7	167.5	
STDEV													
22-94 Avg	354.1	352.4	343.4	279.3	241.6	209.9	204.7	209.5	261.1	305.4	303.3	336.3	
22-94 Wet	419.6	365.3	273.8	121.1	51.4	15.2	54.4	144.9	221.4	366.0	344.7	348.4	
22-94 AN	282.2	312.8	314.0	209.9	82.0	47.9	63.0	109.9	142.5	246.5	223.8	264.5	
22-94 BN	344.7	383.7	431.0	309.9	206.1	154.4	121.1	149.7	144.3	162.9	199.3	190.2	
22-94 Dry	339.9	328.2	294.6	264.9	247.7	166.7	162.9	170.0	222.3	225.9	189.7	206.6	
22-94 Crit	321.0	316.0	322.2	334.3	335.0	283.0	262.9	231.8	198.4	154.7	116.5	98.2	

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	154.1	134.9	239.6	317.7	344.1	394.1	192.0	222.1	255.7	375.9	283.2	108.8	3,022.3
22-94 Wet	177.1	183.7	448.6	695.1	708.1	779.3	411.9	455.0	303.5	315.7	171.7	93.2	4,742.9
22-94 AN	155.2	128.4	204.2	327.5	416.1	565.9	140.5	267.0	258.0	462.3	317.0	75.1	3,317.2
22-94 BN	166.5	121.0	173.7	195.8	222.7	207.0	80.7	92.8	286.8	486.7	428.6	103.1	2,565.4
22-94 Dry	124.7	96.4	127.4	99.6	106.3	157.8	113.7	97.7	242.3	409.1	331.3	126.0	2,032.4
22-94 Crit	138.0	122.4	130.0	82.1	105.7	110.1	84.3	93.9	151.6	235.5	216.5	148.0	1,618.1
STDEV													
22-94 Avg	69.5	111.7	281.6	411.7	348.9	418.5	225.7	259.8	120.1	145.2	153.8	66.9	1,426.9
22-94 Wet	78.8	189.4	428.0	561.9	339.8	483.2	309.9	323.8	157.3	125.4	142.9	65.5	1,153.4
22-94 AN	50.7	60.7	231.4	298.3	357.3	429.5	109.6	301.2	116.9	105.6	123.2	39.2	803.3
22-94 BN	78.8	44.0	90.6	174.6	212.5	146.5	56.6	40.6	95.5	72.0	70.3	50.9	553.8
22-94 Dry	54.2	33.8	63.1	51.4	58.6	100.1	87.2	62.1	65.0	104.0	137.7	70.9	414.4
22-94 Crit	64.1	49.0	74.2	48.1	59.3	91.4	53.3	50.4	62.8	164.2	116.8	81.6	457.6
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	751.8	931.4	1,542.5	2,022.3	2,212.9	2,100.0	1,448.6	1,195.5	1,042.8	1,129.0	910.1	787.4	16,074.4
22-94 Wet	898.5	1,313.8	2,901.3	3,456.1	3,433.9	3,233.0	2,501.7	2,023.0	1,453.0	1,203.1	960.3	1,060.1	24,437.8
22-94 AN	708.8	1,007.6	1,325.0	2,782.0	2,975.5	3,077.4	1,735.2	1,395.1	1,092.4	1,278.8	979.5	779.4	19,136.9
22-94 BN	749.2	777.9	1,119.6	1,546.2	1,990.3	1,598.9	1,102.4	964.4	1,008.3	1,229.5	1,029.4	724.0	13,840.2
22-94 Dry	664.5	770.2	899.2	963.5	1,335.8	1,399.6	830.8	731.7	823.3	1,117.3	880.2	698.7	11,114.6
22-94 Crit	650.5	592.4	697.3	847.5	870.2	821.1	594.5	468.7	616.6	772.9	665.3	509.0	8,106.1
STDEV													
22-94 Avg	258.1	645.9	1,253.4	1,442.9	1,298.4	1,269.5	1,095.7	803.2	489.1	201.8	158.0	242.1	6,795.4
22-94 Wet	368.1	923.1	1,262.3	1,344.7	1,006.6	1,197.9	1,286.1	909.8	650.1	101.6	98.8	234.3	4,627.8
22-94 AN	152.4	691.7	1,178.9	1,439.2	938.3	961.4	916.0	600.0	438.8	73.7	62.4	41.8	2,577.1
22-94 BN	173.0	199.7	885.1	687.3	939.3	455.6	575.8	299.5	154.1	70.1	79.6	48.2	1,311.2
22-94 Dry	169.4	420.0	265.4	261.7	750.8	695.3	222.5	91.2	100.1	121.0	120.2	84.2	910.8
22-94 Crit	176.7	156.2	224.2	344.5	370.1	377.2	96.6	69.4	68.9	187.7	146.2	164.5	1,123.3
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	186.2	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.5	140.7	103.2	112.6	2,806.0
22-94 Wet	255.0	160.5	319.6	531.0	623.6	750.6	628.6	597.0	521.0	227.1	133.9	154.4	4,902.3
22-94 AN	136.9	113.8	162.2	324.2	433.7	455.8	402.9	364.9	275.3	140.1	119.0	124.1	3,052.8
22-94 BN	190.5	109.1	165.1	192.9	343.4	299.0	325.0	293.5	134.0	119.2	112.3	108.9	2,392.7
22-94 Dry	165.0	97.5	112.2	110.3	147.3	154.3	197.5	183.3	103.7	99.0	82.1	87.3	1,539.6
22-94 Crit	130.4	89.8	91.0	87.1	99.5	105.9	121.0	109.7	75.8	70.7	53.8	67.6	1,102.4
STDEV													
22-94 Avg	148.4	96.9	223.1	300.1	354.3	425.3	277.6	276.4	338.8	131.3	33.2	48.3	2,166.7
22-94 Wet	217.5	171.4	364.6	406.5	459.8	608.1	351.5	367.2	516.7	220.0	11.8	65.0	2,854.0
22-94 AN	58.4	45.3	143.5	264.7	341.0	202.1	146.8	124.7	227.8	39.6	9.7	24.5	1,055.8
22-94 BN	116.7	24.7	104.5	117.2	214.4	187.2	106.6	106.6	29.0	16.9	15.3	11.6	693.3
22-94 Dry	122.4	16.3	30.5	35.2	85.8	59.0	69.0	61.2	17.1	18.7	26.9	15.1	429.0
22-94 Crit	59.4	16.4	15.1	12.8	21.4	23.9	23.0	24.5	7.8	11.0	13.1	4.2	165.4
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	233.6	217.3	316.3	361.4	316.9	311.4	142.0	91.3	189.0	260.4	276.3	268.8	2,984.7
22-94 Wet	256.5	281.1	361.5	392.8	354.1	386.0	191.5	131.1	289.2	266.0	333.6	357.6	3,601.1
22-94 AN	247.4	255.3	344.8	446.0	389.5	392.1	181.3	118.3	223.0	307.2	294.0	300.3	3,499.4
22-94 BN	234.9	234.2	322.3	380.3	346.4	341.8	151.6	86.1	201.3	345.0	345.7	263.4	3,253.1
22-94 Dry	221.8	169.0	299.0	312.4	291.6	264.9	107.0	64.8	131.1	296.9	253.0	235.1	2,646.7
22-94 Crit	196.2	118.6	229.6	279.0	190.5	139.9	58.3	40.7	47.8	64.2	111.6	138.0	1,614.4
STDEV													
22-94 Avg	102.2	125.8	106.2	113.6	132.7	137.3	62.6	63.8	112.6	144.2	137.8	99.4	854.2
22-94 Wet	100.3	117.5	93.3	106.2	91.8	66.9	51.6	78.7	106.8	134.8	107.6	63.3	642.2
22-94 AN	120.7	132.4	82.6	45.8	83.4	70.3	29.9	57.5	72.7	123.5	115.1	62.3	316.0
22-94 BN	86.8	115.8	108.1	104.5	150.8	127.1	38.6	52.1	54.7	77.7	56.3	45.8	239.7
22-94 Dry	107.2	116.6	98.5	101.8	128.0	128.5	36.0	31.1	59.1	98.8	138.8	62.7	363.9
22-94 Crit	103.5	79.5	110.0	124.3	134.7	128.8	30.7	23.9	50.6	122.7	139.2	100.2	650.9
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.9
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	1.0
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	1.0

22-94 BN	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.0
22-94 Dry	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	1.0
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.7
STDEV													
22-94 Avg	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 Wet	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 AN	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.5
22-94 BN	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.4
22-94 Dry	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.5
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	3.6	3.0	2.8	2.0	2.1	2.5	3.2	3.5	3.6	3.7	3.7	3.6	37.2
22-94 Wet	4.0	3.3	3.1	2.8	2.7	3.0	3.5	3.8	3.9	4.1	4.0	3.9	42.4
22-94 AN	3.5	2.8	2.7	2.1	2.5	3.1	3.6	3.9	4.0	4.1	4.1	4.0	42.5
22-94 BN	3.9	3.2	3.1	1.8	2.0	2.7	3.5	4.0	4.1	4.3	4.2	4.1	41.9
22-94 Dry	3.3	2.7	2.5	1.9	1.9	2.4	3.2	3.5	3.6	3.8	3.7	3.6	36.3
22-94 Crit	3.3	2.7	2.6	1.1	1.2	1.4	1.8	1.9	2.0	2.0	2.0	2.0	19.2
STDEV													
22-94 Avg	0.9	0.8	0.7	1.1	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.9	9.4
22-94 Wet	0.3	0.2	0.3	0.6	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.8
22-94 AN	1.3	1.0	1.0	1.2	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.8
22-94 BN	0.5	0.4	0.4	1.3	0.9	0.7	0.5	0.3	0.3	0.3	0.3	0.3	2.4
22-94 Dry	1.2	1.0	0.9	1.0	0.8	0.7	0.6	0.6	0.6	0.7	0.7	0.6	6.0
22-94 Crit	1.1	0.9	0.9	1.0	0.8	0.9	1.0	1.0	1.1	1.1	1.1	1.1	8.1
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	197.9	175.2	165.7	87.7	118.9	151.9	191.5	261.2	334.0	352.9	342.9	249.9	2,616.7
22-94 Wet	209.0	185.1	174.8	119.3	148.7	174.8	202.0	270.9	347.6	368.8	358.3	255.5	2,831.1
22-94 AN	207.0	183.3	173.2	93.9	147.1	193.8	233.3	311.2	399.6	420.7	409.5	298.8	3,155.0
22-94 BN	219.4	194.4	186.0	81.1	113.8	165.3	221.5	317.4	406.6	428.4	416.4	305.2	3,120.3
22-94 Dry	170.8	151.1	142.1	79.7	106.3	136.8	192.7	262.2	335.3	352.7	342.6	252.4	2,546.9
22-94 Crit	181.9	161.0	151.5	45.6	65.8	81.6	101.7	135.7	169.0	180.9	175.0	131.8	1,298.3

STDEV													
22-94 Avg	60.6	53.8	51.8	51.7	52.4	54.8	59.3	79.9	102.5	108.0	105.6	77.4	772.5
22-94 Wet	30.2	27.0	25.7	28.3	24.2	23.2	28.8	40.9	52.4	54.7	54.4	43.1	393.0
22-94 AN	82.1	72.8	69.0	55.3	36.1	22.8	26.5	37.6	44.1	46.3	45.2	39.9	352.3
22-94 BN	49.4	43.7	45.7	62.9	58.6	51.2	41.9	29.0	34.1	35.9	35.2	30.1	233.1
22-94 Dry	69.6	61.7	58.2	43.7	50.0	45.6	45.5	61.4	80.8	83.7	82.4	58.9	546.0
22-94 Crit	71.6	63.6	60.3	47.0	51.1	61.4	65.6	88.1	106.0	117.5	114.2	86.1	689.8
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	3.6	5.4	23.7	45.3	68.6	91.8	11.1	3.9	0.3	0.0	0.0	1.7	255.5
22-94 Wet	4.3	7.4	47.3	75.4	118.2	150.6	30.3	13.6	1.1	0.0	0.0	6.0	537.8
22-94 AN	0.0	0.0	0.0	25.4	63.2	141.8	7.3	0.0	0.0	0.0	0.0	0.0	280.6
22-94 BN	11.1	10.4	26.3	49.7	65.3	82.2	7.4	0.0	0.0	0.0	0.0	0.0	161.1
22-94 Dry	0.1	0.8	11.5	33.0	40.7	49.0	0.0	0.0	0.0	0.0	0.0	0.0	100.4
22-94 Crit	1.5	6.5	15.3	20.5	27.4	15.3	0.0	0.0	0.0	0.0	0.0	0.0	57.7
STDEV													
22-94 Avg	15.7	19.4	57.3	73.2	76.8	80.8	24.3	16.4	1.9	0.0	0.0	10.6	274.2
22-94 Wet	17.1	23.5	68.9	87.8	66.2	51.0	35.6	28.9	3.6	0.0	0.0	19.5	307.5
22-94 AN	0.0	0.0	0.0	41.3	72.4	38.5	8.5	0.0	0.0	0.0	0.0	0.0	181.8
22-94 BN	28.3	26.8	66.8	75.9	84.1	87.8	19.3	0.1	0.0	0.0	0.0	0.0	138.5
22-94 Dry	0.4	3.1	46.0	71.0	68.3	70.6	0.0	0.0	0.0	0.0	0.0	0.0	104.8
22-94 Crit	5.3	22.5	53.1	54.5	63.0	53.1	0.0	0.0	0.0	0.0	0.0	0.0	116.7
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	2,082.3	2,136.0	2,240.0	2,375.6	2,534.6	2,693.2	2,948.0	3,061.2	2,899.6	2,504.8	2,218.1	2,117.7	
22-94 Wet	2,304.6	2,417.2	2,645.4	2,768.9	2,869.2	2,899.3	3,249.8	3,442.0	3,406.1	3,143.7	3,011.5	2,961.9	
22-94 AN	2,019.7	2,103.6	2,197.9	2,465.7	2,681.7	2,905.9	3,265.0	3,392.0	3,228.1	2,752.6	2,437.9	2,376.4	
22-94 BN	2,177.5	2,189.7	2,225.4	2,362.7	2,562.2	2,758.4	3,118.6	3,310.9	3,079.4	2,557.7	2,114.9	1,989.9	
22-94 Dry	1,965.8	2,010.8	2,085.2	2,191.0	2,417.2	2,688.3	2,854.1	2,896.4	2,642.9	2,163.7	1,793.9	1,643.3	
22-94 Crit	1,789.7	1,774.8	1,789.2	1,873.2	1,950.5	2,085.6	2,081.6	2,047.5	1,872.0	1,573.2	1,332.8	1,206.3	
STDEV													
22-94 Avg	340.6	340.1	333.9	277.6	239.3	213.6	208.4	210.4	251.7	294.2	293.6	325.6	
22-94 Wet	413.4	366.5	278.3	124.5	49.5	16.4	59.0	150.1	230.2	366.3	372.3	386.8	

22-94 AN	239.2	276.5	287.0	201.1	84.0	49.7	65.2	117.3	137.0	226.9	201.5	245.8	
22-94 BN	330.3	356.1	399.4	308.4	206.1	151.2	115.9	122.0	119.2	139.2	167.8	155.5	
22-94 Dry	321.3	305.3	270.2	245.1	224.0	158.2	156.4	164.6	201.2	203.2	172.6	185.0	
22-94 Crit	300.7	297.2	308.8	329.2	326.6	285.4	266.1	239.4	200.3	157.4	119.1	107.1	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	425.2	454.5	565.0	770.3	883.6	933.6	842.6	656.6	507.4	412.2	349.7	372.5	
22-94 Wet	530.4	608.6	750.1	944.0	1,018.7	1,061.0	990.2	822.5	752.6	645.8	601.3	685.7	
22-94 AN	317.5	377.6	526.8	822.0	983.6	1,033.2	954.7	757.2	566.5	461.3	362.5	382.5	
22-94 BN	421.5	445.7	539.9	748.1	897.0	975.9	861.0	620.6	396.7	313.4	255.1	227.4	
22-94 Dry	429.3	440.5	558.3	729.3	851.6	905.2	785.4	570.5	369.3	308.3	239.1	226.1	
22-94 Crit	329.7	277.9	311.0	504.0	590.7	616.1	545.5	439.4	342.5	216.3	156.3	180.5	
STDEV													
22-94 Avg	340.6	340.1	333.9	277.6	239.3	213.6	208.4	210.4	251.7	294.2	293.6	325.6	
22-94 Wet	413.4	366.5	278.3	124.5	49.5	16.4	59.0	150.1	230.2	366.3	372.3	386.8	
22-94 AN	239.2	276.5	287.0	201.1	84.0	49.7	65.2	117.3	137.0	226.9	201.5	245.8	
22-94 BN	330.3	356.1	399.4	308.4	206.1	151.2	115.9	122.0	119.2	139.2	167.8	155.5	
22-94 Dry	321.3	305.3	270.2	245.1	224.0	158.2	156.4	164.6	201.2	203.2	172.6	185.0	
22-94 Crit	300.7	297.2	308.8	329.2	326.6	285.4	266.1	239.4	200.3	157.4	119.1	107.1	

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	152.5	133.4	240.0	317.3	342.1	401.1	191.9	221.5	261.0	370.8	280.6	109.2	3,021.4
22-94 Wet	178.5	184.3	457.9	689.8	694.1	778.8	413.2	454.6	316.8	310.1	180.3	94.8	4,753.1
22-94 AN	150.3	128.5	198.1	335.8	416.2	575.2	140.5	260.5	252.2	459.0	319.3	76.5	3,312.0
22-94 BN	160.2	114.4	166.9	195.8	229.9	208.3	80.7	94.6	295.6	474.3	417.6	96.1	2,534.4
22-94 Dry	122.3	95.4	127.4	99.5	111.2	183.4	111.3	98.6	238.2	404.9	326.4	132.4	2,051.0
22-94 Crit	140.4	121.0	128.7	82.1	103.3	110.2	84.5	92.8	160.6	237.6	203.2	146.3	1,610.7
STDEV													
22-94 Avg	69.2	111.8	282.9	408.8	345.9	429.1	225.7	260.0	116.2	142.5	153.9	67.7	1,426.3
22-94 Wet	80.9	189.2	427.9	554.2	342.7	515.3	308.5	324.0	145.3	121.5	152.0	66.8	1,132.7
22-94 AN	45.7	60.8	221.1	312.8	357.3	444.6	109.6	305.2	114.0	106.3	125.5	43.3	791.2
22-94 BN	77.1	43.6	87.9	174.6	223.2	145.6	56.6	41.8	94.0	84.2	69.6	44.7	557.3
22-94 Dry	52.4	33.0	63.1	51.3	62.8	117.1	86.4	62.3	64.1	103.0	136.4	75.2	426.3
22-94 Crit	63.8	48.6	73.3	48.1	60.6	91.3	53.4	47.5	63.6	158.8	122.7	79.9	459.3
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	750.4	934.0	1,545.2	2,017.9	2,210.8	2,099.7	1,449.0	1,194.7	1,045.9	1,124.0	909.6	784.2	16,065.4
22-94 Wet	895.1	1,316.4	2,913.2	3,446.9	3,419.6	3,217.0	2,505.6	2,022.7	1,466.3	1,198.0	960.6	1,062.3	24,423.7
22-94 AN	704.6	1,014.2	1,324.4	2,783.9	2,976.9	3,079.7	1,735.2	1,387.6	1,087.4	1,275.8	979.4	779.8	19,128.7
22-94 BN	740.9	774.1	1,115.1	1,546.6	1,993.0	1,599.8	1,102.7	966.3	1,016.3	1,217.8	1,016.2	715.1	13,803.9
22-94 Dry	668.7	774.6	903.0	958.4	1,337.2	1,418.1	828.8	732.6	812.4	1,111.4	887.5	692.9	11,125.6
22-94 Crit	655.5	597.2	693.4	841.1	875.6	819.5	592.5	467.5	621.5	775.5	667.5	503.7	8,110.6
STDEV													
22-94 Avg	258.6	644.8	1,258.6	1,438.9	1,298.3	1,267.4	1,096.3	803.3	488.5	198.6	161.7	243.9	6,796.9
22-94 Wet	367.6	920.7	1,266.3	1,329.0	1,025.9	1,211.8	1,283.1	910.5	636.7	92.0	101.8	231.8	4,662.4
22-94 AN	151.6	693.0	1,180.7	1,443.6	938.7	960.6	916.0	602.5	441.1	74.7	63.7	46.8	2,573.3
22-94 BN	179.3	189.2	887.5	685.3	944.4	456.5	577.0	300.2	155.8	90.7	81.2	48.8	1,319.6
22-94 Dry	170.2	420.6	263.8	261.7	753.2	697.5	219.9	91.3	103.6	121.4	134.9	85.0	927.8
22-94 Crit	185.2	158.4	205.8	358.7	364.7	376.4	92.9	68.2	81.7	181.9	166.8	159.6	1,128.2
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	186.1	118.8	185.4	272.7	353.3	387.0	361.5	336.2	248.6	140.7	103.2	112.6	2,805.9
22-94 Wet	255.3	160.4	319.6	531.0	623.5	750.6	628.6	597.0	521.0	227.1	133.9	154.4	4,902.5
22-94 AN	135.7	113.8	162.3	324.2	433.7	455.9	402.9	364.9	276.0	140.1	119.0	124.1	3,052.6
22-94 BN	190.2	108.7	165.1	192.9	343.4	299.0	325.0	293.5	134.0	119.1	112.3	108.9	2,392.0
22-94 Dry	165.0	97.5	112.3	110.4	147.3	154.3	197.5	183.3	103.6	98.9	82.0	87.5	1,539.6
22-94 Crit	130.3	90.1	91.0	87.1	99.5	105.9	121.0	109.7	75.9	70.7	53.8	67.6	1,102.7
STDEV													
22-94 Avg	148.5	96.9	223.1	300.1	354.3	425.3	277.6	276.3	338.8	131.4	33.2	48.3	2,166.7
22-94 Wet	217.2	171.4	364.6	406.5	459.9	608.1	351.5	367.2	516.7	220.0	11.8	65.0	2,853.8
22-94 AN	59.2	45.3	143.6	264.7	341.0	202.2	146.8	124.7	227.5	39.6	9.7	24.5	1,056.0
22-94 BN	117.2	25.2	104.5	117.2	214.4	187.2	106.6	106.6	29.1	17.0	15.3	11.5	693.6
22-94 Dry	122.4	16.3	30.5	35.2	85.8	59.0	69.0	61.2	17.1	18.7	26.8	15.2	428.9
22-94 Crit	59.4	16.2	15.1	12.8	21.4	23.9	23.0	24.5	7.8	10.9	13.1	4.2	165.1
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	231.3	215.1	313.7	358.4	319.1	312.2	141.7	87.7	192.2	253.5	275.8	268.2	2,969.0
22-94 Wet	251.8	276.6	359.3	389.8	361.4	383.1	190.9	129.9	295.9	256.3	342.4	356.5	3,593.7
22-94 AN	242.5	251.7	350.7	448.2	389.6	400.7	180.8	110.2	217.4	303.4	297.4	303.5	3,496.0
22-94 BN	230.4	233.7	316.9	373.0	345.1	337.7	151.6	86.1	209.7	332.3	342.6	256.9	3,216.0
22-94 Dry	222.8	168.0	294.9	309.8	292.0	272.3	106.7	58.3	126.7	292.3	245.2	238.1	2,627.0
22-94 Crit	198.8	117.8	224.7	276.5	192.5	138.2	58.5	36.3	56.3	63.5	104.0	137.3	1,604.3
STDEV													
22-94 Avg	102.6	127.0	106.0	114.0	133.2	136.7	62.3	63.2	110.1	142.8	138.2	99.9	844.9
22-94 Wet	101.9	122.8	94.6	107.8	94.1	72.5	51.4	78.4	91.5	132.5	98.4	64.8	601.6
22-94 AN	119.1	137.1	76.0	46.5	82.8	59.2	28.9	54.6	74.8	127.0	116.4	62.9	294.9
22-94 BN	84.8	112.9	107.2	100.8	150.0	125.9	38.6	52.1	59.7	86.4	55.6	47.2	235.1
22-94 Dry	112.4	117.3	103.1	101.3	127.5	124.5	36.0	27.8	59.4	96.7	133.9	67.1	375.3
22-94 Crit	102.6	80.9	100.5	126.3	135.2	131.0	30.8	16.5	50.8	122.5	142.1	97.3	640.0
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	1.0
22-94 Wet	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	1.0
22-94 AN	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	1.0

22-94 BN	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.0
22-94 Dry	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	1.0
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.8
STDEV													
22-94 Avg	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 Wet	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
22-94 AN	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.2	0.2	0.1	0.5
22-94 BN	0.2	0.1	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.4
22-94 Dry	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.5
22-94 Crit	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	4.0	3.3	3.1	2.3	2.4	2.8	3.5	3.9	4.0	4.1	4.1	4.0	41.3
22-94 Wet	4.4	3.6	3.4	3.2	3.0	3.3	3.9	4.2	4.3	4.5	4.4	4.3	46.6
22-94 AN	3.8	3.1	3.0	2.4	2.8	3.4	4.0	4.3	4.4	4.5	4.5	4.4	46.7
22-94 BN	4.3	3.5	3.4	2.0	2.2	3.0	3.9	4.4	4.5	4.7	4.6	4.5	46.2
22-94 Dry	3.7	3.0	2.8	2.1	2.2	2.7	3.6	4.0	4.1	4.2	4.2	4.0	40.8
22-94 Crit	3.7	3.0	2.9	1.2	1.4	1.6	2.0	2.2	2.3	2.4	2.3	2.3	22.2
STDEV													
22-94 Avg	1.0	0.8	0.8	1.2	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.9	9.9
22-94 Wet	0.2	0.2	0.2	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
22-94 AN	1.4	1.1	1.1	1.3	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.0
22-94 BN	0.5	0.4	0.4	1.4	1.0	0.8	0.6	0.3	0.3	0.3	0.3	0.3	2.6
22-94 Dry	1.2	1.0	1.0	1.1	0.9	0.8	0.6	0.6	0.6	0.7	0.7	0.6	6.0
22-94 Crit	1.2	1.0	0.9	1.1	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.1	8.6
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	198.2	174.3	164.3	89.1	119.4	151.9	189.9	257.2	327.3	345.3	334.9	246.5	2,585.0
22-94 Wet	208.8	183.6	173.2	120.5	148.1	173.1	200.0	265.5	338.2	359.2	347.9	250.2	2,784.0
22-94 AN	205.6	180.9	170.7	95.0	147.0	192.6	229.5	303.8	387.5	408.4	396.5	292.3	3,094.0
22-94 BN	218.7	192.5	181.8	83.2	115.3	166.3	219.4	312.5	398.0	419.3	407.1	301.0	3,080.9
22-94 Dry	173.3	152.4	143.2	81.4	107.2	137.6	191.1	258.7	329.0	345.7	335.5	249.7	2,523.5
22-94 Crit	182.7	160.7	151.0	46.6	67.1	83.1	103.4	137.2	173.1	181.2	175.5	133.7	1,315.9

STDEV													
22-94 Avg	59.4	52.4	49.8	51.2	51.6	54.2	57.7	77.2	99.1	104.0	101.3	75.1	749.4
22-94 Wet	30.7	27.4	26.4	24.7	21.9	23.5	29.1	39.8	51.1	53.3	52.2	42.6	389.0
22-94 AN	82.4	72.6	68.8	55.1	35.7	22.5	25.2	37.2	43.9	46.0	44.7	39.3	347.7
22-94 BN	48.0	42.5	40.5	62.3	57.3	50.3	41.5	29.9	34.4	36.3	35.8	31.5	240.3
22-94 Dry	68.3	60.1	56.9	44.8	50.2	46.3	43.4	58.9	77.8	80.2	78.7	56.4	531.1
22-94 Crit	68.9	60.8	57.7	47.4	52.0	61.9	64.9	86.8	111.6	115.0	111.9	84.9	680.1
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	5.8	6.4	24.9	47.9	70.0	93.6	11.6	4.1	0.7	0.0	0.1	2.0	267.2
22-94 Wet	6.9	10.8	51.7	74.6	114.4	150.8	31.1	14.4	2.5	0.0	0.3	7.1	570.4
22-94 AN	0.0	0.0	0.0	26.8	73.5	144.1	9.1	0.0	0.0	0.0	0.0	0.0	305.4
22-94 BN	11.1	10.2	26.2	65.2	67.3	83.7	7.3	0.0	0.0	0.0	0.0	0.0	157.2
22-94 Dry	3.2	1.4	11.5	32.7	43.9	54.3	0.0	0.0	0.0	0.0	0.0	0.0	99.7
22-94 Crit	5.9	6.5	15.3	18.7	27.4	15.3	0.0	0.0	0.0	0.0	0.0	0.0	56.7
STDEV													
22-94 Avg	19.7	20.8	58.8	75.7	76.9	79.7	24.5	17.3	4.1	0.0	0.7	12.2	287.0
22-94 Wet	21.9	27.1	71.7	90.0	68.8	50.9	36.2	30.4	7.4	0.0	1.3	22.4	310.4
22-94 AN	0.0	0.0	0.0	46.7	73.5	36.9	10.4	0.0	0.0	0.0	0.0	0.0	200.3
22-94 BN	28.3	26.1	66.7	82.3	86.3	86.1	17.7	0.0	0.0	0.0	0.0	0.0	135.8
22-94 Dry	12.7	5.7	46.0	70.5	67.5	69.6	0.0	0.0	0.0	0.0	0.0	0.0	103.8
22-94 Crit	20.5	22.5	53.1	53.3	62.7	53.1	0.0	0.0	0.0	0.0	0.0	0.0	116.0
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	2,112.6	2,167.8	2,271.6	2,407.6	2,568.5	2,720.1	2,975.0	3,088.8	2,921.8	2,532.0	2,247.8	2,146.8	
22-94 Wet	2,349.1	2,461.2	2,680.0	2,808.9	2,923.2	2,953.7	3,303.0	3,495.5	3,446.2	3,189.2	3,048.2	2,996.9	
22-94 AN	2,034.2	2,118.3	2,218.6	2,478.2	2,694.2	2,909.0	3,268.1	3,401.5	3,243.3	2,771.1	2,454.1	2,391.1	
22-94 BN	2,192.0	2,210.9	2,253.5	2,390.9	2,583.2	2,778.1	3,138.2	3,328.7	3,088.3	2,579.0	2,146.9	2,028.8	
22-94 Dry	2,019.0	2,064.8	2,139.3	2,245.1	2,466.5	2,711.9	2,880.1	2,921.4	2,671.9	2,196.8	1,831.9	1,674.7	
22-94 Crit	1,796.2	1,782.8	1,798.5	1,882.5	1,962.1	2,097.2	2,093.0	2,060.0	1,875.4	1,574.5	1,347.4	1,222.5	
STDEV													
22-94 Avg	347.2	346.9	337.4	274.0	240.9	210.9	205.7	210.6	256.4	300.0	298.3	329.6	
22-94 Wet	424.1	370.8	279.0	119.5	46.1	14.3	57.7	149.7	224.8	364.9	353.2	361.3	

22-94 AN	254.8	287.3	282.8	197.6	75.4	38.6	67.5	118.8	144.6	242.8	219.7	267.3	
22-94 BN	334.9	374.0	420.0	304.6	206.4	154.5	118.8	126.0	119.4	137.8	171.7	165.5	
22-94 Dry	326.7	316.1	282.3	253.7	241.9	161.6	158.8	173.6	204.9	207.3	174.3	182.1	
22-94 Crit	306.1	301.8	307.2	324.4	327.5	279.2	256.8	227.9	204.2	157.5	111.2	91.6	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	438.5	464.9	574.5	774.3	887.2	936.6	845.6	660.0	518.7	423.4	365.5	389.6	
22-94 Wet	530.6	607.4	747.2	939.1	1,020.4	1,062.5	992.7	825.6	771.3	664.3	633.7	719.9	
22-94 AN	325.1	383.7	542.5	837.2	988.9	1,039.3	956.6	762.4	581.2	484.0	401.0	428.7	
22-94 BN	457.2	477.1	569.8	756.1	902.4	975.4	862.0	627.3	420.2	332.1	278.7	242.9	
22-94 Dry	439.9	446.8	559.4	727.2	849.0	905.8	786.9	570.3	370.3	308.5	236.0	225.8	
22-94 Crit	348.2	293.1	324.5	517.8	602.6	626.7	554.6	442.9	337.6	211.1	140.9	168.7	
STDEV													
22-94 Avg	347.2	346.9	337.4	274.0	240.9	210.9	205.7	210.6	256.4	300.0	298.3	329.6	
22-94 Wet	424.1	370.8	279.0	119.5	46.1	14.3	57.7	149.7	224.8	364.9	353.2	361.3	
22-94 AN	254.8	287.3	282.8	197.6	75.4	38.6	67.5	118.8	144.6	242.8	219.7	267.3	
22-94 BN	334.9	374.0	420.0	304.6	206.4	154.5	118.8	126.0	119.4	137.8	171.7	165.5	
22-94 Dry	326.7	316.1	282.3	253.7	241.9	161.6	158.8	173.6	204.9	207.3	174.3	182.1	
22-94 Crit	306.1	301.8	307.2	324.4	327.5	279.2	256.8	227.9	204.2	157.5	111.2	91.6	

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	152.8	129.5	224.6	286.3	318.3	372.0	190.0	221.1	278.9	426.2	293.9	120.6	3,014.2
22-94 Wet	173.5	175.3	397.5	630.1	654.4	739.7	413.4	456.5	334.5	438.9	232.0	98.2	4,743.9
22-94 AN	150.8	104.0	211.7	290.4	395.0	556.5	150.6	273.9	264.1	516.5	359.2	102.9	3,375.6
22-94 BN	156.5	117.2	147.6	163.1	214.7	189.1	78.0	99.2	330.2	511.7	411.0	146.5	2,564.9
22-94 Dry	137.8	102.7	140.7	93.3	90.3	137.3	100.9	89.8	253.6	414.3	314.6	131.0	2,006.4
22-94 Crit	133.9	120.9	134.5	82.1	91.2	101.0	81.3	82.4	167.9	244.8	183.5	130.4	1,553.9
STDEV													
22-94 Avg	70.2	106.2	254.0	404.3	335.1	401.0	225.9	262.4	120.4	149.1	156.9	77.1	1,457.8
22-94 Wet	76.7	185.5	390.5	582.0	346.4	463.5	308.7	322.9	141.3	130.6	166.8	83.3	1,181.3
22-94 AN	61.1	28.0	218.0	291.3	333.0	399.2	104.9	311.5	120.9	89.0	113.3	57.3	839.8
22-94 BN	80.4	37.4	82.0	172.4	212.6	141.8	54.9	55.7	97.3	75.7	101.9	80.2	605.8
22-94 Dry	62.1	38.6	73.1	43.2	41.1	82.3	80.2	47.3	72.1	133.5	151.8	82.7	458.9
22-94 Crit	63.8	32.5	84.9	48.1	61.6	80.9	47.7	40.7	67.5	154.5	117.3	65.8	428.8
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	753.4	923.2	1,530.2	2,012.1	2,189.3	2,103.8	1,462.2	1,176.6	1,036.2	1,126.6	880.7	766.4	15,960.5
22-94 Wet	901.4	1,293.8	2,830.3	3,426.5	3,401.0	3,229.0	2,528.6	1,993.1	1,404.3	1,241.4	950.4	1,003.7	24,203.6
22-94 AN	719.2	957.0	1,343.0	2,744.7	2,962.3	3,103.4	1,745.6	1,365.7	1,090.3	1,300.4	977.2	786.6	19,095.4
22-94 BN	723.3	795.0	1,097.5	1,518.3	1,970.3	1,616.0	1,103.7	940.6	1,048.4	1,208.6	975.6	750.4	13,747.8
22-94 Dry	680.7	774.0	931.1	978.7	1,298.8	1,384.7	841.3	722.9	817.4	1,073.7	836.6	671.5	11,011.4
22-94 Crit	654.7	595.0	714.5	880.1	867.3	829.4	605.8	470.0	624.4	755.5	626.7	479.4	8,102.8
STDEV													
22-94 Avg	233.1	618.8	1,213.5	1,430.7	1,301.6	1,273.5	1,096.9	784.6	461.0	218.0	181.1	226.4	6,725.7
22-94 Wet	309.6	897.6	1,259.7	1,355.5	1,039.1	1,219.6	1,276.1	880.6	607.9	129.7	104.4	203.8	4,570.7
22-94 AN	143.0	624.6	1,161.3	1,461.9	962.9	957.5	919.2	601.9	431.4	88.8	79.2	61.3	2,592.6
22-94 BN	159.0	196.2	806.8	663.0	931.9	447.8	570.1	276.1	147.4	82.5	109.8	85.2	1,389.2
22-94 Dry	159.2	403.9	255.8	246.7	731.3	676.6	204.7	83.2	103.0	116.8	181.6	102.5	881.9
22-94 Crit	194.3	141.4	216.9	370.8	380.4	384.3	116.2	60.5	102.0	178.2	167.9	151.2	1,178.4
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	177.4	118.6	185.2	272.8	353.8	387.0	362.7	342.5	249.3	140.4	104.2	111.3	2,805.2
22-94 Wet	240.7	160.3	319.0	532.8	626.5	752.8	635.5	617.5	527.2	227.0	134.9	150.4	4,924.4
22-94 AN	134.3	113.7	162.7	323.1	433.0	453.7	400.4	365.6	271.2	140.0	119.8	121.4	3,038.8
22-94 BN	181.7	108.7	165.0	191.9	343.5	299.3	324.8	299.3	133.6	119.0	112.7	109.3	2,388.7
22-94 Dry	157.0	97.4	112.1	110.2	146.5	153.4	196.2	180.6	102.4	98.1	83.5	87.9	1,525.3
22-94 Crit	124.4	89.7	91.0	87.1	99.3	105.3	120.2	108.4	75.3	70.9	54.8	68.2	1,094.5
STDEV													
22-94 Avg	136.7	96.8	223.0	300.0	355.7	427.0	282.4	288.1	338.4	131.0	32.9	44.2	2,176.5
22-94 Wet	205.1	171.2	364.4	405.4	461.7	610.2	359.0	377.4	516.4	219.3	11.9	58.2	2,856.2
22-94 AN	42.8	44.8	144.6	262.1	341.8	202.9	146.2	142.0	203.8	39.7	9.9	18.6	1,060.5
22-94 BN	103.9	24.8	104.1	117.0	213.2	189.2	107.4	121.0	29.7	16.8	15.1	12.0	699.4
22-94 Dry	109.8	16.4	30.6	35.2	85.7	58.9	68.8	59.7	16.7	18.4	26.3	15.2	415.5
22-94 Crit	45.7	16.6	15.1	12.8	21.3	23.8	22.9	24.5	7.9	10.9	12.5	4.1	150.4
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	258.3	228.8	344.2	375.3	323.3	331.9	149.9	105.3	208.3	291.6	274.9	273.3	3,165.1
22-94 Wet	316.3	314.1	410.3	439.7	379.0	422.4	213.7	177.1	316.8	337.5	345.8	375.8	4,048.6
22-94 AN	257.9	241.5	375.5	439.9	392.1	432.0	184.6	114.7	246.5	350.4	329.1	307.6	3,671.8
22-94 BN	261.2	233.8	335.6	395.2	356.1	357.7	151.8	93.2	224.3	359.3	342.7	278.8	3,389.8
22-94 Dry	222.8	176.3	318.0	326.2	270.5	268.0	111.0	68.1	137.6	297.4	231.3	228.7	2,655.9
22-94 Crit	201.3	133.2	247.6	250.7	200.5	145.2	58.8	35.4	61.9	75.9	84.6	118.5	1,613.4
STDEV													
22-94 Avg	107.3	122.0	99.4	113.0	135.0	140.7	69.4	79.4	118.0	140.3	153.8	105.0	956.1
22-94 Wet	87.0	85.9	34.8	64.5	110.6	51.6	55.2	93.7	92.3	94.5	111.7	38.1	397.7
22-94 AN	109.7	146.7	50.3	70.3	72.2	36.1	38.0	56.9	86.7	89.1	103.4	56.1	317.4
22-94 BN	107.8	100.1	111.4	105.8	152.8	117.2	38.6	48.9	58.5	71.6	100.2	67.8	368.9
22-94 Dry	111.1	114.6	94.7	103.2	113.9	128.5	33.6	38.5	64.3	124.7	154.0	64.2	438.0
22-94 Crit	96.8	92.5	114.1	107.7	124.3	124.2	36.9	19.8	70.8	122.4	136.9	75.8	631.5
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	2.4	0.3	0.0	0.0	0.0	0.5	1.9	2.0	1.9	2.5	2.8	3.1	17.4
22-94 Wet	2.3	0.1	0.0	0.0	0.0	0.4	2.5	2.7	2.6	2.5	2.8	3.3	20.5
22-94 AN	2.2	0.5	0.0	0.0	0.0	0.1	2.3	2.5	2.3	3.6	3.5	3.6	20.4

22-94 BN	3.2	0.4	0.0	0.0	0.0	0.8	2.1	2.2	1.9	2.6	3.4	4.2	20.5
22-94 Dry	2.5	0.5	0.0	0.0	0.1	0.5	1.5	1.7	1.7	2.6	2.8	2.8	15.8
22-94 Crit	2.0	0.5	0.0	0.0	0.1	0.7	0.6	0.5	0.8	1.5	1.5	1.3	8.0
STDEV													
22-94 Avg	1.5	0.6	0.0	0.0	0.1	0.9	1.2	1.1	1.0	1.6	1.7	1.6	6.5
22-94 Wet	1.7	0.2	0.0	0.0	0.0	0.9	1.0	0.8	1.0	1.5	1.5	1.5	3.2
22-94 AN	1.3	0.9	0.0	0.0	0.0	0.3	1.5	1.1	0.7	2.0	2.3	1.6	5.2
22-94 BN	1.5	0.8	0.0	0.0	0.0	1.3	0.9	0.9	0.5	1.6	1.9	1.7	5.4
22-94 Dry	1.8	0.8	0.0	0.0	0.2	0.8	0.9	1.1	0.9	1.5	1.5	1.3	5.2
22-94 Crit	0.9	0.4	0.0	0.0	0.2	0.9	0.8	0.5	0.7	1.0	0.9	0.8	5.0
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	6.0	5.0	5.1	2.8	3.2	3.9	5.1	5.6	5.8	6.0	6.0	5.8	59.9
22-94 Wet	6.9	5.8	6.0	4.3	4.7	5.3	6.4	6.9	7.1	7.4	7.4	7.1	76.7
22-94 AN	5.8	4.8	4.8	2.9	3.9	5.1	6.5	7.0	7.1	7.4	7.4	7.2	75.4
22-94 BN	6.6	5.5	5.7	2.6	2.9	4.1	5.7	6.5	6.7	6.9	6.9	6.7	67.3
22-94 Dry	5.1	4.3	4.3	2.1	2.3	2.9	4.4	4.9	5.0	5.1	5.1	4.9	49.7
22-94 Crit	5.1	4.2	4.3	1.2	1.4	1.7	2.1	2.2	2.3	2.4	2.4	2.3	22.7
STDEV													
22-94 Avg	2.2	1.9	2.0	1.9	1.7	1.7	1.9	2.0	2.0	2.1	2.1	2.1	21.6
22-94 Wet	1.2	1.1	1.3	1.5	0.9	0.4	0.5	0.5	0.6	0.6	0.6	0.6	6.3
22-94 AN	2.5	2.1	2.1	1.6	1.1	0.5	0.6	0.6	0.7	0.7	0.7	0.7	8.4
22-94 BN	1.9	1.6	1.8	2.2	1.7	1.4	1.2	0.7	0.7	0.8	0.8	0.7	7.1
22-94 Dry	2.7	2.3	2.3	1.2	1.2	1.1	1.4	1.4	1.4	1.5	1.5	1.4	13.4
22-94 Crit	2.3	1.9	2.1	1.4	1.1	1.3	1.4	1.5	1.5	1.6	1.6	1.5	11.9
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	238.4	211.1	202.9	95.0	133.8	173.3	215.9	288.3	351.5	375.1	361.5	280.5	2,912.8
22-94 Wet	273.2	238.8	235.0	147.1	197.7	234.6	267.2	350.1	425.2	453.4	434.9	340.1	3,650.1
22-94 AN	231.0	206.0	193.9	97.4	165.9	228.1	275.1	356.5	437.0	464.0	448.9	345.3	3,635.7
22-94 BN	261.1	233.3	223.4	89.2	123.4	180.8	239.3	336.4	414.1	439.1	424.2	327.7	3,326.6
22-94 Dry	203.7	181.6	171.5	70.1	96.9	128.0	187.3	252.7	307.9	329.7	318.4	246.7	2,478.4
22-94 Crit	203.6	180.0	172.0	41.7	56.6	72.0	87.8	114.8	136.4	149.8	144.8	112.1	1,116.7

STDEV													
22-94 Avg	84.7	76.2	75.0	65.5	72.6	75.3	80.4	102.9	126.4	133.4	128.8	99.7	1,039.4
22-94 Wet	44.3	41.5	45.7	51.5	38.6	18.4	21.9	30.8	37.8	39.4	40.8	29.1	289.3
22-94 AN	98.5	88.7	84.2	56.3	45.4	24.8	27.2	34.2	41.8	44.4	43.8	30.8	358.8
22-94 BN	72.0	65.9	65.3	75.9	74.5	63.3	52.6	38.4	47.2	49.7	48.8	36.8	351.7
22-94 Dry	105.3	94.8	89.8	40.7	52.8	50.2	63.3	79.5	100.2	103.2	100.2	77.9	716.1
22-94 Crit	90.4	81.2	78.5	48.5	49.5	60.5	64.0	84.0	95.0	109.7	106.4	82.4	666.1
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.0	0.0	2.0	17.4	33.9	60.6	6.6	0.5	0.0	0.0	0.0	0.0	121.0
22-94 Wet	0.0	0.0	3.9	34.3	42.4	102.2	12.6	0.0	0.0	0.0	0.0	0.0	190.5
22-94 AN	0.0	0.0	0.0	10.0	42.4	72.6	0.9	0.0	0.0	0.0	0.0	0.0	75.6
22-94 BN	0.0	0.0	0.0	0.0	30.1	57.2	8.5	1.5	0.0	0.0	0.0	0.0	84.0
22-94 Dry	0.0	0.0	0.0	5.7	23.0	35.4	5.5	0.8	0.0	0.0	0.0	0.0	101.3
22-94 Crit	0.0	0.0	5.5	30.3	30.7	15.3	0.0	0.0	0.0	0.0	0.0	0.0	106.6
STDEV													
22-94 Avg	0.0	0.0	11.2	47.9	61.7	70.2	18.8	2.8	0.0	0.0	0.0	0.0	129.6
22-94 Wet	0.0	0.0	15.3	63.4	64.5	59.0	24.4	0.0	0.0	0.0	0.0	0.0	124.2
22-94 AN	0.0	0.0	0.0	31.6	56.0	65.8	2.8	0.0	0.0	0.0	0.0	0.0	64.8
22-94 BN	0.0	0.0	0.0	0.0	56.9	78.9	21.6	5.5	0.0	0.0	0.0	0.0	82.9
22-94 Dry	0.0	0.0	0.0	19.8	62.8	64.3	19.6	3.1	0.0	0.0	0.0	0.0	144.1
22-94 Crit	0.0	0.0	19.2	70.7	71.6	53.1	0.0	0.0	0.0	0.0	0.0	0.0	168.6
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	1,962.0	2,021.0	2,140.0	2,307.0	2,491.8	2,672.3	2,929.4	3,043.3	2,857.7	2,410.9	2,111.6	1,996.6	
22-94 Wet	2,141.3	2,262.4	2,541.5	2,730.0	2,884.1	2,953.7	3,303.0	3,493.2	3,424.9	3,037.3	2,842.6	2,784.9	
22-94 AN	1,959.4	2,068.6	2,155.5	2,460.5	2,697.7	2,931.1	3,280.3	3,399.6	3,228.4	2,696.2	2,336.8	2,244.0	
22-94 BN	2,058.4	2,074.7	2,136.5	2,306.5	2,514.0	2,728.0	3,090.9	3,276.1	3,000.2	2,451.6	2,023.6	1,852.0	
22-94 Dry	1,826.5	1,864.6	1,925.6	2,037.5	2,279.8	2,571.0	2,750.0	2,800.2	2,535.4	2,049.7	1,694.9	1,536.8	
22-94 Crit	1,718.5	1,704.7	1,714.6	1,798.4	1,890.3	2,034.2	2,033.9	2,011.7	1,819.9	1,511.1	1,303.0	1,192.9	
STDEV													
22-94 Avg	697.6	726.3	715.4	649.6	559.5	504.9	564.4	609.6	638.8	606.1	633.8	673.9	
22-94 Wet	703.8	673.9	481.1	340.5	108.4	129.5	97.1	105.2	164.9	281.6	391.0	414.8	

22-94 AN	825.2	898.2	858.5	582.5	306.7	102.7	128.9	186.3	302.5	262.3	312.1	371.5	
22-94 BN	786.8	809.3	822.3	737.7	592.0	513.6	331.5	258.1	214.1	213.9	213.4	259.8	
22-94 Dry	628.0	655.5	647.8	621.0	534.3	465.2	430.6	359.6	331.2	234.8	181.9	222.9	
22-94 Crit	541.9	587.9	618.6	595.1	595.0	589.3	581.6	557.7	501.8	420.6	362.0	345.0	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	324.2	329.3	441.9	671.4	803.3	884.1	778.0	585.3	433.9	356.7	279.9	282.1	
22-94 Wet	374.2	431.5	583.4	811.9	935.0	1,008.4	909.3	731.9	611.6	515.6	419.6	448.8	
22-94 AN	251.9	271.0	427.2	730.4	890.2	1,016.7	893.9	650.5	442.3	348.6	260.9	246.8	
22-94 BN	297.4	287.4	369.5	628.2	801.8	900.8	766.2	509.8	286.1	214.1	152.0	118.6	
22-94 Dry	328.5	309.7	427.7	642.3	760.5	840.1	722.9	521.3	364.6	324.6	254.4	243.8	
22-94 Crit	322.6	274.3	309.8	465.7	559.5	595.5	538.7	447.5	380.7	294.5	234.3	261.9	
STDEV													
22-94 Avg	270.2	268.5	294.6	277.7	257.4	234.1	225.1	231.5	255.9	270.8	235.4	250.8	
22-94 Wet	347.1	321.5	304.5	201.4	178.3	124.0	140.4	215.3	267.3	330.1	289.1	307.7	
22-94 AN	125.7	169.3	232.0	233.3	139.7	61.0	82.3	121.9	177.6	218.5	192.3	209.5	
22-94 BN	241.7	233.8	259.2	277.7	255.2	200.1	168.0	157.2	138.4	133.0	95.4	70.2	
22-94 Dry	250.5	236.3	249.9	271.2	247.7	211.8	222.9	230.8	265.0	274.9	245.3	247.2	
22-94 Crit	284.2	300.8	355.3	323.4	302.9	282.2	277.3	271.4	237.1	197.8	161.0	154.5	

Feather River Flow (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	152.6	129.8	222.2	283.5	316.8	368.3	188.9	224.3	279.7	430.8	293.0	124.7	3,014.6
22-94 Wet	171.0	175.5	389.5	620.7	653.3	738.0	413.4	455.8	338.0	445.1	231.6	101.2	4,733.2
22-94 AN	151.7	104.9	221.6	289.3	391.2	540.7	150.7	274.1	260.9	519.5	361.7	114.4	3,380.6
22-94 BN	154.9	119.1	148.1	163.6	211.0	188.9	80.0	104.6	329.5	515.1	405.9	139.7	2,560.3
22-94 Dry	142.4	102.7	138.4	93.3	90.3	132.9	94.2	100.6	257.4	420.0	314.4	143.2	2,029.7
22-94 Crit	132.1	118.9	128.3	82.1	91.2	101.0	81.3	82.3	164.9	248.2	183.0	132.1	1,545.3
STDEV													
22-94 Avg	69.8	106.3	254.2	399.7	332.9	397.1	225.2	261.4	122.1	149.6	156.1	83.9	1,457.9
22-94 Wet	74.3	185.5	390.4	576.3	343.1	463.3	308.7	323.1	141.0	131.2	166.4	83.0	1,184.4
22-94 AN	63.3	27.3	229.2	291.5	329.5	375.3	105.0	311.4	121.2	88.0	114.5	67.0	848.9
22-94 BN	79.2	37.8	82.7	172.4	207.4	141.9	54.8	61.1	105.7	78.1	98.1	84.2	625.3
22-94 Dry	65.4	38.6	72.6	43.2	41.1	80.7	63.6	59.7	72.9	130.8	152.1	102.9	492.3
22-94 Crit	63.8	33.1	85.8	48.2	61.6	80.9	47.7	40.7	62.8	158.7	117.6	71.0	435.9
Sacramento River Flow into the Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	754.2	924.1	1,529.7	2,009.4	2,186.3	2,101.6	1,461.8	1,179.5	1,038.3	1,130.0	880.2	769.7	15,964.8
22-94 Wet	898.2	1,296.1	2,824.2	3,426.9	3,402.1	3,225.8	2,530.7	1,991.6	1,406.3	1,246.0	950.4	1,003.0	24,201.3
22-94 AN	725.7	958.3	1,355.6	2,730.5	2,939.6	3,103.6	1,745.5	1,362.1	1,086.4	1,301.2	979.6	797.7	19,085.8
22-94 BN	720.2	798.0	1,098.4	1,519.6	1,969.2	1,611.2	1,111.9	947.8	1,049.4	1,212.7	969.4	741.2	13,749.0
22-94 Dry	685.8	774.2	927.4	977.7	1,295.4	1,383.0	829.8	734.4	827.2	1,077.4	838.4	688.0	11,038.9
22-94 Crit	656.6	591.8	715.6	874.8	871.8	829.4	605.7	470.0	622.7	758.3	626.3	480.3	8,103.2
STDEV													
22-94 Avg	232.9	620.2	1,211.8	1,430.2	1,300.2	1,272.4	1,098.4	783.3	459.4	218.7	179.4	227.0	6,719.3
22-94 Wet	311.0	898.8	1,260.0	1,353.4	1,038.6	1,222.9	1,275.8	884.5	607.1	131.5	104.6	204.1	4,573.3
22-94 AN	141.8	626.7	1,154.2	1,470.8	964.9	956.5	919.0	598.8	433.6	88.9	82.1	62.4	2,582.7
22-94 BN	160.4	195.5	808.9	656.9	930.8	454.4	571.1	281.6	131.5	85.2	104.2	77.7	1,383.1
22-94 Dry	162.0	404.4	258.8	248.8	734.7	657.9	204.3	76.3	95.5	115.1	177.2	122.7	856.8
22-94 Crit	194.0	143.9	236.9	356.4	381.3	384.4	116.2	60.3	101.4	181.1	167.8	154.8	1,198.7
San Joaquin River Flow at Vernalis (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													

22-94 Avg	177.4	118.6	185.2	272.8	353.8	387.0	362.7	342.5	249.3	140.5	104.1	111.3	2,805.3
22-94 Wet	241.3	160.3	319.0	532.8	626.5	752.8	635.5	617.5	527.2	226.9	134.9	150.4	4,925.0
22-94 AN	134.4	113.7	162.8	323.1	433.0	453.7	400.4	365.6	271.2	140.0	119.8	121.4	3,039.0
22-94 BN	180.9	108.7	165.0	191.9	343.5	299.3	324.8	299.3	133.6	118.9	112.7	109.3	2,387.7
22-94 Dry	157.0	97.4	112.1	110.1	146.4	153.4	196.2	180.7	102.6	98.3	83.6	87.7	1,525.6
22-94 Crit	124.4	89.7	91.0	87.1	99.3	105.3	120.2	108.4	75.3	70.9	54.8	68.2	1,094.5
STDEV													
22-94 Avg	136.6	96.8	223.0	300.0	355.7	427.0	282.4	288.1	338.4	131.0	33.0	44.2	2,176.6
22-94 Wet	204.7	171.2	364.4	405.4	461.7	610.2	359.0	377.4	516.4	219.3	11.9	58.2	2,855.8
22-94 AN	42.8	44.8	144.9	262.1	341.8	202.9	146.2	142.0	203.8	39.7	9.9	18.6	1,060.6
22-94 BN	103.8	24.8	104.1	117.0	213.2	189.2	107.4	121.0	29.7	16.9	15.2	12.0	699.6
22-94 Dry	109.8	16.4	30.6	35.2	85.7	58.9	68.8	59.7	16.7	18.5	26.4	14.9	415.7
22-94 Crit	45.7	16.6	15.1	12.8	21.3	23.8	22.9	24.5	7.9	10.9	12.5	4.1	150.4
Banks SWP Pumping (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	257.4	230.0	345.4	377.9	324.5	331.6	148.8	108.7	210.1	296.2	273.7	274.2	3,178.4
22-94 Wet	314.3	316.9	411.4	446.2	379.1	423.5	214.0	175.4	319.4	343.8	345.9	375.1	4,065.1
22-94 AN	257.6	240.9	381.4	439.6	396.9	432.0	184.6	114.7	245.8	354.8	331.7	317.0	3,697.1
22-94 BN	259.1	238.4	337.8	397.0	357.1	357.1	152.4	107.2	229.1	362.3	335.9	274.5	3,408.1
22-94 Dry	224.7	175.9	316.3	326.8	271.6	265.8	105.3	73.8	140.7	302.8	230.5	231.4	2,665.6
22-94 Crit	198.9	131.3	247.2	252.5	200.7	145.0	58.7	35.5	59.3	78.2	84.0	119.0	1,610.4
STDEV													
22-94 Avg	107.6	122.9	100.6	113.3	136.1	142.0	70.6	77.9	119.0	139.6	152.9	105.1	963.0
22-94 Wet	87.9	86.0	33.4	56.6	110.9	51.5	55.4	91.3	93.4	89.8	112.5	40.2	386.4
22-94 AN	109.3	146.9	45.2	70.3	74.4	35.7	38.0	56.9	87.3	87.1	103.7	57.4	321.3
22-94 BN	108.0	97.2	107.0	104.5	155.7	119.3	38.5	54.0	56.9	69.4	96.2	66.1	355.8
22-94 Dry	112.5	115.1	95.6	108.0	113.1	131.2	37.2	37.6	64.9	122.1	153.0	64.5	440.0
22-94 Crit	97.3	94.7	123.3	107.2	125.3	124.2	36.9	19.8	68.9	125.5	136.1	76.2	651.1
Table A Deliveries to Butte and Yuba (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	2.4	0.3	0.0	0.0	0.0	0.5	1.8	2.0	1.9	2.5	2.8	3.0	17.3
22-94 Wet	2.3	0.1	0.0	0.0	0.0	0.4	2.5	2.7	2.5	2.5	2.8	3.3	20.5
22-94 AN	2.2	0.5	0.0	0.0	0.0	0.1	2.2	2.5	2.3	3.6	3.5	3.6	20.3

22-94 BN	3.2	0.4	0.0	0.0	0.0	0.8	2.0	2.2	1.9	2.6	3.3	4.1	20.2
22-94 Dry	2.5	0.5	0.0	0.0	0.1	0.5	1.5	1.7	1.6	2.5	2.8	2.8	15.7
22-94 Crit	2.0	0.5	0.0	0.0	0.1	0.7	0.6	0.5	0.8	1.5	1.4	1.3	7.9
STDEV													
22-94 Avg	1.5	0.6	0.0	0.0	0.1	0.9	1.2	1.1	1.0	1.6	1.7	1.6	6.5
22-94 Wet	1.7	0.2	0.0	0.0	0.0	0.9	1.0	0.8	1.0	1.5	1.5	1.5	3.3
22-94 AN	1.3	0.9	0.0	0.0	0.0	0.3	1.4	1.1	0.7	2.0	2.3	1.6	5.3
22-94 BN	1.5	0.8	0.0	0.0	0.0	1.3	0.9	0.9	0.5	1.5	1.8	1.6	5.3
22-94 Dry	1.8	0.8	0.0	0.0	0.2	0.8	0.9	1.1	0.9	1.5	1.5	1.4	5.2
22-94 Crit	0.9	0.4	0.0	0.0	0.2	0.9	0.8	0.5	0.7	1.0	0.9	0.7	4.8
Table A Deliveries to North Bay Aqueduct (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	6.0	5.0	5.1	2.7	3.1	3.9	5.1	5.6	5.7	5.9	5.9	5.7	59.6
22-94 Wet	6.8	5.8	6.1	4.3	4.7	5.3	6.4	6.9	7.1	7.4	7.4	7.2	76.7
22-94 AN	5.8	4.8	4.8	2.8	3.8	5.1	6.5	6.9	7.1	7.4	7.4	7.1	75.2
22-94 BN	6.5	5.5	5.8	2.5	2.9	4.0	5.6	6.4	6.6	6.8	6.8	6.6	66.4
22-94 Dry	5.1	4.2	4.3	2.0	2.3	2.9	4.3	4.8	4.9	5.1	5.1	4.9	49.4
22-94 Crit	5.0	4.2	4.2	1.2	1.3	1.6	2.0	2.2	2.3	2.4	2.3	2.2	22.3
STDEV													
22-94 Avg	2.2	1.9	2.1	1.9	1.7	1.7	1.9	2.0	2.0	2.1	2.1	2.1	21.7
22-94 Wet	1.2	1.1	1.5	1.5	0.9	0.4	0.5	0.5	0.6	0.6	0.6	0.6	6.5
22-94 AN	2.5	2.1	2.2	1.6	1.1	0.6	0.6	0.7	0.7	0.7	0.8	0.8	8.8
22-94 BN	1.8	1.6	1.9	2.1	1.7	1.4	1.1	0.7	0.7	0.8	0.8	0.7	7.2
22-94 Dry	2.6	2.2	2.3	1.2	1.2	1.1	1.4	1.4	1.4	1.5	1.5	1.4	13.1
22-94 Crit	2.3	1.9	2.0	1.4	1.1	1.3	1.3	1.4	1.5	1.5	1.5	1.5	11.6
Table A Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	236.3	209.5	203.2	92.9	133.0	172.7	217.4	290.5	356.5	380.2	367.6	282.4	2,927.7
22-94 Wet	270.4	237.1	236.3	144.7	197.6	235.1	270.9	354.0	434.0	461.7	444.7	344.1	3,684.8
22-94 AN	230.0	205.6	194.2	94.7	164.0	226.6	277.8	360.7	444.9	471.8	457.5	349.9	3,665.9
22-94 BN	259.1	231.5	225.2	86.3	123.0	180.1	238.5	336.6	416.9	441.6	427.9	327.2	3,320.7
22-94 Dry	202.0	180.2	170.8	68.9	95.9	126.9	188.7	254.9	310.9	335.1	324.1	248.4	2,491.1
22-94 Crit	201.1	178.0	170.4	40.3	55.5	70.8	87.3	114.4	137.5	150.1	145.2	111.2	1,111.2

STDEV													
22-94 Avg	84.4	75.9	77.7	64.1	72.8	75.5	81.3	104.1	129.0	135.7	131.8	101.2	1,050.5
22-94 Wet	45.1	41.9	54.6	51.0	39.7	18.7	21.7	31.1	38.4	40.3	44.4	30.3	299.4
22-94 AN	98.7	89.2	84.9	54.5	46.6	26.0	28.9	36.2	43.6	46.6	46.0	33.9	378.3
22-94 BN	70.2	64.0	68.3	72.8	74.3	63.6	53.0	39.7	48.8	51.3	50.8	39.1	360.2
22-94 Dry	104.8	94.4	89.8	40.2	51.9	49.4	63.1	80.0	101.9	104.6	101.6	78.2	712.8
22-94 Crit	90.3	81.1	78.6	47.0	48.1	59.1	63.2	83.1	95.5	109.1	106.0	81.1	658.5
Article 21 Deliveries South of Delta (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.0	0.0	2.1	16.8	32.4	63.4	7.1	0.4	0.0	0.0	0.0	0.0	122.2
22-94 Wet	0.0	0.0	3.6	33.5	39.8	105.7	13.4	0.0	0.0	0.0	0.0	0.0	188.2
22-94 AN	0.0	0.0	0.0	10.0	42.8	74.9	1.0	0.0	0.0	0.0	0.0	0.0	77.1
22-94 BN	0.0	0.0	0.0	0.0	24.8	59.8	10.1	1.5	0.0	0.0	0.0	0.0	88.9
22-94 Dry	0.0	0.0	0.0	3.7	24.1	40.0	5.4	0.6	0.0	0.0	0.0	0.0	106.3
22-94 Crit	0.0	0.0	6.4	30.3	30.7	15.3	0.0	0.0	0.0	0.0	0.0	0.0	104.5
STDEV													
22-94 Avg	0.0	0.0	12.5	46.4	61.6	70.1	18.8	2.7	0.0	0.0	0.0	0.0	127.7
22-94 Wet	0.0	0.0	16.4	60.2	64.3	56.9	23.5	0.0	0.0	0.0	0.0	0.0	122.1
22-94 AN	0.0	0.0	0.0	31.6	59.0	67.2	3.3	0.0	0.0	0.0	0.0	0.0	67.3
22-94 BN	0.0	0.0	0.0	0.0	55.1	77.6	22.3	5.8	0.0	0.0	0.0	0.0	83.4
22-94 Dry	0.0	0.0	0.0	14.7	62.6	65.3	19.6	2.3	0.0	0.0	0.0	0.0	142.1
22-94 Crit	0.0	0.0	22.2	70.7	71.6	53.1	0.0	0.0	0.0	0.0	0.0	0.0	167.1
End of Month Lake Oroville Storage (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	1,950.2	2,009.0	2,130.4	2,300.1	2,486.4	2,670.6	2,928.8	3,039.5	2,853.2	2,401.8	2,103.4	1,984.5	
22-94 Wet	2,121.4	2,242.3	2,529.4	2,727.3	2,882.4	2,953.7	3,303.0	3,493.8	3,422.1	3,028.3	2,834.1	2,773.4	
22-94 AN	1,949.6	2,057.8	2,134.8	2,440.9	2,681.8	2,931.2	3,280.3	3,399.4	3,231.4	2,696.1	2,334.2	2,230.0	
22-94 BN	2,057.6	2,071.7	2,133.0	2,302.5	2,513.7	2,728.0	3,088.8	3,268.7	2,993.6	2,441.7	2,019.0	1,854.3	
22-94 Dry	1,816.8	1,854.9	1,918.2	2,030.2	2,272.4	2,568.1	2,753.8	2,793.2	2,524.6	2,033.3	1,678.8	1,508.6	
22-94 Crit	1,703.9	1,692.3	1,708.3	1,792.2	1,884.0	2,027.9	2,027.6	2,005.7	1,816.8	1,504.8	1,297.2	1,185.5	
STDEV													
22-94 Avg	704.1	731.9	715.7	650.8	559.5	505.4	566.2	610.4	638.8	607.1	636.4	679.8	
22-94 Wet	724.0	697.4	486.5	347.6	107.7	129.5	97.1	104.5	169.7	287.9	397.4	423.3	

22-94 AN	832.0	909.5	867.8	598.8	312.9	102.6	128.9	186.3	302.8	265.7	319.0	388.7	
22-94 BN	791.1	809.1	824.0	737.9	597.4	522.0	341.5	261.1	212.6	216.3	215.8	267.3	
22-94 Dry	618.9	644.3	638.2	610.0	523.3	451.7	426.9	349.8	316.4	229.1	193.5	251.7	
22-94 Crit	548.5	592.1	620.3	595.4	596.1	589.6	581.8	557.1	502.2	414.4	355.2	337.9	
End of Month Storage in SWP Portion of San Luis Reservoir (TAF)													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
AVERAGE													
22-94 Avg	313.2	320.3	434.7	669.6	805.7	884.4	775.3	584.3	427.4	349.7	269.1	270.1	
22-94 Wet	357.8	417.8	573.2	808.3	935.0	1,005.9	902.2	717.2	589.1	493.3	391.3	416.6	
22-94 AN	237.5	255.8	415.7	721.6	889.2	1,015.4	889.6	641.9	427.2	331.8	240.5	229.4	
22-94 BN	278.8	274.6	359.3	625.1	805.7	900.9	766.2	525.1	299.4	224.5	152.3	114.4	
22-94 Dry	328.6	310.9	427.4	647.7	768.4	844.8	721.5	527.5	362.7	321.9	253.6	242.7	
22-94 Crit	318.1	269.1	305.8	464.7	559.5	596.6	540.1	448.8	380.4	296.5	236.2	266.0	
STDEV													
22-94 Avg	259.9	258.6	290.4	275.9	257.3	235.1	227.0	225.4	247.3	261.8	226.0	239.4	
22-94 Wet	332.2	304.2	299.2	205.0	183.4	128.2	143.8	214.9	263.8	323.5	281.8	297.1	
22-94 AN	113.8	163.0	230.8	230.1	142.4	62.2	84.3	122.9	177.5	213.1	184.8	197.5	
22-94 BN	225.8	218.4	245.0	262.7	253.1	205.2	171.3	146.1	126.7	118.3	78.9	59.7	
22-94 Dry	247.1	236.8	255.3	280.0	248.7	219.6	238.3	232.2	261.6	273.7	243.8	244.2	
22-94 Crit	276.6	295.6	351.5	319.2	298.7	276.5	272.7	267.5	237.9	196.7	159.7	151.4	

Compare Upstream-of-Delta Table A to Feather River Flows By Month and Alternative													
2020 Proposed Project													
2020 Table A Deliveries as a Percent of Feather River Flows													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	1.60%	0.26%	0.00%	0.00%	0.01%	0.14%	0.97%	0.91%	0.69%	0.59%	0.94%	2.54%	0.58%
22-94 Wet	1.32%	0.04%	0.00%	0.00%	0.00%	0.06%	0.60%	0.59%	0.76%	0.58%	1.19%	3.35%	0.43%
22-94 AN	1.48%	0.47%	0.00%	0.00%	0.00%	0.02%	1.50%	0.92%	0.89%	0.69%	0.98%	3.49%	0.60%
22-94 BN	2.02%	0.32%	0.00%	0.00%	0.00%	0.43%	2.64%	2.25%	0.58%	0.51%	0.82%	2.85%	0.80%
22-94 Dry	1.80%	0.48%	0.00%	0.00%	0.06%	0.38%	1.49%	1.91%	0.65%	0.62%	0.88%	2.13%	0.79%
22-94 Crit	1.47%	0.38%	0.00%	0.00%	0.09%	0.66%	0.79%	0.65%	0.47%	0.60%	0.79%	0.97%	0.52%
Compare North Bay Table A to Sacramento River Flows By Month and Alternative													
2020 Proposed Project													
2020 Table A Deliveries as a Percent of Sacramento River Flows													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
22-94 Avg	0.79%	0.54%	0.34%	0.14%	0.14%	0.19%	0.35%	0.48%	0.56%	0.53%	0.68%	0.75%	0.38%
22-94 Wet	0.76%	0.45%	0.21%	0.13%	0.14%	0.16%	0.25%	0.35%	0.51%	0.59%	0.77%	0.71%	0.32%
22-94 AN	0.80%	0.50%	0.36%	0.10%	0.13%	0.17%	0.37%	0.51%	0.65%	0.57%	0.76%	0.91%	0.39%
22-94 BN	0.91%	0.69%	0.52%	0.17%	0.15%	0.25%	0.51%	0.69%	0.64%	0.57%	0.71%	0.89%	0.49%
22-94 Dry	0.75%	0.55%	0.46%	0.21%	0.18%	0.21%	0.52%	0.67%	0.61%	0.48%	0.61%	0.73%	0.45%
22-94 Crit	0.77%	0.71%	0.60%	0.14%	0.16%	0.20%	0.34%	0.48%	0.37%	0.32%	0.38%	0.47%	0.28%
Compare Upstream-of-Delta Table A to Feather River Flows By Month and Alternative													
2020 Baseline and No Project and Alternatives 1 and 2													
2020 Table A Deliveries as a Percent of Feather River Flows													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	1.59%	0.26%	0.00%	0.00%	0.01%	0.14%	0.97%	0.89%	0.68%	0.58%	0.94%	2.44%	0.57%
22-94 Wet	1.34%	0.04%	0.00%	0.00%	0.00%	0.06%	0.60%	0.59%	0.75%	0.57%	1.20%	3.25%	0.43%
22-94 AN	1.47%	0.47%	0.00%	0.00%	0.00%	0.02%	1.49%	0.91%	0.90%	0.69%	0.97%	3.13%	0.60%
22-94 BN	2.04%	0.31%	0.00%	0.00%	0.00%	0.43%	2.53%	2.11%	0.57%	0.50%	0.81%	2.94%	0.79%
22-94 Dry	1.72%	0.47%	0.00%	0.00%	0.06%	0.40%	1.59%	1.69%	0.64%	0.61%	0.88%	1.95%	0.78%
22-94 Crit	1.48%	0.38%	0.00%	0.00%	0.09%	0.65%	0.78%	0.64%	0.47%	0.58%	0.79%	0.95%	0.51%

Compare North Bay Table A to Sacramento River Flows By Month and Alternative													
2020 Baseline and No Project and Alternatives 1 and 2													
2020 Table A Deliveries as a Percent of Sacramento River Flows													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
AVERAGE													
22-94 Avg	0.79%	0.54%	0.34%	0.14%	0.14%	0.19%	0.35%	0.47%	0.55%	0.53%	0.67%	0.75%	0.37%
22-94 Wet	0.76%	0.45%	0.21%	0.12%	0.14%	0.16%	0.25%	0.35%	0.51%	0.59%	0.77%	0.71%	0.32%
22-94 AN	0.80%	0.50%	0.35%	0.10%	0.13%	0.16%	0.37%	0.51%	0.65%	0.57%	0.75%	0.89%	0.39%
22-94 BN	0.91%	0.69%	0.53%	0.17%	0.15%	0.25%	0.50%	0.68%	0.63%	0.56%	0.70%	0.89%	0.48%
22-94 Dry	0.74%	0.55%	0.46%	0.21%	0.17%	0.21%	0.52%	0.66%	0.60%	0.48%	0.61%	0.71%	0.45%
22-94 Crit	0.76%	0.70%	0.59%	0.14%	0.15%	0.20%	0.34%	0.47%	0.36%	0.31%	0.37%	0.47%	0.28%

I. HISTORICAL ANALYSIS REPORT AND MEMORANDUM (STUDY NO. 1)

Effects of the Monterey Amendments and Alternatives on Historic State Water Project Allocations

California Department of Water Resources

August 20076

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EXECUTIVE SUMMARY

The purpose of this study is to use historical data to evaluate the effects of the Monterey Amendments and other alternatives for the Monterey Plus EIR on State Water Project (SWP) water supplies to contractors. The analysis relies on numerous assumptions that may not necessarily reflect what actually could have occurred in the absence of the Monterey Amendments, but the results provide useful data to quantitatively assess some effects of the Monterey Amendments. This study uses historic SWP contractors' requests and other data to evaluate SWP allocations from 1996 to 2005. Because SWP water supplies were not sufficient to meet SWP contractor demands in all years from 1996 to 2005, the Baseline's pre-Monterey Amendments Article 18(a) allocation provisions for water shortages would have substantially affected SWP allocations.

To report the effects of the proposed project, this study organizes the SWP contractors into four groups based on whether a contractor is an Agricultural (AG) or Municipal and Industrial (M&I) contractor and whether a contractor participated in a proposed project-related Table A transfer or retirement (Table HA-6). These are the two most significant factors affecting Table A allocations under the proposed project. The proposed project's Article 18(a) changes reduced M&I Table A allocations in some years of this analysis. M&I contractors that purchased Table A amounts from AG contractors reduced or eliminated the effect of the proposed project's Article 18(a) changes. In contrast to M&I contractors, the proposed project's Article 18(a) changes increased Table A allocations for AG contractors. Agricultural contractors that reduced their Table A amount through a transfer or retirement received less water in some years when this reduction was not offset by the increase in AG Table A allocations caused by the proposed project's Article 18(a) change.

The annual effect of the proposed project's Article 18(a) change depends on the SWP's annual hydrology because the inability of the SWP to satisfy 100% of Table A requests in any year activates the Article 18(a) AG-first reduction in the Baseline. This reduction, however, is limited to a cumulative total of 100% over a seven-year period. Consequently, there may be years in any seven-year period when there is no effect from the proposed project's Article 18(a) changes because the Baseline's cumulative limit on Article 18(a) AG-first reductions has been reached. In these years, the Department applies Article 18(a) the same way in the proposed project and the Baseline. This occurred in 2003-2005.

The proposed project included and possibly facilitated many individual Table A transfers from AG contractors to M&I contractors. In general, AG contractors that sold Table A amounts receive reduced Table A allocations, while M&I contractors that purchased Table A amounts receive increased Table A allocations. The specific change in Table A allocation will vary depending on the size of the Table A amount transferred and the annual SWP Table A allocation. The straightforward effect of a Table A transfer, however, interacts with the other effects of the proposed project, especially the Article 18(a) revision. This occurs because the proposed project's Article 18(a) effects can exercise a greater influence on Table A allocations in some years than the proposed project's Table A amount transfers. In the case of some contractors, such as Zone 7 and Castaic, the Table A amount transfer's effect clearly dominates Table A

allocations because these contractors increased their Table A amounts by 33% and 40%, respectively, through proposed project-related transfers.

Finally, the study showed that the Monterey Amendments' retirement of 45,000 AF generally increased allocations by a small amount for most contractors. This effect occurs in every year of the study, but the Article 18(a) changes and Table A transfers overshadow its effect for many contractors. This effect is most noticeable in contractors that did not purchase Table A amounts and in years when the Article 18(a) AG-first shortage provision is not applied.

The No Project Alternative 1 (NPA1) alternative had few Table A allocation effects because it did not include any Table A retirements or any revisions of Article 18(a) procedures. The only effects of NPA1 were changes in specific SWP contractor's Table A allocations if they engaged in Table A amount sales or purchases. Contractors that purchased Table A amounts in NPA1 received higher allocations of Table A water in NPA1 than the Baseline. Contractors that sold Table A amounts received lower Table A allocations than in the Baseline.

The Court-Ordered No Project (CNP) alternatives invoke Article 18(b) of the SWP contracts, which reduces the total SWP Table A amount to 1.9 million acre-feet (MAF) by proportionately reducing all contractors' Table A amounts accordingly. The CNP greatly reduces Table A allocations to all contractors, but there is a much higher likelihood that all contractors will annually receive 100% of their reduced amount. In years when there is less than 1.9 MAF of water available to the SWP, CNP causes no Table A allocation changes.

Under current operations, there would be many years when the SWP water supply available for allocation exceeds 1.9 MAF. In these years, it is unclear how the Department of Water Resources (the Department) would allocate the remaining water after it satisfied all Table A amount requests. For this reason, CNP is subdivided into two possible alternatives, CNP Alternative 3 (CNPA3) and CNP Alternative 4 (CNPA4). The CNPA3 allocates all the remaining water that can be allocated and scheduled for delivery according to each contractor's share of the total Table A amounts. In CNPA3, the water available beyond 1.9 MAF is called XA water, shorthand for ex-Table A water. The CNPA4 allocates all remaining SWP water that can be allocated and scheduled for delivery according to the allocation rules in Article 21 of the pre-Monterey SWP contracts; essentially, the water available beyond 1.9 MAF is referred to and treated as scheduled surplus water. In short, both CNPA3 and CNPA4 reduced water allocations to almost all M&I (Municipal and Industrial) contractors while increasing water allocations to AG (Agricultural) contractors.

CNPA3 reduced overall water deliveries to selected M&I contractors by 9 – 22% during 1999-2002 and caused minimal reduction (1%) in 1996-1998 due to the available water beyond the 1.9 MAF. Article 18(a) was not as beneficial to contractors with M&I Table A amounts in CNP because there is less M&I Table A that received priority when 18(a) was applied. Conversely, contractors with AG Table A received increased allocations, especially in 2001(290%), in years when Article 18(a) was applied. The application of Article 18(a) to only the reduced 1.9 MAF of Table A amount instead of the Baseline's 4.2 MAF is responsible for virtually all the effects of CNPA3.

CNPA4 reduced overall water deliveries to most M&I contractors by 2– 40% during the 1999-2005 time period. During the years from 1996 through 1998, there was enough water to prevent any reduction in deliveries. The reduced application of 18(a) to only 1.9 MAF accounts for some of these changes, but more importantly, the allocation of scheduled surplus water in accordance with the pre-Monterey Article 21 allocates most of the remaining scheduled surplus (SS) water to AG contractors. This increased total water allocations to AG contractors during 1999-2005. A few M&I contractors that were assigned high levels of groundwater replenishment use also received higher allocations in some years in CNPA4.

1.0 INTRODUCTION

This study uses historical data to evaluate the effects of the Monterey Amendments and other alternatives on SWP Table A allocations. It focuses on the provisions in each alternative that have the greatest effect on the Department's SWP allocations to SWP contractors in each alternative. These provisions are changes in the Table A amounts of certain SWP contractors, modification of Article 18(a) provisions, and invocation of Article 18(b).

Note: This report utilizes terms such as: proposed project, No Project Alternative 1, Court-Ordered No Project Alternative 3, etc. These terms are used in order to stay consistent with the Monterey Plus EIR. For a more thorough explanation of the proposed project and alternatives, refer to the appropriate chapter in the main body of the Monterey Plus EIR.

1.1 Period of Analysis

The period 1996-2005 provides an interesting set of years to evaluate the EIR's alternatives. The period 1996-2000 was a consistently "wet" period, while the 2001-2005 period was variable with "dry" and "wet" years. The SWP contractors' Table A requests during 1996-2000 was variable and less than the total maximum Table A amount of the SWP, but requests after 2000 were almost uniformly equal to the contractors' total maximum Table A amounts. As a result, the SWP had sufficient water supply available to satisfy all contractor requests for water during 1996-1999, but the SWP contractors' requests for water exceeded the SWP's water supply during 2000-2005. Also, beginning in 1996, SWP contractors made numerous proposed project-related Table A amount changes and transfers.

In hindsight and assuming that the SWP did not adopt the Monterey Amendments in the mid-1990s, the interaction of California's annual hydrology and SWP contractors' water requests on the SWP's annual water allocations would have challenged the Department's management of the SWP. Unable to fully satisfy all Table A requests, the Department would have had to impose Article 18(a) reductions on agricultural contractors in order to meet the requests of M&I contractors. Tables HA-1 and HA-2 show the probable Article 18(a) allocation actions that the Department would have executed during 1996-2005 under the Baseline contractual provisions that existed prior to implementation of the Monterey Amendments. Due to the post-1999 water allocation shortages, the Baseline's pre-Monterey Amendments Article 18(a) allocation provisions for water shortages would have substantially affected SWP allocations during these years. Comparing each alternative's 1996-2005 allocations to the Baseline's 1996-2005 allocations demonstrates the effects the alternatives' water shortage provisions have on SWP allocations.

The Baseline's Article 18(a) water shortage provisions only affect SWP allocations in years when the SWP does not have enough water available to meet SWP contractors' requests. Analysis of the 1996-1998 period demonstrates that Article 18(a) effects of the proposed project and NPA1 on allocations were non-existent because the SWP had sufficient water supply to fully satisfy requests. In addition, since SWP contractors made relatively few changes to SWP Table

A amounts during 1996-1998[1], the proposed project's and NPA1's various Table A changes did not substantially alter the SWP's allocations during any year within this period. The 1996-1998 years also showed that the CNP did not have a net affect on the amount of water the contractors ultimately received because the SWP had enough available water to satisfy all contractors regardless of invocation of 18(b). For the above reasons, this study focuses on results from 1999 to 2005.

1.2 SWP Allocations vs. SWP Deliveries

This study evaluates the EIR alternatives' effects on SWP Table A allocations[2]. Because the EIR team utilized CALSIM II to simulate SWP deliveries, the analyses of CALSIM II deliveries may show different results than this study's analyses of SWP allocations. The difference between each contractor's requests and the contractor's deliveries varies among contractors and from year to year.

2.0 METHODS

This section describes the variables, assumptions, and analytical methods used in this study.

2.1 Baseline Assumptions

This study uses adjusted SWP Annual Table A amounts to SWP water data to establish annual Baseline deliveries to SWP contractors from 1996-2005.

2.1.1 SWP Water Supply

This study uses final State Water Project Analysis Office (SWPAO) *Notices to State Water Project Contractors*[3] to determine the total SWP water supply available for meeting contractors' annual requests. The Department usually announces the SWP's final annual water supply in late spring after extensive evaluations of Central Valley hydrological data. This study assumes that the Baseline's SWP water supply and alternatives' water supply in all years would have been identical to the actual historical water supply available to the SWP. In addition, this study assumes in the Baseline and all alternatives that the Department would not have acquired additional water for the SWP to allocate through altered operations or from other sources.

[1] Dudley Ridge and KCWA collectively retired 45,000 AF of Table A amount, and Mojave acquired 25,000 AF of Table A amount from KCWA in 1998. These actions would have slightly affected the individual allocations to Dudley Ridge and KCWA and Mojave, but the Table A changes did not affect total SWP Table A allocations because all contractor Table A requests were fully met during 1996-1998.

[2] SWP Table A allocations are different from SWP water deliveries. SWP contractors may request their full Table A amounts, receive a smaller Table A allocation, and then take only a portion of their allocated Table A water for delivery in that year. Therefore, a contractor's annual "request" can differ from its actual "demand," and Table A allocations may differ from actual water deliveries.

[3] The SWPAO Allocation Notices are available at http://www.swpao.water.ca.gov/notices/index.cfm.

2.1.2 Table A Amounts

Each contractor's annual Table A amount is an essential component of this historical analysis because it determines the Department's allocation of water among all the SWP contractors. A contractor's Table A amount indicates the maximum amount of Table A water it may request in a particular year and the maximum Table A that the Department will allocate to it in that year. Each contractor determined schedules for their annual Table A amounts during the original SWP contract negotiations and approvals. In general, most contractors' Table A amounts started out fairly low when the project first began operating in the 1960's, but then ramped up in successive years. Some contractors' Table A amounts reached their maximums by 1994, but other contractors' Table A amounts continued to increase. Other contractors amended their contracts to change their scheduled Table A amounts. Because of these complexities, the study carefully tracked Table A amounts in each year to ensure that scheduled contractual increases in Table A amounts did not influence or confound the evaluation of the proposed project or alternatives.

In each year of analysis, the study uses each contractor's actual, historic Table A amount for the years 1996-2005. Since some of these include the proposed project's Table A transfers and Table A retirements, this study computes Baseline Table A amounts by removing the proposed project-related Table A changes from the contractual Table A amounts. Removal of proposed project-related Table A changes and retention of other Table A changes unrelated to the proposed project ensures an accurate determination of effects and not exaggerated or artificial effects due to other unrelated changes in a contractor's Table A amount[4]. The need for careful construction of the Baseline in this analysis is because of the complexity of analyzing the past impacts of proposed project actions that have already been completed in the midst of many other non-proposed project actions that have also been completed in the past. Table HA-3 lists the contractors whose actual, historic Table A amounts were adjusted to create their Baseline Table A amounts. Table HA-3 also indicates the reason for the Table A amount adjustment.

[4] For example, if Contractor X had an actual Table A amount of 100 TAF in the year 2000, but 25 TAF of this was the result of a Project-related Table A amount transfer implemented in the year 2000, then the Baseline Table A amount for Contractor X in 2000 would be 75 TAF (100 - 25 TAF). If Contractor X had a Table A amount in 1999 of 150 TAF, but it entered into an independent, unrelated 10-year agreement with the Department to reduce its Table A amount by 75 TAF in every subsequent year, its Table A amount in the Baseline for the year 2000 would remain 75 TAF. If the year 2000 Baseline Table A amount for Contractor X was set or "frozen" at the 1999 amount, however, it would be 150 AF in 2000. In this case, a comparison of the Baseline to the Project would indicate that the Project caused a reduction in Contractor X's Table A amount of 50 AF in the year 2000 (150 AF compared to 100 AF). This is clearly an erroneous conclusion because the fact is that the Project in this example included a purchase of 25 AF of Table A amount from another contractor, which was implemented in 2000. The real effect of the Project in the year 2000, then, must be an increase in X's Table A amount of 25 AF (100 AF compared to 75 AF). This brief example shows that including the non-Project related Table A amount changes in the Baseline as well as the Project reveals the true effect of the Project and the Project only. Conversely, failing to adjust the Baseline Table A amounts to incorporate actions that have already occurred obscures results and can even lead to opposite, erroneous conclusions about the effects of the Project. In this example, the "frozen" Baseline method would have led to the conclusion that the Project caused a decrease in Contractor X's Table A amount, and related water allocations, when in fact the proper effect determination is that the Project caused an increase in Table A amount and related allocations.

2.1.3 Baseline Table A Requests

The requests[5] of the SWP contractors in each year are another important component of the historical analysis. The study uses the actual historical requests of AG and M&I contractors to estimate SWP contractors' requests for the Baseline. Since the 1980's, Agricultural contractors routinely requested 100% of their Table A amounts. This study assumes that agricultural contractors' requests remained 100% of their Table A amounts for the Baseline and all alternatives[6].

By the 1990's, many M&I contractors were also requesting their full Table A amounts. In 1999 and 2000, there were still a few M&I contractors that did not request 100% of their Table A; the most notable example is MWD, which holds almost 50% of the total SWP Table A. However, in 2001 and all subsequent years, all contractors requested 100% of their Table A amounts.

An important effect of these assumptions is that the Baseline's total AG Table A amounts and total SWP Table A requests are greater than the historic total AG Table A amounts and requests that occurred during 1996-2005. Table HA-4 lists the Table A amount values used by this study for each contractor in each alternative. In these years, the Baseline AG Table A amounts are greater than in the proposed project because the Baseline has no retirement of Table A amounts. Additionally, since this study assumes that AG contractors always request 100% of their Table A amounts and several M&I contractors that acquired Table A amounts did not request 100% of their Table A amounts in several years of this study, the Baseline has a greater total SWP Table A request than the proposed project.

2.2. Assumptions for Evaluation of Alternatives

To represent each alternative most accurately, the study made assumptions about certain variables, particularly those that change in the alternatives. Table HA-5 lists this study's provisions or assumptions for the Baseline and each alternative regarding the major variables that are the focus of this analysis.

2.2.1. Monterey Plus

The proposed project incorporates all Table A actions that occurred after implementation of the Monterey Amendments during the period 1996-2005. The proposed project's Table A amounts include the actual Table A transfers from KCWA and Tulare to SWP M&I contractors. It also includes the retirement of Table A amounts by KCWA and Dudley Ridge. Additionally, the proposed project alternative includes Dudley Ridge's purchase of 3,973 acre-feet (AF) of Table A amount from Tulare. Table HA-4 summarizes Table A amounts under the proposed project.

[5] Request and demand are often used interchangeably, but the two words have different meanings in the context of the SWP. It is also important to understand that what contractors request often differs from what they actually end up taking from the SWP in the form of deliveries, which complicates any attempt to compare actual delivery values with values predicted by this historic analysis.

[6] The study also assumes that CLWA requests all of the transferred 12,700 AF of Table A that it acquired from Devil's Den.

This study uses the final SWPAO *Notice to State Water Project Contractors* to determine total SWP requests in each year. These actual requests occurred after implementation of the provisions in the Monterey Amendments.

2.2.2 No Project Alternative 1

This study assumes that No Project Alternative 1 (NPA1) does not invoke Article 18(b) and that the Monterey Amendments are not in effect. It also assumes that transfers of Table A amounts remain the same as found in the Baseline. Since this study utilizes historic SWP water supply determinations to determine alternatives' allocations and the SWP did not develop conservation storage in the Kern Fan Element property during 1996-2005, this study does not evaluate the potential water allocation effects of SWP storage in the Kern Fan Element property property.

2.2.2.1 NPA1 Table A Amounts

As mentioned, this study incorporates the Table A amount transfers already implemented as part of the proposed project. The NPA1 assumes that no contractor would retire Table A amounts.

To evaluate the effects of Table A transfers, this study maintained the distinction between Agricultural Table A (AG Table A) and Municipal and Industrial Table A (M&I Table A) for each contractor's Table A amount. In this study, the designation of AG or M&I always remains with the Table A amounts regardless of whether they are transferred from an AG contractor to an M&I contractor because this allows Article 18(a) to be effectively implemented.[7]

The study also assumes that the transfers would have been implemented in the NPA1 in the same year they were actually implemented in the proposed project. Table A amounts of other SWP contractors did not change as a result of NPA1 and remained the same as those in the Baseline, listed in Table HA-4.

2.2.2.2 NPA1 Table A Requests

As noted earlier in the Baseline discussion, this study uses the actual historical requests of agricultural and M&I contractors as the requests for the Baseline and the NPAs. Agricultural contractor requests remain 100% of Table A in all scenarios.[8] M&I requests also remain the same in all scenarios. NPA1's Table A requests are greater than the proposed project's total SWP requests, for the same reason as explained in the Baseline discussion.

[7] Although the SWP long-term water supply contracts did not designate each contactor's Table A amount as "AG" or "M&I" for purposes of applying 18(a), the amounts and proportions of contractors' Table A used for agriculture and Table A used for M&I affected SWP allocations during dry periods. The preservation of the AG and M&I designations is included in the provisions of the 1991 Table A transfer from Devil's Den Water District to Castaic Lake W.A.; Castaic Lake's contract amendment for the Table A acquisition included Castaic Lake's agreement to classify water requests for the acquired Table A amount as agricultural use.

[8] The study also assumes that CLWA requests all of the transferred 12,700 AF of Table A that it acquired from Devil's Den.

NPA1's total of AG Table A amounts is greater than the proposed project total of AG Table A amounts because the NPAs include fewer transfers of AG Table A amounts to M&I contractors and there is no retirement of Table A amount by KCWA and Dudley Ridge. Since M&I contractor requests were not 100% of their Table A until 2001, while agricultural contractors always request 100% of their Table A during the analysis period, some initial Table A transfers reduced requests associated with AG Table A amounts.

2.2.3 Court-Ordered No Projects

In September 2000, the California State Court of Appeal ordered the Department to analyze a no project alternative that included invocation of Article 18(b) of the pre-Monterey Amendments long-term water supply contracts. The Court-Ordered No Projects (CNP) analyze the Department's invocation and implementation of Article 18(b). The proposed project, in fact, eliminated Article 18(b) from the SWP contracts. Part of the value of analyzing the implementation of Article 18(b) in the CNP is to assess the effects of the elimination of Article 18(b). Article 18(b) of the original long-term water supply contracts stated that in the case of a permanent shortage of SWP water the Director could reduce all contractors' Table A amounts to the minimum project yield as determined by special coordinated operations studies conducted by the Department.

Although Article 18(b) was part of the original long-term water supply contracts, the Department had never invoked it during the first 30 years of SWP operation. Consequently, there is no course of practice or routine methodology to guide development of this alternative. This study analyzes the effects of invoking of 18(b) during 1996-2005. As previously mentioned, the CNP results are not only useful to demonstrate the effects of invoking Article 18(b), but also to determine the proposed project's effect of removing Article 18(b) of the SWP contracts because evaluating what possibilities were lost with the removal of Article 18(b) is only possible if the effects and usefulness of invoking Article 18(b) are examined. Department staff developed the CNP based on interpretations and predictions of what might occur (might have occurred) if the Director invoked Article 18(b). Department staff also used the Settlement Agreement, the Third District Court of Appeal's *PCL et al. v. Department of Water Resources* decision, and EIR committee comments to develop CNP's description.

2.2.3.1 CNP Table A Amounts

In the CNP alternatives, the Department reduces the total Table A amount of the SWP to the "minimum project yield." CALSIM II modeling studies performed as part of the Monterey Plus EIR effort determined that the total SWP Table A amount should be reduced to 1.9 MAF. The 1.9 MAF amount is close to, but actually less than, numerous values reported in Department publications.[9]

To determine contractors' Table A amounts, all contractors' Baseline Table A amounts were reduced proportionately regardless of whether they were agricultural or municipal contractors. The reduction procedure multiplied each contractor's Table A amount in a particular year by the fraction of 1.9 million divided by the total Baseline SWP Table A amount for that year. This

[9] See Bulletins 160-87 (p.24), 160-93 (p.63), 160-98 (p.3-33), 132-90 (p.86), 132-93 (p.18).

procedure decreased each contractor's Table A amount by roughly 52% each year. Table A amounts for the CNP are listed in Table HA-4.

2.2.3.2 CNP Table A Requests and Ex-Table A Requests

This study used actual historical requests of each contractor to determine the Table A requests for the CNP. Historically, only a few contractors requested less Table A water than their new, reduced Table A amount under the CNP. As a result, the vast majority of contractors request all their Table A amount in the CNP during 1996-2005.

In most cases, a contractor's historical Table A request exceeds its CNP reduced Table A amount. As a result, requests for SWP water remain after all Table A amounts have been filled. In the Baseline, that requested water is simply part of contractors' Table A requests, but in the CNP it can not be considered part of the Table A requests because the contractors do not have that much Table A amount. Consequently, this study computes the difference between each contractor's historical Table A request and its CNP Table A request and considers this amount an additional request for additional SWP water.[10]

2.3. Allocation Methods

Earlier discussion described the classification of Table A amounts as either AG or M&I. The CNP analysis also keeps AG Table A and M&I Table A separate, chiefly for implementation of Article 18(a).[11]

2.3.1 AG and M&I Table A Amounts

If contractors' requests exceed the SWP's water supply in any year, the Baseline's Article 18(a) requires a reduction in agricultural allocations before reducing municipal allocations. To analyze how Article 18(a) and the revisions of Article 18(a) in the proposed project affect Table A allocations, this study assumes that the AG and M&I labels that were attached to Table A amounts in the Baseline remain with those Table A amounts regardless of whether a contractor transfers Table A amounts in the NPAs. This practice is consistent with the Department's treatment of the 12,700 AF of Table A amount that CLWA purchased from Devil's Den Water District in 1991.

[10] For example, assume Contractor X had a Baseline Table A amount of 100 AF in the year 2000 and requested all 100 AF of its Table A, then Contractor X would only have 45 AF of Table A amount in No Project B in that year. For the year 2000 in No Project B, Contractor X's Table A request would be 45 AF and its additional SWP water request would be 55 AF.

[11] The literal language of Article 18(a) does not expressly call for such a rigid distinction between AG and M&I Table A amounts. Instead, Article 18(a) uses the terminology agricultural, groundwater, and municipal uses.

2.3.2 SWP Water Supply

Each year the SWP determines the amount of Table A water for delivery to its contractors. The amount allocated depends on the hydrology, SWP operational capabilities, and regulatory limitations of that particular year. The SWP water supply for Table A allocation is the most crucial input in the historic analysis.

This study uses the historic final SWP Table A allocations during 1996-2005 to represent the maximum amount of Table A water available to the SWP in each of those years and for all alternatives. In effect, this assumption made the historical SWP allocation in each year the total amount of water that could be allocated as Table A under any of the alternatives in that year.[12] While use of the historic SWP water supply may not be 100% accurate in all years because the SWP may have had additional water available for delivery if contractors had requested it, the assumption is accurate for years when the actual SWP allocation did not fully satisfy requests. This occurred in 2000-2005.

2.3.3 Allocation Calculations

This study's allocation procedure uses the same general methodology for the proposed project and all alternatives. The first step is to distribute the total available historic SWP Table A water supply for each year into two general blocks based on total Agricultural and total M&I Table A requests. This initial distribution of Table A water varies between the Baseline, proposed project, and alternatives because Article 18(a) is applied differently and because the size of the blocks differs depending on the total SWP AG and M&I Table A amounts.

After determination of a bulk quantity for the initial AG and M&I Table A blocks, the study further allocates Table A water to individual SWP contractors based on how much AG and/or M&I Table A amounts they have in a year relative to the total quantity of Table A that all contractors had in that year. If a contractor had both M&I and AG Table A, then the calculations included two separate calculations for that contractor, and the contractor's total allocation was a combination of AG and M&I Table A.

For 1999 and 2000, a few contractors still requested less than 100% of their Table A. For these contractors, the study's initial allocation exceeded those contractors' individual requests. Consequently, the study allocated water to meet 100% of those contractors' requests and allocated the remaining excess water (from the initial allocation of water to these contractors) to other contractors.

[12] As discussed, this assumption may not be totally accurate for years where all contractors received 100% of what they requested (1999-2000) because once all Table A requests have been fulfilled, the SWP may not operate in a manner to maximize current year deliveries and therefore it is uncertain whether additional Table A water could have been allocated if the contractors had asked for it. Typically, when all Table A requests are fulfilled, the Department makes any additional water available as Article 21 water. But if requests for Article 21 water are less than the total supply of Article 21 water available to the project, and all EWA debts to the SWP in San Luis Reservoir have been repaid, the historic deliveries of Article 21 water may also not represent the true maximum possible Article 21 deliveries in that year.

2.3.3.1 Allocation of Table A in the Baseline

The pre-Monterey Article 18(a) applies in the Baseline; therefore, in years when the amount of Table A supply is insufficient to meet both AG and M&I Table A requests this study applies an Article 18(a) AG-first reduction to the initial AG Table A block. Note that the AG-first reduction has two constraints in the Baseline; it can not exceed 50% in any one year, and the size of any reduction can not exceed the 100% cumulative limit on AG-first reductions within a 7-year period. If either of these constraints is exceeded, this study applies equal additional percentage reductions to allocations of both the AG and M&I blocks until the sum of the two blocks equals the Table A water supply available that year (Table HA-8).

2.3.3.2 Allocation of Table A in the Proposed Project

Allocation of Table A in the proposed project is generally similar to the Baseline's method except there is no longer an AG-first reduction to the AG block of water. In any year where the amount of Table A water available to the SWP can not satisfy the AG and M&I requests, this study reduces the percent allocations to the initial AG and M&I blocks simultaneously and equally until the sum of water allocated to the AG and M&I blocks equals the amount of Table A water available to the SWP in that year (Table HA-11).

2.3.3.3 Allocation of Table A in NPA1

The procedures for allocating Table A water in the NPA1 are identical to the Baseline procedures. The actual allocations, however, differ because of Table A transfers that occur in NPA1. These Table A transfers change some contractors' percentage share of the Total AG Table A amounts and consequently change the amount of water a contractor receives from the initial AG block (Table HA-9).

2.3.4 CNP Water Allocations

This study allocates Table A water in CNP the same way as in the Baseline and NPA1; the Department satisfies Table A requests first using the same Article 18(a) provisions as in the Baseline and NPA1. As a practical matter, however, 18(a) applies less frequently because the available water supply to the SWP exceeds 1.9 million AF in most years and this is all the water required to satisfy 100% of the Table A requests in the CNP (Table HA-10).

The more complicated issue is the allocation of the remaining available water supply after satisfying the reduced Table A amount requests in the CNP. In this study, the Department considers two possibilities. One possibility treats the water as XA water, while the other treats the water as scheduled surplus water as discussed in the pre-Monterey Article 21. These methods are described below.

2.3.4.1 Allocating XA Water in CNP Alternative 3

One method to allocate the water remaining after all CNP Table A requests are satisfied is to make the XA water available to the contractors in proportion to their Table A amounts (or requests if a contractor requests less than its full Table A). This allocation would not differentiate between AG and M&I contractors. If a contractor's Table A amount (or Table A request) represents 10% of the total Table A amount of the SWP that year, then the contractor is allocated 10% of the available XA water. This method is called the CNPA3 method.

This allocation procedure results in allocations that are similar to the Baseline in many years, but it reduces the number of times Article 18(a) AG-first shortages need to be applied because the SWP often has 1.9 MAF to allocate. The CNPA3 method applies Article 18(a) and its AG-first shortage provision only to the 1.9 MAF of Table A amount, after that the contractors equally share in any water shortage if the XA water available is less than the total amount of requested water.

2.3.4.2 Allocating Scheduled Surplus Water For CNP Alternative 4

Another method to allocate the remaining water is to consider it scheduled surplus water and follow the applicable provisions of the pre-Monterey Article 21. Article 21 sets out a complicated procedure for allocating all surplus water based on geographic location and percent use of the water for agricultural or groundwater replenishment purposes. The details of the procedures are summarized below.[13]

The pre-Monterey Article 21 makes several geographic distinctions that affect allocations of scheduled surplus water. The first is a distinction between SWP contractors upstream and downstream of Dos Amigos Pumping Plant (Dos Amigos Pumping Plant is located near Los Banos, approximately 100 miles south of Banks Pumping Plant). Upstream contractors include Plumas, Butte, Yuba City, Napa, Solano, Alameda County, Zone 7, Santa Clara, and Oak Flat. All other SWP contractors are considered downstream contractors. Upstream and downstream groups of contractors receive scheduled surplus allocations based on the percent of agricultural and groundwater replenishment use each group has relative to the total agricultural and groundwater replenishment use of both groups.[14]

After this initial "block" distribution, there are additional procedures to allocate the blocks of scheduled surplus water to individual contractors in the upstream and downstream groups. For the upstream group, each contractor simply receives a share of the scheduled surplus designated

[13] The procedure was developed using MWD's SWP long term water supply contract and any amendments to it that were enacted prior to MWD's execution of the Monterey Amendment.

[14] For example, assume the group upstream of Dos Amigos Pumping Plant has a combined demand of 100 AF for agricultural and groundwater replenishment use and the downstream group has a combined demand of 900 AF for the same use. The supply of scheduled surplus would then be allocated in proportion to each group's respective demand relative to the total demand of both groups; therefore, the upstream group would be allocated 10% of the scheduled surplus and the downstream group would be allocated 90% of the scheduled surplus.

for upstream contractors proportionate to their share of the total agricultural and groundwater replenishment use of the upstream group as a whole.

Pre-Monterey Article 21 further subdivides the downstream group of contractors into three groups – San Joaquin, Central Coast, and Southern California contractors. Article 21 specifies that the "block" of scheduled surplus water for the downstream contractors should be split 69% to the San Joaquin group, 29% to the Southern California group, and 2% to the Central Coast group. After this step the scheduled surplus water is allocated to contractors within each group in the same way as it was in the upstream group; each contractor gets a share of the scheduled surplus water designated for its group in proportion to its share of the total agricultural and groundwater replenishment use of its subgroup.

If particular contractors within a group can not take all the scheduled surplus available to them, then other contractors within that group can take water allocated to their group before the water is made available to SWP contractors in other groups for agricultural and groundwater replenishment uses. Scheduled surplus water deliveries to contractors with municipal or industrial uses are a lower priority. The Department developed assumptions about each contractor's use of SWP water for agricultural, groundwater replenishment, and municipal uses to complete this study. Table HA-7 lists these assumptions for each contractor.

3.0 RESULTS

The annual net effect of each alternative is the annual difference between the Baseline's allocation and the alternative's allocation. As emphasized earlier, this study discusses the years 1996-2005 because some of these years demonstrate the alternatives' effects on allocations during a period when the SWP's water supply was less than the SWP contractors' requests.[15] To clarify the alternatives' effects, the discussion focuses on the relative effects of the alternatives' Article 18(a) provisions, Table A transfers, Table A retirements, and the CNP invocation of Article 18(b).

In order to make the presentation of results more concise and focused, this study organizes the SWP contractors into groups. In the proposed project analysis, two critical distinctions define four groups of contractors: the first distinction is whether the contractor is an Agricultural (AG) or Municipal and Industrial (M&I) contractor, while the second distinction is whether the contractor participated in a Table A transfer or retirement. Table HA-5 presents the four categories of contractors. Contractors within each of these groups experienced similar, if not identical, Table A allocation effects in each of the alternatives.

[15] Although the SWP's 1999 allocation was 100% for all contractors, the 1999 allocation was based on the Monterey Amendment's provisions which included retirement of 45 TAF by agricultural contractors. Because this study fixes the available water supply for allocation in all alternatives at the historic 1999 SWP quantity, utilizes a Baseline that does not include the retirement of 45 TAF of agricultural contractors' Table A amount, assumes that agricultural contractors would have requested an additional 45 TAF of water (associated with the non-retired 45 TAF of Table A amount) in the Baseline, and assumes that the SWP did NOT have an additional 45 TAF of water available for allocation, this study's Baseline allocation includes a difference of 45 TAF between the Baseline's SWP water supply and the Baseline's total SWP contractor requests for Table A. In the absence of the Monterey Amendment's 45 TAF retirement, however, it is very likely that the SWP would have allocated an additional 45 TAF in 1999 and thereby satisfied all contractor requests.

3.1 Effects of the Proposed Project

In the Baseline, the original Article 18(a) "AG-first" shortage provision was applied when total SWP Table A requests exceed the SWP Table A supply during 1999-2002 (Table HA-8). There was no Article 18(a) AG-first cuts in 1996-1998. There was also no Article 18(a) AG-first cuts in 2003-2005 even though Table A requests exceeded Table A water supply in 2003-2005 because AG-first allocation reduction reached the Article 18(a) cumulative cap of 100% in a seven-year period in 2002. After 2002 allocations, the Department could not impose further AG-first reductions until 2006. Therefore, Article 18(a) reduces AG and M&I Table A allocations equally during 2003-2005. Note that the Baseline also applied equally shared reductions to all contractors in 2001 and 2002 in addition to AG first reductions.

Table HA-11 shows the proposed project's effect on allocations for Agricultural and M&I contractors during 1996-2005. The difference in percent allocation between the proposed project and the Baseline causes the SWP to allocate large quantities of Table A water differently. Tables HA-13 and HA-14 list the quantities of Table A allocation changes for M&I and AG contractors in the proposed project compared to the Baseline. Tables HA-15 and HA-16 list the quantities of Table A allocation changes for M&I and AG contractors to the Baseline under NPA1. Tables HA-17 and HA-18 list the quantities of Table A allocation changes for M&I and AG contractors to the Baseline under the CNP alternatives.

Some contractors' Table A requests in 1999 and 2000 were not 100% of Table A amounts. MWD and several other M&I contractors requested Table A amounts below their maximum contractual allowance in those years. These less-than-maximum requests made it easier for the Department to satisfy the total Table A request, forestalling application of Article 18(a). However, since 2001, virtually all SWP contractors have requested 100% of their maximum Table A amount in each year The SWP does not have sufficient water to fulfill all Table A requests in most years.

3.1.1 Effects of the Proposed Project on M&I Contractors With No Table A Transfers – Group One

Seventeen SWP M&I contractors that did not participate in transfers or retirements of Table A amounts are in Group One. Table HA-19 shows the proposed project's effects on selected Group One contractors. The Table displays Santa Clara Valley, whose Table A amount of 100 TAF is a conveniently round number that makes evaluation easier; Santa Barbara, a contractor whose Table A amount is approximately equal to the median M&I Table A amount, and MWDSC, the largest SWP contractor that also has Table A amount changes that are unrelated to the proposed project. Note that Group One also includes KCWA's M&I Table A amount

The Baseline's allocations include AG-first cuts during 1999-2002 (Table HA-8). Although the Baseline includes a 6% Article 18(a) AG-first reduction for AG Table A allocations in 1999, the proposed project had no Article 18(a)-related effect on Group One's Table A allocations in 1999 because the AG-first reduction did not increase M&I Table A allocations. In 2000-2002, the effects of the pre-Monterey Amendments' Article 18(a) provisions were more pronounced because almost all SWP contractors requested 100% of their Table A (except MWDSC in 2000).

In these years, the total SWP Table A requests (AG and M&I combined) were much greater than the SWP's Table A water supply available for allocation. The results demonstrate that the proposed project reduced allocations for all Group One contractors.. The proposed project caused annual reductions in Table A allocation of approximately 26%, and 8% in 2001, and 2002, respectively (Table HA-19). The 45,000 AF Table A retirement by KCWA and Dudley Ridge slightly offsets the effect of the proposed project's Article 18(a) revision by slightly increasing allocations to all contractors. This effect is more evident in 2003-2005.

In 2003-2005, total SWP Table A requests were still greater than the water supply available for Table A allocation, but the Department could no longer impose Article 18(a) AG-first cuts in the Baseline because of the Article 18(a) cap of 100% in a seven-year period. Therefore, the Department applied equal reductions to Table A allocations of both M&I and AG Table A amounts. This study shows that in years when the Article 18(a) cap restricts Ag-first cuts, the Baseline's allocation cuts are identical to the proposed project's cuts under the revised Article 18(a); therefore, the proposed project's Article 18(a) provisions had no effect in these years, although the proposed project's 45,000 AF retirement slightly increased M&I allocations during 2003-2005 (Table HA-19).

3.1.2 Effects of the Proposed Project on Agricultural Contractors With No Table A Transfers or Retirements – Group Two

Four contractors are in Group Two: Empire Westside, Oak Flat, Kings, and Tulare. Table HA-20 shows the proposed project's effect on Group Two contractors. In many respects, the proposed project's effect on Group Two is the opposite of the proposed project's effect on Group One contractors. While contractors with M&I Table A lost allocation because of the proposed project's elimination of the AG-first shortage provision of Article 18(a), contractors with AG Table A received higher allocations. The 45,000 AF Table A amount retirement by KCWA and Dudley Ridge also slightly increased allocations for Group Two contractors in 1999-2005. There was no change in Table A allocation for Group Two contractors from 1996 to 1998.

During 1999-2002, Group Two received higher allocations from the proposed project due to the elimination of the Article 18(a) AG-first shortage provision and the 45,000 AF retirement. This beneficial effect was most pronounced in 2001. In that year, the Baseline included a 50% AG-first cut, the maximum allowed under the Baseline's original Article 18(a) provisions. The Baseline also included an additional 47% shared cut to all Table A across the board in 2001. As a consequence, Baseline deliveries to Group Two contractors were extremely low in 2001, approximately 3% of full Table A requests. The deliveries under the proposed project in 2001, on the other hand, were over twelve times these Baseline deliveries.

Once the Article 18(a) AG-first cumulative seven-year 100% cap is reached, the Baseline and proposed project allocations in 2003-2005 are very similar. The only difference is that the proposed project allocates slightly more water to Group Two contractors in each year due to the retirement of 45,000 AF of Table A amount (Table HA-20).

3.1.3 Effects of the Proposed Project on M&I Contractors With Table A Transfers – Group Three

This group includes six SWP M&I contractors that purchased additional Table A amounts from agricultural contractors. For the years prior to each Group Three contractor's Table A acquisition, Group Three contractors experienced the same Article 18(a) and 45,000 AF Table A retirement effects of the proposed project as the Group One contractors (Table HA-21). However, following their respective transfers, Group Three contractors received more water than Group One contractors. From 2002-2005 Group Three contractors received allocation increases of 13-78%.

The acquisition of additional SWP Table A amounts and the effect of AG requests associated with these Table A transfers have unique and direct effects on each Group Three contractor's Table A allocation. The following analysis discusses each of the Group Three contractors separately.

3.1.3.1 Napa County FC&WCD

In 2001, Napa purchased 4,025 AF of AG Table A amount from KCWA. The acquisition of AG Table A increased Napa's Table A allocation in 2001 and subsequent years, but the allocation provided by the additional Table A amount[17] was not enough to offset the effect of the proposed project's change to Article 18(a) in 2001. Napa still received a lower Table A allocation in 2001 than it would have in the Baseline, but the Table A acquisition decreased Napa's allocation reduction from 26% (Group One contractors) to only 9%.

In 2002, Napa's allocation from the Table A transfer[17] provided more water than Napa lost from the proposed project's Article 18(a) revision. Since the 2003-2005 Baseline allocations have no Article 18(a) AG cuts due to the provision's 100% limit, the proposed project's Article 18(a) changes did not reduce Napa's allocation and the 45,000 AF retirement increased Napa's allocation. The proposed project's Table A transfer further increases Napa's allocations so that Napa's final allocations are 14% to 24% above the Baseline's allocations during 2002-2005 (Table HA-21).

3.1.3.2 Solano County WA

Solano's purchase of 5,756 AF of AG Table A amount from KCWA became effective in 2001. Similar to Napa's results, implementation of the Table A transfer increased Solano's Table A allocation in 2001, but the transfer's allocation increases[17] did not offset the effect of the proposed project's Article 18(a) change. But Solano's Project allocation was only 16% less than the Baseline allocation rather than the 26% decline experienced by the Group One contractors.

[17] The project's retirement of 45 TAF by KCWA and Dudley Ridge also increases all contractors' allocations by a small amount; the retirement-related allocation effects are much smaller than the Table A transfer effects.

Solano's 2002-2005 results are also similar to Napa's results. Solano's 2002 allocation from the Table A transfer provided more water than Solano lost from the proposed project's Article 18(a) revision. Since the 2003-2005 Baseline allocations have no Article 18(a) AG-first cuts due to the provision's 100% limit, differences in Solano's Project allocations in these years are not attributable to the proposed project's Article 18(a) revision. Instead, the differences between the proposed project and Baseline after 2001 result from the proposed project's Table A amount transfer and 45,000 AF Table A amount retirement. These increase Solano's allocations from 5% to 16% during 2002-2005 (Table HA-21).

3.1.3.3 Alameda County FC&WCD, Zone 7

Beginning in 2000, Zone 7 made several proposed project-related purchases of AG Table A amounts from KCWA and Tulare. These purchases increased Zone 7's Table A allocations in 2000 and all subsequent years of the historical study. Zone 7's percent increase in allocation ranged from 28% to 76% during 2000-2005.

Zone 7's acquisitions offset the reductions experienced by Group One contractors due to the proposed project's elimination of the AG-first shortage provision of Article 18(a). In addition, Zone 7's proposed project-related Table A amount acquisitions and the 45,000 AF Table A amount retirement raised Zone 7's SWP allocations above the Baseline allocations. In 2001, although Group One contractors suffered a 26% reduction in Table A allocation, Zone 7 received an allocation 28% greater than its Baseline allocation (Table HA-21).

3.1.3.4 Castaic Lake WA

Castaic previously purchased 12,700 AF of AG Table A amount from Devil's Den in 1991 before implementation of the proposed project; therefore, Castaic has 12,700 AF of AG Table A amount under both the Baseline and proposed project.

In 2000, Castaic purchased an additional 41,000 AF of Table A amount from KCWA.[18] These varying mixtures of Table A amounts in the baseline and proposed project interact to give Castaic a unique series of proposed project effects. The proposed project's elimination of the Article 18(a) AG-first cutback reduces Castaic's allocations for its 41,500 AF of Table A amount while concurrently increasing allocations for Castaic's 12,700 AF of agricultural Table A amount. In combination with Castaic's 41,700 Table A amount acquisition, the proposed project increases Castaic's SWP allocations from 66% to 78% during 2000-2005 (Table HA-21).

[18] The Monterey Amendment Settlement Agreement recognizes that this transfer is not finalized and is being implemented by DWR and CLWA on an interim basis. The transfer is included in this study to provide an estimation of the historic allocation effects of interim implementation and to allow predictions of future allocation effects.

3.1.3.5 Mojave WA

Mojave was the first M&I contractor to acquire AG Table A amounts after signing the Monterey Amendments. Consequently, Mojave had 25,000 AF of AG Table A amount from 1998 to 2005 of this historical study. Mojave only requested 20,000 AF of Table A water in 1999, this affected its M&I allocation in 1999. Mojave's Table A allocations under the proposed project did increase in 2000-2005 by up to 52% due to the Table A amount acquisition and the previously discussed 45,000 AF Table A amount retirement (Table HA-21).

3.1.3.6 Palmdale WA

Palmdale purchased 4,000 AF of AG Table A amount from KCWA in 2000. This proposed project-related purchase and the 45,000 AF Table A amount retirement increased Palmdale's Table A allocation in five years (2000 and 2002-2005) by 13% to 25%. In 2001, however, Palmdale's Table A acquisition did not provide enough water to counteract the effect of the proposed project's Article 18(a) change, and Palmdale received a 9% reduction in Table A water allocation under the proposed project than it would have under the Baseline. But this reduction of 9% was less than the 26% reduction that Group One contractors experienced—and what Palmdale would have experienced if it had not purchased some AG Table A amount with implementation of the proposed project (Table HA-21).

3.1.4. Effects of Proposed Project on Agricultural Contractors With Table A Transfers or Retirements – Group Four

Group Four contains the two agricultural contractors that had proposed project-related Table A changes. KCWA and Dudley Ridge retired a combined 45,000 AF of Table A amount as specified in Article 53 of the Monterey Amendments. KCWA also transferred Table A amounts to various M&I contractors.

The 45,000 AF Table A amount retirement by KCWA and Dudley Ridge reduced their allocation by up to 8%; however, that reduction was offset by the proposed project's elimination of the Article 18(a) "AG-first" shortage provision. Consequently, the effects of the proposed project on the Group Four contractors vary depending upon the interaction of their Table A amount changes and the Article 18(a) changes. The following analysis discusses each of the Group Four contractors separately (Table HA-22).

3.1.4.1 Dudley Ridge

Dudley Ridge received a slightly lower Table A allocation in 1999 under the proposed project due to its retirement of 4.33 thousand acre-feet (TAF) of Table A amount. The 4.33 TAF

retirements represented 8.1% of Dudley Ridge's Baseline Table A amount, but due to the proposed project's Article 18(a) change and KCWA's 40.33 TAF Table A amount retirement, Dudley Ridge's 1999 allocation fell only 2%. In 2001-2002, Dudley Ridge received a higher Table A allocation due to the proposed project's elimination of Article 18(a)'s AG-first allocation provisions and KCWA's Table A retirement.

3.1.4.2 KCWA

KCWA changed its Table A through transfers, sales, and retirement, which complicates its analysis. Similar to other agricultural contractors, KCWA received more water during 2000-2002, due to the proposed project's Article 18(a) changes and Dudley Ridge's 4.33 TAF Table A amount retirement. The percent increase in KCWA's Table A allocation in each year of this period was less than other agricultural contractors because KCWA transferred AG Table A amounts during this period, which reduced its Table A amount below the Baseline Table A amount. In 2003-2005 when the Article18(a) "AG-first" cuts were not applied in the Baseline, KCWA still received a lower allocation of Table A under the proposed project because of KCWA's transfer and retirement of Table A amounts.

From an amendment to the long-term water supply contract, starting in 1998, KCWA sold Mojave 25,000 AF of its SWP entitlement. This was the first sale under the provisions of the Monterey Amendments that allow for the sale of 130,000 AF of agricultural entitlements to contractors for urban use.

A second factor also complicates any analysis of the proposed project's effects on KCWA. Although KCWA's Table A retirement and transfers confound the proposed project's Article 18(a) and Dudley Ridge Table A retirement effects, KCWA's Table A retirements and transfers apply to specific KCWA member agencies rather than uniformly to all of its member agencies. Thus, the "Group Four" effects described in this section apply to KCWA's member units that transferred Table A amounts.[21] Other member units of KCWA did not modify their SWP Table A amount contracts with KCWA; therefore, the proposed project's effects on these member units[22] are identical to Group Two contractors rather than Group Four (Table HA-22).

3.1.5. Summary of Proposed Project's Effects

As indicated in the introduction, the historical allocation study analyzes the effects of three major changes caused by the Monterey Amendments: Table A transfers, Table A retirements, and the Article 18(a) revision. The following text summarizes the results of these individual changes.

3.1.5.1 Effect of Table A Retirement

[21] Belridge Water Storage District, Berrenda Mesa Water District, Lost Hills Water District, and Wheeler Ridge-Maricopa WSD

[22] Cawelo WD, Henry Miller WD, Kern Delta WD, Improvement District No. 4, Rosedale-Rio Bravo WSD, Semitropic WSD, Tehachapi-Cummings County WD, and West Kern WD.

The proposed project's Table A retirements from KCWA and Dudley Ridge increase the Table A allocations of all other SWP contractors because the retirements reduce the total Table A requests of KCWA and Dudley Ridge and thereby leave a small amount of additional water available for allocation to all the SWP contractors. Theoretically, KCWA and Dudley Ridge benefit from the others retirement of Table A amount in the same way, but the incremental benefit is not sufficient to offset the allocation losses incurred by each contractor's own Table A amount retirement. The allocation percentage increase attributable to the retirements depends on the amount of water available to the SWP for allocation; however, since the 45,000 AF of Table A amount represents approximately 1% of the SWP's total Table A amount, the Table A retirement generally increased allocations in this study by 1% in years when all contractors requested their full Table A amount. This effect is highlighted in 2003-2005 when the Article 18(a) change does not affect allocations because the "agriculture-first" reduction was exhausted during 1999-2002.

3.1.5.2 Effect of Article 18(a) Change

The Baseline's original Article 18(a) provision of the SWP long term water supply contracts shifted a large amount of Table A allocation from Agricultural to M&I contractors when the SWP could not satisfy all Table A requests. The proposed project eliminated this feature of Article 18(a), and instead required the Department to reduce all SWP contractors' Table A amounts equally in years when the SWP Table A water supply could not meet all Table A requests.

In general, this change greatly increased agricultural contractors' Table A allocations and reduces M&I contractors' Table A allocations. This trend is evident in the analysis period, but the results also emphasize that the annual effects of the Article 18(a) change depend on the SWP's annual hydrology and application of the Article 18(a) cumulative cap of 100% AG-first cuts over a seven-year period.

3.1.5.3 Effect of Table A Transfers

The proposed project included or possibly facilitated[23] many individual Table A amount transfers. Most of these were from agricultural contractors to M&I contractors. In general, agricultural contractors that sold Table A amounts receive reduced Table A allocations and contractors that purchased Table A amounts received increased allocations. The specific increase in allocation varies depending on the Table A amount purchased and the SWP Table A allocation in any particular year. Some contractors still receive lower or higher Table A allocations despite their participation in a Table A amount transfer because the proposed project's Article 18(a) effects can exercise a greater influence on Table A allocations in some years than the Table A amount transfers. In other cases, such as Zone 7 and Castaic, the Table A amount transfers clearly had the greatest effect.

[23] The Monterey Amendments may have facilitated transfers by improving the reliability of agricultural contractors' SWP supplies and by improving the value of agricultural contractors' Table A amounts, making them more desirable to other water users.

3.2 Effects of NPA1

NPA1 differs from the Baseline only because it includes all the Table A amount transfers included in the proposed project, except the 41,000 AF transfer from KCWA to CLWA. Although the EIR's NPA1 includes operation of a SWP component in the Kern Fan Element property, this study assumes that SWP water supplies remain identical to historical SWP water supplies for 1996-2005; therefore, this study does not evaluate the potential allocation effects of an SWP component in the Kern Fan Element property. NPA1 implements Article 18(a) the same way as the Baseline. The allocation changes as a result of the Table A transfers are the only differences between SWP contractor allocations under the NPA1 and the Baseline. Contractors that purchased Table A amounts receive higher Table A allocations in NPA1 than in the Baseline, and contractors that sold Table A amounts receive lower Table A allocations in NPA1 than in the baseline. Tables HA-23 through HA-26 display these effects for the contractors with and without Table A transfers in the NPA1.

3.2.1 Effects of NPA1 on M&I Contractors With No Table A Transfers – Group One

The Group One contractors experienced almost no effects when the Baseline is compared to NPA1 (Table HA-23). These M&I contractors did not participate in any Table A transfers in NPA1; therefore, their allocations under the Baseline and the NPA1 are virtually identical. Castaic Lake Water Agency is a member of Group One because the 41,000 AF Table A amount transfer from KCWA is not included in NPA1. A greater AG-first reduction in any year would benefit Group One contractors because they posses mostly M&I Table A amounts.

3.2.2. Effects of NPA1 on Agricultural Contractors With No Table A Transfers or Retirements – Group Two

Group Two contractors experienced minor (up to 2% in 1999) changes to their allocations in NPA1 because they have no Table A amount changes and administration of Article 18(a) remains unchanged from the baseline (Table HA-24).

3.2.3. Effects of NPA1 on M&I Contractors That Transferred Table A – Group Three

Group Three contractors in NPA1 are the same contractors described in the proposed project with the exception of Castaic Lake Water Agency.[24] Castaic is not a part of Group Three because NPA1 does not incorporate the 41,000 acre-foot transfer of Table A amount that occurs in the proposed project. Consequently, Castaic is part of Group One for purposes of analysis of NPA1. Results are depicted in Table HA-25.

[24] Group Three in NPA1 includes Napa, Solano, Zone 7, Castaic, Mojave, and Palmdale

Group Three contractors experienced allocation increases in NPA1 from 2001 through 2005 because their purchases of AG Table A amounts increase their overall Table A amount, while Article 18(a) remains the same as in the Baseline. With the benefits of the AG-first reduction of the pre-Monterey Article 18(a), Group Three contractors gain from any purchase of AG Table A in NPA1. The annual allocation benefit of the purchased AG Table A to any particular contractor, however, varies because it is still subject to the Article 18(a) AG-first reductions. The actual benefit in Table A allocation to a particular Group Three contractor that purchased AG Table A is roughly equal to the amount of AG Table A purchased, discounted by the Baseline SWP allocation percentage to AG Table A in that year.

An interesting effect of NPA1 is the decreased SWP demand due to KCWA's transfer of 25 TAF of Table A amount to Mojave Water Agency in 1998. The assumptions of this study are that AG contractors requested their maximum Table A amounts since 1995; therefore, KCWA would have requested the 25 TAF of Table A amount in the Baseline. The historic requests, however, reflect that Mojave did not request the additional 25 TAF that it purchased until 2000. Consequently, there is a decrease of 25 TAF of SWP demand in NPA1 during the period 1998-1999. The period 1998-1999, however, was a wet period when contractor demands were not at their maximum and in which every contractor received 100% allocations every year; therefore, this slight decrease in SWP demand during 1998 and 1999 probably did not raise SWP Table A allocations for other contractors (Table HA-25).

3.2.4. Effects of NPA1 on Agricultural Contractors That Transferred Table A – Group Four

This analysis divided Group Four contractors into two categories. KCWA transferred Table A amounts to other contractors and thereby reduced its Table A amount during the analysis period. Dudley Ridge did not make any Project related transfers and therefore it experienced minor (up to 2% in 1999) changes to its allocation, similar to the NPA1 related effects to Group Two contractors. KCWA received lower Table A allocations after transferring Table A amounts. The amount of the reduction in Table A allocation depends on how much Table A amount was cumulatively transferred. This generally increased throughout the analysis period as KCWA more Table A amounts. As noted earlier in Section 3.1.4.2, KCWA's Table A amount transfers apply to specific KCWA member agencies rather than uniformly to all KCWA member agencies. KCWA member agencies that did not modify their portion of KCWA's SWP Table A amount have water supply effects identical to Group Two contractors.

While all AG contractors in this group are still subject to the AG-first reductions of Article 18(a), this effect is the same as in the Baseline and the only actions that affect Table A allocations in this analysis are the amounts of Table A possessed by each contractor. (See Table HA-26)

3.2.5. Summary of NPA1 Effects

NPA1's one major effect is either an increase or decrease in particular contractor's Table A allocations depending upon whether they purchased or sold Table A amounts. Contractors that did not change Table A amount experience no Table A allocation changes.

3.2.5.4 Long-Term Effects of NPA1

NPA1 and the Baseline demonstrate some of the implications of the mismatch between SWP contractors' Table A requests and SWP water supplies that began in the 1990's. Beginning during the 1996-2005 period and likely into the foreseeable future, the SWP could expect that contractors' water requests would exceed the SWP's available water supply for allocation in most years. The extent of this difference would depend upon annual hydrology and any additional facilities or projects the SWP completes in the future. In any event, the Department would be required to apply Article 18(a) AG-first reductions as often as permitted by Article 18(a). Only a string of multiple wet years where SWP water supplies for allocation exceeded contractors' requests (generally 4.2 MAF but perhaps as low as 3.3 MAF in some years when contractors' service areas experience exceptionally wet conditions) would interrupt this cycle of water allocation reductions.

Agricultural contractors would experience a reduced and unpredictable water supply as M&I Table A requests increased under both the Baseline and NPA1; however, under NPA1, some Agricultural contractors would receive even less water than in the Baseline because of participation in Table A amount transfers. On the other hand, M&I contractors would receive the same amount of water under the Baseline and NPA1, unless they purchased additional Table A amount which would increase their Table A allocation under NPA1.

3.3 Effects of CNP

<u>Table A Allocations</u>
CNP allocates Table A water using the same general method as the Baseline and NPA1; however, the Table A amounts possessed by the SWP contractors are lowest in CNP. As previously mentioned in the discussion of the Baseline and NPA1, Article 18(a) is applied in years when the SWP's Table A water supply is less than the total Table A amount request of all the contractors. In CNP, as in the Baseline and NPA1, the Article 18(a) AG-first reduction is limited to up to 50% in any one year and a seven-year running total of 100%. After all Table A amount requests have been satisfied, then any remaining water is allocated as scheduled surplus or XA water.

During the years 1996-2005, the SWP was able deliver 100% allocations of Table A water to both AG and M&I contractors in CNP every year except 2001. Conditions were so dry in 2001 that even though the SWP Table A amount totaled only 1.9 MAF there was still a need to apply the shortage provisions of Article 18(a) because there was roughly only 1.6 MAF of water available to the SWP to deliver. In 2001, M&I Table A requests received a virtually full allocation of 99.25%, but AG Table A requests only received an allocation of 49.25% (Table HA-10). As indicated by the percentages, the AG-first shortage was applied to the fullest extent allowed (50%) and then an additional shared reduction of 0.75% was imposed on both AG and M&I Table A requests. The Table A allocations in CNPA3 and CNP Alternative 4 (CNPA4) are identical. Differing allocations of so-called XA water and scheduled surplus cause the real differences in water allocations between the two CNP.

Several factors help clarify the results reported for the CNP. One factor to understand is that the effect of Article 18(a) in CNP is different from its effect in the Baseline because 18(a) is applied more frequently in the Baseline when the SWP Table A amount is not reduced. Refer to Table HA-12 to see the Table A water allocations for CNP. Secondly, the EIR assumes that there are no Table A transfers in CNP, so any effects of CNP are attributable to the difference in application of Article 18(a) and the difference in allocation of scheduled surplus and XA water.

3.3.1 Effects of CNPA3

Many contractors experienced the same effects as other contractors in CNPA3. As with the other discussions, the contractors can be grouped in categories. The general effects on each group of contractors are discussed below.

3.3.1.1 Effects of CNPA3 on M&I Contractors

CNPA3 reduced overall water deliveries to most M&I contractors by 9 – 22% during 1999-2002 and caused minimal reduction (1%) in 1996-1998 due to the available water beyond the 1.9 MAF. Article 18(a) was not as beneficial to contractors with M&I Table A amounts in CNP because there is less M&I Table A that received priority when 18(a) was applied.

M&I contractors that received only M&I Table A amounts were affected by CNPA3 similarly. Every contractor in this group requested 100% of its M&I Table A amount during 1996-2005. In general, all these contractors experienced a decrease in allocations of from 9% to 22% in 1999-2002, but CNPA3 had little effect on allocations during 2003-2005. The results for all contractors in this group are detailed in Table HA-28.

Note that MWD and Mojave did not request the maximum amount of water in 1998 and 1999. Consequently, CNPA3 affected these contractors differently than the rest of the group in those years (Table HA-28).

CNPA3's effect from 1999 to 2002 is a result of the reduced effect of Article 18(a) in CNPA3 compared to the Baseline. Recall that one of Article 18(a)'s biggest effects is to shift allocation from AG to M&I Table A amounts through application of the AG-first shortage provision when SWP Table A supplies are less than Table A requests. In CNPA3, however, Article 18(a)'s effect is reduced because it only applies to the first 1.9 MAF of SWP contractor requests.

Consequently, when SWP supplies are less than the Table A and XA water demand, M&I contractors only receive the Article 18(a) benefits for their initial Table A amount requests, which are lower than in the Baseline. After receiving their Table A allocation, these contractors get the remaining XA water allocation in proportion to the share of their Table A amounts compared to the total Table A amounts of the SWP. Article 18(a) does not apply to XA water allocations. This means that if there is a shortage of XA water, these contractors must equally share any reduction in XA water deliveries with all other contractors, including those with AG Table A amounts.

3.3.1.2 Effects of CNPA3 on Agricultural Contractors

AG contractors with only AG Table A amounts experienced the same allocation effects from CNPA3: reductions of 17% and 1% in 1999 and 2000, increases of 290% in 2001, and 31% increases in 2002. Contractors in this group received from 63% to 290% more allocation from the SWP from 1999-2002, but then experienced mixed effects from 2003-2005. Table HA-29 shows the detailed results for this group.

The increase in allocation for this group is basically the inverse of the previous group of M&I contractors. Article 18(a)'s AG-first shortage provision plays a decreased role in CNP because there is a lower total M&I Table A request that must be satisfied first. As mentioned, when Article 18(a) AG-first reductions are applied, it increases the allocation to M&I Table A amounts at the expense of AG Table A amounts. The years 1999-2002 are years when the AG-first reduction is applied in the Baseline, but it is only applied in 2001 in CNP. Contractors with AG Table A received increased allocations, especially in 2001(290%), in years when Article 18(a) was applied.

3.3.2 Effects of CNPA4

CNPA4 is more complicated than CNPA3 because the remaining available water is allocated according to the pre-Monterey Article 21 provisions. As discussed in Section 2.3.5.2, agricultural and groundwater replenishment use had the highest priority for allocation of scheduled surplus under this method. One of the key assumptions, therefore, is how much groundwater replenishment and agricultural use should be assigned to each contractor. Table HA-7 lists the assumptions used for development and analysis of this allocation method.

Because the Article 21 allocation method applied to scheduled surplus water contains numerous procedures, most contractors experience unique individual effects in CNPA4; however, they can be grouped into three general categories for discussion purposes. The three groups are agricultural contractors, M&I contractors with little agricultural and groundwater use, and M&I contractors with high agricultural or groundwater replenishment use. Tables HA-30 and HA-31 provide results for selected agricultural and M&I contractors.

3.3.2.1 Effects of CNPA4 on AG Contractors

Contractors in this group received more water in CNPA4 than in the Baseline in every year for two major reasons (the years 1996-1998 saw no allocation changes for either scenario). First, these contractors have high rates of agricultural and groundwater replenishment use, which receives priority in CNPA4's Article 21 allocation provisions. Second, they all are geographically located in the San Joaquin group of contractors, which receives 69% of the scheduled surplus water that is directed to the contractors downstream of Dos Amigos Pumping Plant. Due to the Article 18(b) invocation and application of Article 21 provisions, AG contractors receive a general increase in allocations in every year of the analysis (Table HA-31).

3.3.2.2 Effects of CNPA4 on M&I Contractors

Contractors in this group have low scheduled surplus water requests for groundwater replenishment or agricultural use. Two major factors caused this group to receive lower allocations of SWP water in every year of the analysis. First, these contractors all have very high municipal water use rates and little agriculture and groundwater replenishment use. Second, many of these contractors are in the Southern California contractor sub-group, which receives only 29% of the scheduled surplus water delivered to contractors downstream of Dos Amigos Pumping Plant.

Individual contractor's results vary for several reasons. The EIR assumes that some of these contractors have some amount of agricultural or groundwater replenishment use, and these uses elevate the priority of the M&I contractor's request for scheduled surplus water, which increases the contractor's scheduled surplus water allocation. The geographic group the contractor is in causes another slight variation in scheduled surplus allocations. Contractors in this analysis group fall into several geographic groups for purposes of Article 21's allocation provisions. These geographic groups are upstream of Dos Amigos Pumping Plant, Central Coast, and Southern California (Table HA-30).

3.3.2.3 Effects of CNPA4 on M&I Contractors with high amounts of groundwater replenishment or agricultural water use

These M&I contractors have a relatively high amount of groundwater replenishment or agricultural water uses as specified in Article 21. As a result, this group has a higher priority for scheduled surplus water than the other M&I contractors without such water uses. The contractors in this group, Mojave and Coachella were assessed a 100% groundwater replenishment value; therefore, each contractor experienced the same effects from CNPA4. These contractors are in the Southern California sub-group; since Article 21 initially allocates only 29% of the scheduled surplus water supply available downstream from Dos Amigos Pumping Plant to this sub-group, these M&I contractors receive lower scheduled surplus water allocations than San Joaquin Valley agricultural contractors.

CNPA4 only caused a reduction in allocation to Coachella in 2001 because that is the only year when Article 18(a) AG-first cuts had to be imposed. Recall that the AG-first reduction provision of Article 18(a) has less value in CNP because the total AG Table A has been reduced and there is proportionately less AG Table A to cut for the benefit of M&I contractors. In the years 2002-2005, these contractors experienced increased allocations under CNPA4 ranging from 12% - 37%. Table HA-30 details the effects of CNPA4 for each of these contractors.

3.4 Summary of CNP Effects

3.4.1 Table A

CNP reduced Table A allocations because Table A amount were reduced by approximately 55%. During 1996-2005, SWP Contractors received 100% allocations of Table A in every year except

2001. 2001 was the only year that Article 18(a) was applied to impose a 50% AG-first reduction and a very slight shared reduction of less than 1%. It appears that in CNP, contractors would be more likely to get full Table A amount allocations, but these would be considerably lower than Table A allocations in the Baseline in almost all years.

3.4.2 Article 18(a)

Both CNP alternatives applied Article 18(a) less frequently because the Table A amounts of all contractors were reduced. Article 18(a) will only apply when the SWP supply is less than 1.9 MAF. Under similar circumstances in the Baseline, the SWP supply would have to be near 4.2 MAF every year to avoid application of Article 18(a). This indicates that Article 18(a)'s effects on Table A allocations in the CNP would be less than Article 18(a)'s effects in the Baseline.

3.4.3 Scheduled Surplus and EX-Table A Water

Ex-Table A water or scheduled surplus water, makes up a considerable amount of deliverable water in many years under the CNP alternatives. As expected this analysis shows that both the apportioned and surplus allocation methods in CNP increase water allocations to agricultural contractors and reduce allocations to M&I contractors. In the apportioned method all contractors receive scheduled surplus based on their share of the total SWP Table A amount. This reduces the advantage that M&I contractors have from Article 18(a) AG-first reductions. In the scheduled surplus method, M&I contractors are further disadvantaged because their scheduled surplus requests are usually not for the higher priority uses of groundwater replenishment or agriculture specified in Article 21. As a result, agricultural contractors get much more of the water as scheduled surplus under this method than they would as Table A in the Baseline.

3.4.4. Long-Term Effects of CNP

Both CNP alternatives would require the Department to invoke Article 18(a) much less frequently because in many years the SWP would have 1.9 MAF to allocate. Neither CNP alternatives would reduce the SWP's annual water deliveries, but they would complicate the SWP's allocation accounting and modify the distribution of water to SWP contractors. The results of this analysis indicate that most M&I contractors would receive less water in most years under either CNP alternative. This appears to run counter to the purposes of the SWP, and sends reduced amounts of water to the contractors who have paid and will pay the most for the construction, operation, and maintenance of the SWP.

Note: For purposes of space and readability, some of the tables use the term "Project" instead of "Proposed Project".

Table HA-1. List of Article 18(a) actions in the Baseline and NPA1.

Year	Water Year Type	No Table A Allocation Reductions[25]	AG-First Allocation Reductions	AG-First Allocation Reductions & Additional Allocation Reductions for All Contractors	No AG-First Allocation Reductions [26] & Allocation Reductions for All Contractors
1996	W	X			
1997	W	X			
1998	W	X			
1999	W	X			
2000	AN		X		
2001	D			X	
2002	D			X	
2003	AN				X
2004	BN				X
2005	AN				X

[25] Allocation reduction as used in this table denotes a reduction in allocations of Table A water.
[26] No agriculture-first Article 18(a) allocation cuts occur in these years due to the limit of cumulative 100% allocation cuts in a seven-year period

Table HA-2. List of Article 18(a) actions in the CNP.

Year	Water Year Type	No Table A Allocation Reductions[27]	AG-First Allocation Reductions	AG-First Allocation Reductions & Additional Allocation Reductions for All Contractors	No AG-First Allocation Reductions [28] & Allocation Reductions for All Contractors
1996	W	X			
1997	W	X			
1998	W	X			
1999	W	X			
2000	AN	X			
2001	D			X	
2002	D	X			
2003	AN	X			
2004	BN	X			
2005	AN	X			

[27] Allocation reduction as used in this table denotes a reduction in allocations of Table A water.
[28] No agriculture-first Article 18(a) allocation cuts occur in these years due to the limit of cumulative 100% allocation cuts in a seven-year period

Table HA-3. Revisions of Bulletin 132 Table B-4 Values to Convert Published Monterey Amendments (Project) Table A Amounts to Baseline Table A Amounts

Year	Contractor	MA Change to Baseline	Reason
1996	KCWA	Increase Table AG by 40,670 af	Reverse retirement by KCWA
1996	Dudley Ridge	Increase Table A by 4,330 af	Reverse retirement by Dudley Ridge
1998	KCWA	Increase AG Table A by 25,000 af	Reverse transfer to Mojave
1998	Mojave	Decrease AG Table A by 25,000 af	Reverse transfer from KCWA
2000	KCWA	Increase AG Table A by 22,000 af	Reverse transfer to Zone 7
2000	KCWA	Increase AG Table A by 4,000 af	Reverse transfer to Palmdale
2000	KCWA	Increase AG Table A by 41,000 af	Reverse transfer to Castaic
2000	Zone 7	Decrease AG Table A by 22,000 af	Reverse transfer from KCWA
2000	Palmdale	Decrease AG Table A by 4,000 af	Reverse transfer from KCWA
2000	Castaic	Decrease AG Table A by 41,000 af	Reverse transfer from KCWA
2001	KCWA	Increase AG Table A by 4,025 af	Reverse transfer to Napa
2001	KCWA	Increase AG Table A by 5,756 af	Reverse transfer to Solano
2001	KCWA	Increase AG Table A by 12,219 af	Reverse transfer to Zone 7
2001	Napa	Decrease AG Table A by 4,025 af	Reverse transfer from KCWA
2001	Solano	Decrease AG Table A by 5,756 af	Reverse transfer from KCWA
2001	Zone 7	Decrease AG Table A by 12,219 af	Reverse transfer from KCWA

Table HA-4. SWP Contractors' Table A amounts in Baseline, Project, and Alternatives.

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Napa County	1996	10,425	0	10,425	0	10,425	0	4,766	0
	1997	11,065	0	11,065	0	11,065	0	5,091	0
	1998	11,710	0	11,710	0	11,710	0	5,386	0
	1999	15,850	0	15,850	0	15,850	0	7,231	0
	2000	16,325	0	16,325	0	16,325	0	7,444	0
	2001	16,700	0	16,700	4,025	16,700	4,025	7,611	1834
	2002	17,075	0	17,075	4,025	17,075	4,025	7,780	1834
	2003	17,450	0	17,450	4,025	17,450	4,025	8,021	0
	2004	17,825	0	17,825	4,025	17,825	4,025	8,114	1832
	2005	18,200	0	18,200	4,025	18,200	4,025	8,291	1834
Solano County	1996	37,800	0	37,800	0	37,800	0	17,280	0
	1997	38,250	0	38,250	0	38,250	0	17,597	0
	1998	38,710	0	38,710	0	38,710	0	17,804	0
	1999	39,170	0	39,170	0	39,170	0	17,870	0
	2000	39,620	0	39,620	0	39,620	0	18,067	0
	2001	40,080	0	40,080	5,756	40,080	5,756	18,266	2623
	2002	40,540	0	40,540	5,756	40,540	5,756	18,471	2623
	2003	41,000	0	41,000	5,756	41,000	5,756	18,845	0
	2004	41,450	0	41,450	5,756	41,450	5,756	18,869	2620
	2005	41,500	0	41,500	5,756	41,500	5,756	18,906	2622
Alameda Zone 7	1996	44,000	0	44,000	0	44,000	0	20,114	0
	1997	46,000	0	46,000	0	46,000	0	21,163	0
	1998	46,000	0	46,000	0	46,000	0	21,157	0
	1999	46,000	0	46,000	0	46,000	0	20,986	0
	2000	46,000	0	46,000	22,000	46,000	22,000	20,976	10032
	2001	46,000	0	46,000	34,219	46,000	32,000	20,964	14583
	2002	46,000	0	46,000	34,219	46,000	32,000	20,959	14580
	2003	46,000	0	46,000	34,219	46,000	32,000	21,143	0
	2004	46,000	400	46,000	34,619	46,000	34,619	20,940	15759
	2005	46,000	400	46,000	34,619	46,000	34,619	20,956	15771
Alameda	1996	42,000	0	42,000	0	42,000	0	19,200	0
	1997	42,000	0	42,000	0	42,000	0	19,323	0
	1998	42,000	0	42,000	0	42,000	0	19,317	0
	1999	42,000	0	42,000	0	42,000	0	19,161	0
	2000	42,000	0	42,000	0	42,000	0	19,152	0
	2001	42,000	0	42,000	0	42,000	0	19,141	0
	2002	42,000	0	42,000	0	42,000	0	19,137	0
	2003	42,000	0	42,000	0	42,000	0	19,305	0
	2004	42,000	0	42,000	0	42,000	0	19,119	0
	2005	42,000	0	42,000	0	42,000	0	19,134	0

Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Santa Clara Valley WD	1996	100,000	0	100,000	0	100,000	0	45,713	0
	1997	100,000	0	100,000	0	100,000	0	46,006	0
	1998	100,000	0	100,000	0	100,000	0	45,993	0
	1999	100,000	0	100,000	0	100,000	0	45,622	0
	2000	100,000	0	100,000	0	100,000	0	45,600	0
	2001	100,000	0	100,000	0	100,000	0	45,573	0
	2002	100,000	0	100,000	0	100,000	0	45,563	0
	2003	100,000	0	100,000	0	100,000	0	45,963	0
	2004	100,000	0	100,000	0	100,000	0	45,522	0
	2005	100,000	0	100,000	0	100,000	0	45,556	0
SLO	1996	25,000	0	25,000	0	25,000	0	11,428	0
	1997	6,215	0	6,215	0	6,215	0	2,859	0
	1998	6,215	0	6,215	0	6,215	0	2,858	0
	1999	25,000	0	25,000	0	25,000	0	11,406	0
	2000	25,000	0	25,000	0	25,000	0	11,400	0
	2001	25,000	0	25,000	0	25,000	0	11,393	0
	2002	25,000	0	25,000	0	25,000	0	11,391	0
	2003	25,000	0	25,000	0	25,000	0	11,491	0
	2004	25,000	0	25,000	0	25,000	0	11,380	0
	2005	25,000	0	25,000	0	25,000	0	11,389	0
Santa Barbara	1996	45,486	0	45,486	0	45,486	0	20,793	0
	1997	38,986[29]	0	38,986	0	38,986	0	17,936	0
	1998	38,986	0	38,986	0	38,986	0	17,931	0
	1999	45,486	0	45,486	0	45,486	0	20,752	0
	2000	45,486	0	45,486	0	45,486	0	20,742	0
	2001	45,486	0	45,486	0	45,486	0	20,729	0
	2002	45,486	0	45,486	0	45,486	0	20,725	0
	2003	45,486	0	45,486	0	45,486	0	20,907	0
	2004	45,486	0	45,486	0	45,486	0	20,706	0
	2005	45,486	0	45,486	0	45,486	0	20,722	0
Dudley Ridge	1996	0	57,700	0	53,370	0	57,700	0	26377
	1997	0	57,700	0	53,370	0	57,700	0	26546
	1998	0	57,700	0	53,370	0	57,700	0	26538
	1999	0	57,700	0	53,370	0	57,700	0	26324
	2000	0	57,700	0	53,370	0	57,700	0	26311
	2001	0	57,700	0	53,370	0	57,700	0	26296
	2002	0	61,673	0	57,343	0	61,673	0	28100
	2003	0	61,673	0	57,343	0	61,673	0	28347
	2004	0	61,673	0	57,343	0	61,673	0	28075
	2005	0	61,673	0	57,343	0	61,673	0	28096

[29] For the years 1997and 1998, Santa Barbara saw a reduction of Table A entitlement of 6,500 AF due to the execution of an amendment to Santa Barbara's long- term water supply by the Department.

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Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Empire West Side	1996	0	3,000	0	3,000	0	3,000	0	1371
	1997	0	3,000	0	3,000	0	3,000	0	1380
	1998	0	3,000	0	3,000	0	3,000	0	1380
	1999	0	3,000	0	3,000	0	3,000	0	1369
	2000	0	3,000	0	3,000	0	3,000	0	1368
	2001	0	3,000	0	3,000	0	3,000	0	1367
	2002	0	3,000	0	3,000	0	3,000	0	1367
	2003	0	3,000	0	3,000	0	3,000	0	1379
	2004	0	3,000	0	3,000	0	3,000	0	1366
	2005	0	3,000	0	3,000	0	3,000	0	1367
KCWA	1996	134,600	1,023,130	134,600	982,460	134,600	1,023,130	61,530	467706
	1997	134,600	1,018,800	134,600	978,130	134,600	1,018,800	61,925	468713
	1998	134,600	1,018,800	134,600	953,130	134,600	993,800	61,907	457083
	1999	134,600	1,018,800	134,600	953,130	134,600	993,800	61,407	453393
	2000	134,600	1,018,800	134,600	886,130	134,600	926,800	61,378	422624
	2001	134,600	1,021,019	134,600	866,349	134,600	907,019	61,341	413356
	2002	134,600	1,021,019	134,600	866,349	134,600	907,019	61,328	413267
	2003	134,600	1,021,019	134,600	866,349	134,600	907,019	61,866	469293
	2004	134,600	1,018,800	134,600	864,130	134,600	904,800	61,273	411883
	2005	134,600	1,018,800	134,600	864,130	134,600	904,800	61,318	412191
Kings	1996	0	4,000	0	4,000	0	4,000	0	1829
	1997	0	4,000	0	4,000	0	4,000	0	1840
	1998	0	4,000	0	4,000	0	4,000	0	1840
	1999	0	4,000	0	4,000	0	4,000	0	1825
	2000	0	4,000	0	4,000	0	4,000	0	1824
	2001	0	4,000	0	4,000	0	4,000	0	1823
	2002	0	4,000	0	4,000	0	4,000	0	1823
	2003	0	9,000	0	9,000	0	9,000	0	4137
	2004	0	9,000	0	9,000	0	9,000	0	4097
	2005	0	9,000	0	9,000	0	9,000	0	4100
Oak Flat Irrigation District	1996	0	5,700	0	5,700	0	5,700	0	2606
	1997	0	5,700	0	5,700	0	5,700	0	2622
	1998	0	5,700	0	5,700	0	5,700	0	2622
	1999	0	5,700	0	5,700	0	5,700	0	2600
	2000	0	5,700	0	5,700	0	5,700	0	2599
	2001	0	5,700	0	5,700	0	5,700	0	2598
	2002	0	5,700	0	5,700	0	5,700	0	2597
	2003	0	5,700	0	5,700	0	5,700	0	2620
	2004	0	5,700	0	5,700	0	5,700	0	2595
	2005	0	5,700	0	5,700	0	5,700	0	2597

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Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Tulare	1996	0	118,500	0	118,500	0	118,500	0	54170
	1997	0	118,500	0	118,500	0	118,500	0	54518
	1998	0	118,500	0	118,500	0	118,500	0	54502
	1999	0	118,500	0	118,500	0	118,500	0	54062
	2000	0	118,500	0	118,500	0	118,500	0	54036
	2001	0	118,500	0	118,500	0	118,500	0	54004
	2002	0	111,527	0	111,527	0	111,527	0	50815
	2003	0	111,127	0	111,127	0	111,127	0	51077
	2004	0	96,227	0	96,227	0	96,227	0	43804
	2005	0	96,227	0	96,227	0	96,227	0	43837
AVEK	1996	138,400	0	138,400	0	138,400	0	63,267	0
	1997	138,400	0	138,400	0	138,400	0	63,673	0
	1998	138,400	0	138,400	0	138,400	0	63,655	0
	1999	138,400	0	138,400	0	138,400	0	63,141	0
	2000	138,400	0	138,400	0	138,400	0	63,111	0
	2001	138,400	0	138,400	0	138,400	0	63,073	0
	2002	138,400	3,000	138,400	3,000	138,400	3,000	63,059	1367
	2003	138,400	3,000	138,400	3,000	138,400	3,000	63,613	1379
	2004	138,400	3,000	138,400	3,000	138,400	3,000	63,002	1366
	2005	138,400	3,000	138,400	3,000	138,400	3,000	63,050	1367
Castaic	1996	41,500	12,700	41,500	12,700	41,500	12,700	18,971	5806
	1997	41,500	12,700	41,500	12,700	41,500	12,700	19,093	5843
	1998	41,500	12,700	41,500	12,700	41,500	12,700	19,087	5841
	1999	41,500	12,700	41,500	12,700	41,500	12,700	18,933	5794
	2000	41,500	12,700	41,500	53,700	41,500	53,700	18,924	24487
	2001	41,500	12,700	41,500	53,700	41,500	53,700	18,913	24473
	2002	41,500	12,700	41,500	53,700	41,500	53,700	18,909	24467
	2003	41,500	12,700	41,500	53,700	41,500	53,700	19,075	5837
	2004	41,500	12,700	41,500	53,700	41,500	53,700	18,892	24445
	2005	41,500	12,700	41,500	53,700	41,500	53,700	18,906	24464
Coachella	1996	23,100	0	23,100	0	23,100	0	10,560	0
	1997	23,100	0	23,100	0	23,100	0	10,627	0
	1998	23,100	0	23,100	0	23,100	0	10,624	0
	1999	23,100	0	23,100	0	23,100	0	10,539	0
	2000	23,100	0	23,100	0	23,100	0	10,534	0
	2001	23,100	0	23,100	0	23,100	0	10,527	0
	2002	23,100	0	23,100	0	23,100	0	10,525	0
	2003	23,100	0	23,100	0	23,100	0	10,617	0
	2004	23,100	9,900	23,100	9,900	23,100	9,900	10,516	4507
	2005	111,200	9,900	111,200	9,900	111,200	9,900	50,658	4510

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Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Crestline	1996	5,800	0	5,800	0	5,800	0	2,651	0
	1997	5,800	0	5,800	0	5,800	0	2,668	0
	1998	5,800	0	5,800	0	5,800	0	2,668	0
	1999	5,800	0	5,800	0	5,800	0	2,646	0
	2000	5,800	0	5,800	0	5,800	0	2,645	0
	2001	5,800	0	5,800	0	5,800	0	2,643	0
	2002	5,800	0	5,800	0	5,800	0	2,643	0
	2003	5,800	0	5,800	0	5,800	0	2,666	0
	2004	5,800	0	5,800	0	5,800	0	2,640	0
	2005	5,800	0	5,800	0	5,800	0	2,642	0
Desert	1996	38,100	0	38,100	0	38,100	0	17,417	0
	1997	38,100	0	38,100	0	38,100	0	17,528	0
	1998	38,100	0	38,100	0	38,100	0	17,524	0
	1999	38,100	0	38,100	0	38,100	0	17,382	0
	2000	38,100	0	38,100	0	38,100	0	17,374	0
	2001	38,100	0	38,100	0	38,100	0	17,363	0
	2002	38,100	0	38,100	0	38,100	0	17,360	0
	2003	38,100	0	38,100	0	38,100	0	17,512	0
	2004	38,100	0	38,100	0	38,100	0	17,344	0
	2005	50,000	0	50,000	0	50,000	0	22,778	0
Littlerock	1996	2,300	0	2,300	0	2,300	0	1,051	0
	1997	2,300	0	2,300	0	2,300	0	1,058	0
	1998	2,300	0	2,300	0	2,300	0	1,058	0
	1999	2,300	0	2,300	0	2,300	0	1,049	0
	2000	2,300	0	2,300	0	2,300	0	1,049	0
	2001	2,300	0	2,300	0	2,300	0	1,048	0
	2002	2,300	0	2,300	0	2,300	0	1,048	0
	2003	2,300	0	2,300	0	2,300	0	1,057	0
	2004	2,300	0	2,300	0	2,300	0	1,047	0
	2005	2,300	0	2,300	0	2,300	0	1,048	0
Mojave	1996	50,800	0	50,800	0	50,800	0	23,222	0
	1997	50,800	0	50,800	0	50,800	0	23,371	0
	1998	50,800	0	50,800	25,000	50,800	25,000	23,365	11498
	1999	50,800	0	50,800	25,000	50,800	25,000	23,176	11406
	2000	50,800	0	50,800	25,000	50,800	25,000	23,165	11400
	2001	50,800	0	50,800	25,000	50,800	25,000	23,151	11393
	2002	50,800	0	50,800	25,000	50,800	25,000	23,146	11391
	2003	50,800	0	50,800	25,000	50,800	25,000	23,349	11491
	2004	50,800	0	50,800	25,000	50,800	25,000	23,125	11380
	2005	50,800	0	50,800	25,000	50,800	25,000	23,142	11389

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Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Palmdale	1996	17,300	0	17,300	0	17,300	0	7,908	0
	1997	17,300	0	17,300	0	17,300	0	7,959	0
	1998	17,300	0	17,300	0	17,300	0	7,957	0
	1999	17,300	0	17,300	0	17,300	0	7,893	0
	2000	17,300	0	17,300	4,000	17,300	4,000	7,889	1824
	2001	17,300	0	17,300	4,000	17,300	4,000	7,884	1823
	2002	17,300	0	17,300	4,000	17,300	4,000	7,882	1823
	2003	17,300	0	17,300	4,000	17,300	4,000	7,952	0
	2004	17,300	0	17,300	4,000	17,300	4,000	7,875	1821
	2005	17,300	0	17,300	4,000	17,300	4,000	7,881	1822
San Bernardino	1996	102,600	0	102,600	0	102,600	0	46,902	0
	1997	102,600	0	102,600	0	102,600	0	47,203	0
	1998	102,600	0	102,600	0	102,600	0	47,189	0
	1999	102,600	0	102,600	0	102,600	0	46,808	0
	2000	102,600	0	102,600	0	102,600	0	46,786	0
	2001	102,600	0	102,600	0	102,600	0	46,758	0
	2002	102,600	0	102,600	0	102,600	0	46,748	0
	2003	102,600	0	102,600	0	102,600	0	47,158	0
	2004	102,600	0	102,600	0	102,600	0	46,706	0
	2005	102,600	0	102,600	0	102,600	0	46,741	0
San Gabriel	1996	28,800	0	28,800	0	28,800	0	13,165	0
	1997	28,800	0	28,800	0	28,800	0	13,250	0
	1998	28,800	0	28,800	0	28,800	0	13,246	0
	1999	28,800	0	28,800	0	28,800	0	13,139	0
	2000	28,800	0	28,800	0	28,800	0	13,133	0
	2001	28,800	0	28,800	0	28,800	0	13,125	0
	2002	28,800	0	28,800	0	28,800	0	13,122	0
	2003	28,800	0	28,800	0	28,800	0	13,237	0
	2004	28,800	0	28,800	0	28,800	0	13,110	0
	2005	28,800	0	28,800	0	28,800	0	13,120	0
San Gorgonio	1996	0	0	0	0	0	0	0	0
	1997	0	0	0	0	0	0	0	0
	1998	0	0	0	0	0	0	0	0
	1999	2,000	0	2,000	0	2,000	0	912	0
	2000	3,000	0	3,000	0	3,000	0	1,368	0
	2001	4,000	0	4,000	0	4,000	0	1,823	0
	2002	4,000	0	4,000	0	4,000	0	1,823	0
	2003	5,000	0	5,000	0	5,000	0	2,298	0
	2004	6,000	0	6,000	0	6,000	0	2,731	0
	2005	6,500	0	6,500	0	6,500	0	2,961	0

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Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
MWD	1996	2,011,500	0	2,011,500	0	2,011,500	0	920,482	0
	1997	2,011,500	0	2,011,500	0	2,011,500	0	925,417	0
	1998	2,011,500	0	2,011,500	0	2,011,500	0	925,159	0
	1999	2,011,500	0	2,011,500	0	2,011,500	0	917,689	0
	2000	2,011,500	0	2,011,500	0	2,011,500	0	917,252	0
	2001	2,011,500	0	2,011,500	0	2,011,500	0	916,701	0
	2002	2,011,500	0	2,011,500	0	2,011,500	0	916,504	0
	2003	2,011,500	0	2,011,500	0	2,011,500	0	924,549	0
	2004	2,011,500	0	2,011,500	0	2,011,500	0	915,674	0
	2005	1,911,500	0	1,911,500	0	1,911,500	0	870,804	0
Ventura	1996	20,000	0	20,000	0	20,000	0	9,143	0
	1997	20,000	0	20,000	0	20,000	0	9,201	0
	1998	20,000	0	20,000	0	20,000	0	9,199	0
	1999	20,000	0	20,000	0	20,000	0	9,124	0
	2000	20,000	0	20,000	0	20,000	0	9,120	0
	2001	20,000	0	20,000	0	20,000	0	9,115	0
	2002	20,000	0	20,000	0	20,000	0	9,113	0
	2003	20,000	0	20,000	0	20,000	0	9,193	0
	2004	20,000	0	20,000	0	20,000	0	9,104	0
	2005	20,000	0	20,000	0	20,000	0	9,111	0
Yuba	1996	9,600	0	9,600	0	9,600	0	4,388	0
	1997	9,600	0	9,600	0	9,600	0	4,417	0
	1998	9,600	0	9,600	0	9,600	0	4,415	0
	1999	9,600	0	9,600	0	9,600	0	4,380	0
	2000	9,600	0	9,600	0	9,600	0	4,378	0
	2001	9,600	0	9,600	0	9,600	0	4,375	0
	2002	9,600	0	9,600	0	9,600	0	4,374	0
	2003	9,600	0	9,600	0	9,600	0	4,412	0
	2004	9,600	0	9,600	0	9,600	0	4,370	0
	2005	9,600	0	9,600	0	9,600	0	4,373	0
Butte	1996	1,200	0	1,200	0	1,200	0	549	0
	1997	1,200	0	1,200	0	1,200	0	552	0
	1998	1,200	0	1,200	0	1,200	0	552	0
	1999	2,890	0	2,890	0	2,890	0	1,318	0
	2000	2,890	0	2,890	0	2,890	0	1,318	0
	2001	3,500	0	3,500	0	3,500	0	1,595	0
	2002	3,500	0	3,500	0	3,500	0	1,595	0
	2003	3,500	0	3,500	0	3,500	0	1,609	0
	2004	3,500	0	3,500	0	3,500	0	1,593	0
	2005	1,200	0	1,200	0	1,200	0	547	0

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Contractor	Year	Table A Amount							
		Baseline		Project		NPA1		CNP	
		M&I	AG	M&I	AG	M&I	AG	M&I	AG
Plumas	1996	1,300	0	1,300	0	1,300	0	594	0
	1997	1,350	0	1,350	0	1,350	0	621	0
	1998	1,400	0	1,400	0	1,400	0	644	0
	1999	1,450	0	1,450	0	1,450	0	662	0
	2000	1,510	0	1,510	0	1,510	0	689	0
	2001	1,570	0	1,570	0	1,570	0	715	0
	2002	1,630	0	1,630	0	1,630	0	743	0
	2003	1,690	0	1,690	0	1,690	0	777	0
	2004	1,750	0	1,750	0	1,750	0	797	0
	2005	0	0	0	0	0	0	0	0

Table HA-5 – Historical Analysis Assumptions for Baseline, Project, and Alternatives.

Issue	Assumptions for EIR Alternatives				
	Baseline	**Proposed Project**	**NPA1**	**CNPA3**	**CNPA4**
Article 18 provisions for allocation of Table A Water	Uses 1994 contract provisions	Uses Monterey Plus provisions	Uses 1994 contract provisions	Uses 1994 contract provisions	Uses 1994 contract provisions
Table A changes and transfers	A contractor's Table A changes only if original SWP contract specified or through another action unrelated to Project.	Baseline values and includes 22 TAF of transfers from TLBWD to M& I contractors during 2000-05, (2) 114 TAF of transfers from KCWA to M&I contractors during 1998-2003.	Same as Baseline	Baseline values reduced proportionately so that total SWP Table A amounts equal 1.9 MAF in each year. No transfers of Table A amount between SWP contractors.	Same as CNPA3
Table A Retirements by KCWA (40,670) and DRWD (4,330)	No retirement. KCWA and DRWD retain Table A amounts.	Table A amounts are retired in 1996	Same as Baseline.	Same as Baseline.	Same as Baseline.
Invocation of Article 18(b)	Contracts retain Article 18(b) but DWR does not invoke Article 18(b).	Elimination of Article 18(b) from the SWP contracts.	Same as Baseline.	DWR invokes Article 18(b) in 1996.	DWR invokes Article 18(b) in 1996.

Table HA-6. Four Groupings of SWP Contractors for Interpretation of Project Effects*.

SWP Contractors With …	M&I Contractors	Agricultural Contractors
No Monterey Amendment-related Transfers or Retirements	***Group 1*** Plumas, Butte, Yuba City, Alameda, Santa Clara, San Luis Obispo, Santa Barbara, Crestline, Desert, Littlerock Creek, MWD, San Bernardino Valley, San Gabriel Valley, San Gorgonio Pass, Coachella, AVEK & Ventura	***Group 2*** Oak Flat, Kings, Tulare & Empire Westside
Table A Transfers or Retirements	***Group 3*** Napa, Solano, Zone 7, Castaic, Mojave & Palmdale	***Group 4*** KCWA (AG), & Dudley Ridge

* Note that these groupings apply only to Project effects. Different groupings are used to present the effects of other alternatives.

Table HA-7. Study Assumptions Regarding SWP contractors' Agricultural, Groundwater Replenishment, and Municipal uses of Scheduled Surplus Water in CNPA4.

Contractor	Agricultural Use	Groundwater Replenishment Use (%)	Municipal or other use (%)
Butte	0%	0%	100%
Yuba	0%	0%	100%
Plumas	0%	0%	100%
Napa	10%	0%	90%
Solano	0%	0%	100%
Alameda County	0%	10%	90%
Zone 7	10%	0%	90%
Santa Clara	10%	10%	80%
Oak Flat	100%	0%	0%
Kings	100%	0%	0%
Dudley	100%	0%	0%
Empire	100%	0%	0%
KCWA	90%	0%	10%
Tulare	100%	0%	0%
San Luis Obispo	0%	0%	100%
Santa Barbara	0%	0%	100%
AVEK	30%	0%	70%
Castaic	0%	0%	100%
Coachella	0%	100%	0%
Crestline	0%	0%	100%
Desert	0%	0%	100%
Littlerock	30%	0%	70%
Mojave	0%	100%	0%
Palmdale	0%	0%	100%
San Bernardino	0%	0%	100%
San Gabriel	0%	100%	0%
San Gorgonio	5%	0%	95%
MWD	7%	20%	73%
Ventura	0%	0%	100%

Table HA-8. Implementation of Article 18(a) cuts in the Baseline			
Year	Baseline's Article 18(a) Reductions[30]		
	AG-first Reduction	Cumulative 7-year Total Ag-first Reduction	AG and M&I shared Reduction
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	6%	6%	0
2000	21%	27%	0
2001	50%	77%	47%
2002	23%	100%	24%
2003	0	100%	11%
2004	0	100%	36%
2005	0	100%	10%

Table HA-9. Implementation of Article 18(a) cuts in NPA1			
Year	NPA1's Article 18(a) Reductions		
	AG-first Reduction	Cumulative 7-year Total Ag-first Reduction	AG and M&I Shared Reduction
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	4%	4%	0
2000	21%	25%	0
2001	50%	75%	47%
2002	25%	100%	23%
2003	0	100%	11%
2004	0	100%	36%
2005	0	100%	10%

[30] Percentages are rounded to the nearest whole percent.

Table HA-10. Implementation of Article 18(a) cuts in CNP			
Year	**CNP's Article 18(a) Reductions**		
	AG-first Reduction	**Cumulative 7-year Total Ag-first Reduction**	**AG and M&I Shared Reduction**
1996	0	0	0
1997	0	0	0
1998	0	0	0
1999	0	0	0
2000	0	0	0
2001	50%	50%	1%
2002	0	50%	0
2003	0	50%	0
2004	0	50%	0
2005	0	50%	0

Table HA-11. Baseline and Project Table A Allocations				
Year	**AG Table A Allocation (%)**		**M&I Table A Allocation (%)**	
	Baseline	**Project**	**Baseline**	**Project**
1996	100%	100%	100%	100%
1997	100%	100%	100%	100%
1998	100%	100%	100%	100%
1999	94%	100%	100%	100%
2000	79%	90%	100%	90% (96%)[31]
2001	3%	39%	53%	39%
2002	53%	70%	76%	70%
2003	89%	90%	89%	90%
2004	64%	65%	64%	65%
2005	89%	90%	89%	90%

[31] MWDSC allocation was 100% of its request, while all other M&I requests received 90% allocation. Overall, SWP M&I Table A allocation was 96% of total M&I Table A requests in 2000.

Table HA-12. NPA1 and CNP Table A Allocations				
Year	AG Table A Allocation (%)		M&I Table A Allocation (%)	
	NPA1	CNP	NPA1	CNP
1996	100%	100%	100%	100%
1997	100%	100%	100%	100%
1998	100%	100%	100%	100%
1999	96%	100%	100%	100%
2000	79%	100%	100%	100%
2001	3%	49%	53%	99%
2002	51%	100%	77%	100%
2003	89%	100%	89%	100%
2004	64%	100%	64%	100%
2005	89%	100%	89%	100%

Table HA-13. Project Effects on Total M&I Table A Allocations				
Year	M&I Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	2,931,611	2,931,611	0	0%
1997	2,909,466	2,909,466	0	0%
1998	2,910,621	2,910,621	0	0%
1999	2,063,859	2,063,859	0	0%
2000	2,394,920	2,394,920	0	0%
2001	1,562,830	1,150,007	-412,823	-26%
2002	2,241,720	2,064,742	-176,978	-8%
2003	2,623,456	2,652,015	28,559	1%
2004	1,890,183	1,919,717	29,534	2%
2005	2,625,755	2,655,257	29,503	1%
Total	24,154,420	23,652,215	-502,205	-2%

Table HA-14. Project Effects on Total AG Table A Allocations				
Year	AG Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	1,224,730	1,179,730	-45,000	-4%
1997	1,220,400	1,175,400	-45,000	-4%
1998	1,220,400	1,175,400	-45,000	-4%
1999	1,147,176	1,175,400	28,224	2%
2000	1,012,932	1,057,860	44,928	4%
2001	36,679	459,271	422,593	1152%
2002	648,200	824,333	176,133	27%
2003	1,090,810	1,062,251	-28,559	-3%
2004	781,056	764,010	-17,046	-2%
2005	1,086,156	1,057,860	-28,296	-3%
Total	9,468,539	9,931,516	462,977	5%

Table HA-15. NPA1 Effects on Total M&I Table A Allocations				
Year	M&I Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	2,931,611	2,931,611	0	0%
1997	2,909,466	2,909,466	0	0%
1998	2,910,621	2,910,621	0	0%
1999	2,063,859	2,063,859	0	0%
2000	2,394,920	2,394,920	0	0%
2001	1,562,830	1,562,830	0	0%
2002	2,241,720	2,241,720	0	0%
2003	2,623,456	2,624,850	1,394	0%
2004	1,890,183	1,890,183	0	0%
2005	2,625,755	2,625,755	0	0%
Total	24,154,420	24,155,814	1,394	0%

Table HA-16. NPA1 Effects on Total AG Table A Allocations				
Year	AG Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	1,224,730	1,224,730	0	0%
1997	1,220,400	1,220,400	0	0%
1998	1,220,400	1,220,400	0	0%
1999	1,147,176	1,171,584	24,408	2%
2000	1,012,932	1,025,136	12,204	1%
2001	36,679	36,612	-67	0%
2002	648,200	646,812	-1,388	0%
2003	1,090,810	1,089,416	-1,394	0%
2004	781,056	781,056	0	0%
2005	1,086,156	1,086,156	0	0%
Total	9,468,539	9,502,302	33,764	0%

Table HA-17. CNP Effects on Total M&I Table A Allocations				
Year	M&I Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	2,931,611	1,340,136	-1,591,475	-54%
1997	2,909,466	1,338,539	-1,570,927	-54%
1998	2,910,621	1,338,696	-1,571,925	-54%
1999	2,063,859	1,334,716	-729,143	-35%
2000	2,394,920	1,335,882	-1,059,038	-44%
2001	1,562,830	1,316,951	-245,879	-16%
2002	2,241,720	1,343,947	-897,773	-40%
2003	2,623,456	1,356,615	-1,266,841	-48%
2004	1,890,183	1,344,450	-545,733	-29%
2005	2,625,755	1,344,034	-1,281,721	-49%
Total	24,154,420	13,393,964	-10,760,456	-45%

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Table HA-18. CNP Effects on Total AG Table A Allocations				
Year	M&I Table A Allocations (AF)		Allocation Difference (AF)	Percent Change
	Baseline	Project		
1996	1,224,730	559,864	-664,866	-54%
1997	1,220,400	561,461	-658,939	-54%
1998	1,220,400	561,304	-659,096	-54%
1999	1,147,176	556,772	-590,404	-51%
2000	1,012,932	556,507	-456,425	-45%
2001	36,679	278,086	241,408	658%
2002	648,200	556,053	-92,147	-14%
2003	1,090,810	575,559	-515,251	-47%
2004	781,056	555,550	-225,506	-29%
2005	1,086,156	555,966	-530,190	-49%
Total	9,468,539	5,317,125	-4,151,414	-44%

Table HA-19. Effects of Project on Historic SWP Table A Allocations To Selected M&I Contractors With No Project-Related Table A Changes (Group One)

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Santa Clara Valley WD	1996	100,000	0	100,000	100,000	0	100,000	0	0%
	1997	100,000	0	100,000	100,000	0	100,000	0	0%
	1998	100,000	0	100,000	100,000	0	100,000	0	0%
	1999	100,000	0	100,000	100,000	0	100,000	0	0%
	2000	100,000	0	100,000	100,000	0	100,000	0	0%
	2001	53,000	0	53,000	39,000	0	39,000	-14,000	-26%
	2002	76,000	0	76,000	70,000	0	70,000	-6,000	-8%
	2003	88,885	0	88,885	89,852	0	89,852	968	1%
	2004	64,000	0	64,000	65,000	0	65,000	1,000	2%
	2005	89,000	0	89,000	90,000	0	90,000	1,000	1%
	Total	870,885	0	870,885	853,852	0	853,852	-17,032	-2%
Santa Barbara	1996	45,486	0	45,486	45,486	0	45,486	0	0%
	1997	38,986	0	38,986	38,986	0	38,986	0	0%
	1998	38,986	0	38,986	38,986	0	38,986	0	0%
	1999	45,486	0	45,486	45,486	0	45,486	0	0%
	2000	45,486	0	45,486	45,486	0	45,486	0	0%
	2001	24,108	0	24,108	17,740	0	17,740	-6,368	-26%
	2002	34,569	0	34,569	31,840	0	31,840	-2,729	-8%
	2003	40,430	0	40,430	40,870	0	40,870	440	1%
	2004	29,111	0	29,111	29,566	0	29,566	455	2%
	2005	40,483	0	40,483	40,937	0	40,937	455	1%
	Total	383,131	0	383,131	375,383	0	375,383	-7,747	-2%
MWD	1996	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1997	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1998	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1999	1,180,000	0	1,180,000	1,180,000	0	1,180,000	0	0%
	2000	1,507,136	0	1,507,136	1,507,136	0	1,507,136	0	0%
	2001	1,066,095	0	1,066,095	784,485	0	784,485	-281,610	-26%
	2002	1,528,740	0	1,528,740	1,408,050	0	1,408,050	-120,690	-8%
	2003	1,787,916	0	1,787,916	1,807,380	0	1,807,380	19,463	1%
	2004	1,287,360	0	1,287,360	1,307,475	0	1,307,475	20,115	2%
	2005	1,701,235	0	1,701,235	1,720,350	0	1,720,350	19,115	1%
	Total	16,092,982	0	16,092,982	15,749,376	0	15,749,376	-343,607	-2%

Table HA-20. Effects of Project on SWP Table A Allocations To Agricultural Contractors With No Project-Related Table A Changes (Group Two)

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Empire West Side	1996	0	3,000	3,000	0	3,000	3,000	0	0%
	1997	0	3,000	3,000	0	3,000	3,000	0	0%
	1998	0	3,000	3,000	0	3,000	3,000	0	0%
	1999	0	2,820	2,820	0	3,000	3,000	180	6%
	2000	0	2,490	2,490	0	2,700	2,700	210	8%
	2001	0	90	90	0	1,170	1,170	1,080	1200%
	2002	0	1,590	1,590	0	2,100	2,100	510	32%
	2003	0	2,667	2,667	0	2,696	2,696	29	1%
	2004	0	1,920	1,920	0	1,950	1,950	30	2%
	2005	0	2,670	2,670	0	2,700	2,700	30	1%
	Total	0	23,247	23,247	0	25,316	25,316	2,069	9%
Oak Flat Irrigation District	1996	0	5,700	5,700	0	5,700	5,700	0	0%
	1997	0	5,700	5,700	0	5,700	5,700	0	0%
	1998	0	5,700	5,700	0	5,700	5,700	0	0%
	1999	0	5,358	5,358	0	5,700	5,700	342	6%
	2000	0	4,731	4,731	0	5,130	5,130	399	8%
	2001	0	171	171	0	2,223	2,223	2,052	1200%
	2002	0	3,021	3,021	0	3,990	3,990	969	32%
	2003	0	5,066	5,066	0	5,122	5,122	55	1%
	2004	0	3,648	3,648	0	3,705	3,705	57	2%
	2005	0	5,073	5,073	0	5,130	5,130	57	1%
	Total	0	44,168	44,168	0	48,100	48,100	3,931	9%

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Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Kings	1996	0	4,000	4,000	0	4,000	4,000	0	0%
	1997	0	4,000	4,000	0	4,000	4,000	0	0%
	1998	0	4,000	4,000	0	4,000	4,000	0	0%
	1999	0	3,760	3,760	0	4,000	4,000	240	6%
	2000	0	3,320	3,320	0	3,600	3,600	280	8%
	2001	0	120	120	0	1,560	1,560	1,440	1200%
	2002	0	2,120	2,120	0	2,800	2,800	680	32%
	2003	0	8,000	8,000	0	8,087	8,087	87	1%
	2004	0	5,760	5,760	0	5,850	5,850	90	2%
	2005	0	8,010	8,010	0	8,100	8,100	90	1%
	Total	0	43,090	43,090	0	45,997	45,997	2,907	7%
Tulare	1996	0	118,500	118,500	0	118,500	118,500	0	0%
	1997	0	118,500	118,500	0	118,500	118,500	0	0%
	1998	0	118,500	118,500	0	118,500	118,500	0	0%
	1999	0	111,390	111,390	0	118,500	118,500	7,110	6%
	2000	0	98,355	98,355	0	106,650	106,650	8,295	8%
	2001	0	3,555	3,555	0	46,215	46,215	42,660	1200%
	2002	0	59,109	59,109	0	78,069	78,069	18,960	32%
	2003	0	98,775	98,775	0	99,850	99,850	1,075	1%
	2004	0	61,585	61,585	0	62,548	62,548	962	2%
	2005	0	85,642	85,642	0	86,604	86,604	962	1%
	Total	0	873,912	873,912	0	953,936	953,936	80,024	9%

Table HA-21. Effects of Project on SWP Table A Allocations To M&I Contractors With Project-Related Table A Changes (Group Three)

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Napa County	1996	10,425	0	10,425	10,425	0	10,425	0	0%
	1997	11,065	0	11,065	11,065	0	11,065	0	0%
	1998	11,710	0	11,710	11,710	0	11,710	0	0%
	1999	15,850	0	15,850	15,850	0	15,850	0	0%
	2000	16,325	0	16,325	16,325	0	16,325	0	0%
	2001	8,851	0	8,851	6,513	1,570	8,083	-768	-9%
	2002	12,977	0	12,977	11,953	2,818	14,770	1,793	14%
	2003	15,510	0	15,510	15,679	3,617	19,296	3,785	24%
	2004	11,408	0	11,408	11,586	2,616	14,203	2,795	24%
	2005	16,198	0	16,198	16,380	3,623	20,003	3,805	23%
	Total	130,319	0	130,319	127,486	14,243	141,729	11,409	9%
Solano County	1996	37,800	0	37,800	37,800	0	37,800	0	0%
	1997	38,250	0	38,250	38,250	0	38,250	0	0%
	1998	38,710	0	38,710	38,710	0	38,710	0	0%
	1999	39,170	0	39,170	39,170	0	39,170	0	0%
	2000	39,620	0	39,620	39,620	0	39,620	0	0%
	2001	21,242	0	21,242	15,631	2,245	17,876	-3,366	-16%
	2002	30,810	0	30,810	28,378	4,029	32,407	1,597	5%
	2003	36,443	0	36,443	36,839	5,172	42,011	5,569	15%
	2004	26,528	0	26,528	26,943	3,741	30,684	4,156	16%
	2005	36,935	0	36,935	37,350	5,180	42,530	5,595	15%
	Total	345,509	0	345,509	338,691	20,368	359,059	13,550	4%
Alameda Zone 7	1996	44,000	0	44,000	44,000	0	44,000	0	0%
	1997	46,000	0	46,000	46,000	0	46,000	0	0%
	1998	46,000	0	46,000	46,000	0	46,000	0	0%
	1999	46,000	0	46,000	46,000	0	46,000	0	0%
	2000	46,000	0	46,000	46,000	19,800	65,800	19,800	43%
	2001	24,380	0	24,380	17,940	13,345	31,285	6,905	28%
	2002	34,960	212	35,172	32,200	23,953	56,153	20,981	60%
	2003	40,887	0	40,887	41,332	30,747	72,079	31,192	76%
	2004	29,440	256	29,696	29,900	22,502	52,402	22,706	76%
	2005	40,940	356	41,296	41,400	31,157	72,557	31,261	76%
	Total	398,607	824	399,431	390,772	141,505	532,277	132,846	33%

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Mojave	1996	50,800	0	50,800	50,800	0	50,800	0	0%
	1997	50,800	0	50,800	50,800	0	50,800	0	0%
	1998	50,800	0	50,800	50,800	25,000	75,800	25,000	49%
	1999	20,000	0	20,000	20,000	25,000	45,000	25,000	125%
	2000	20,000	0	20,000	20,000	22,500	42,500	22,500	113%
	2001	26,924	0	26,924	19,812	9,750	29,562	2,638	10%
	2002	38,608	0	38,608	35,560	17,500	53,060	14,452	37%
	2003	45,153	0	45,153	45,645	22,463	68,108	22,955	51%
	2004	32,512	0	32,512	33,020	16,250	49,270	16,758	52%
	2005	45,212	0	45,212	45,720	22,500	68,220	23,008	51%
	Total	380,809	0	380,809	372,157	160,963	533,120	152,311	40%
Castaic	1996	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1997	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1998	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1999	41,500	11,938	53,438	41,500	12,700	54,200	762	1%
	2000	41,500	10,541	52,041	41,500	48,330	89,830	37,789	73%
	2001	21,995	381	22,376	16,185	20,943	37,128	14,752	66%
	2002	31,540	6,731	38,271	29,050	37,590	66,640	28,369	74%
	2003	36,887	11,288	48,176	37,289	48,251	85,539	37,364	78%
	2004	26,560	8,128	34,688	26,975	34,905	61,880	27,192	78%
	2005	36,935	11,303	48,238	37,350	48,330	85,680	37,442	78%
	Total	361,417	98,410	459,828	354,349	289,149	643,497	183,670	40%
Palmdale	1996	17,300	0	17,300	17,300	0	17,300	0	0%
	1997	17,300	0	17,300	17,300	0	17,300	0	0%
	1998	17,300	0	17,300	17,300	0	17,300	0	0%
	1999	17,300	0	17,300	17,300	0	17,300	0	0%
	2000	17,300	0	17,300	17,300	3,600	20,900	3,600	21%
	2001	9,169	0	9,169	6,747	1,560	8,307	-862	-9%
	2002	13,148	0	13,148	12,110	2,800	14,910	1,762	13%
	2003	15,377	0	15,377	15,544	3,594	19,139	3,761	24%
	2004	11,072	0	11,072	11,245	2,600	13,845	2,773	25%
	2005	15,397	0	15,397	15,570	3,600	19,170	3,773	25%
	Total	150,663	0	150,663	147,716	17,754	165,471	14,807	10%

Table HA-22. Effects of Project on SWP Table A Allocations To Agricultural Contractors With Project-Related Table A Changes (Group Four)

Contractor	Year	Baseline Table A Allocation (AF)			Project's Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Dudley Ridge	1996	0	57,700	57,700	0	53,370	53,370	-4,330	-8%
	1997	0	57,700	57,700	0	53,370	53,370	-4,330	-8%
	1998	0	57,700	57,700	0	53,370	53,370	-4,330	-8%
	1999	0	54,238	54,238	0	53,370	53,370	-868	-2%
	2000	0	47,891	47,891	0	48,033	48,033	142	0%
	2001	0	1,731	1,731	0	20,814	20,814	19,083	1102%
	2002	0	32,687	32,687	0	40,140	40,140	7,453	23%
	2003	0	54,818	54,818	0	51,524	51,524	-3,294	-6%
	2004	0	39,471	39,471	0	37,273	37,273	-2,198	-6%
	2005	0	54,889	54,889	0	51,609	51,609	-3,280	-6%
	Total	0	458,824	458,824	0	462,873	462,873	4,049	1%
KCWA	1996	134,600	1,023,130	1,157,730	134,600	982,460	1,117,060	-40,670	-4%
	1997	134,600	1,018,800	1,153,400	134,600	978,130	1,112,730	-40,670	-4%
	1998	134,600	1,018,800	1,153,400	134,600	953,130	1,087,730	-65,670	-6%
	1999	134,600	957,672	1,092,272	134,600	953,130	1,087,730	-4,542	0%
	2000	134,600	845,604	980,204	134,600	797,517	932,117	-48,087	-5%
	2001	71,338	30,631	101,969	52,494	337,876	390,370	288,402	283%
	2002	102,296	541,140	643,436	94,220	606,444	700,664	57,228	9%
	2003	119,639	907,530	1,027,169	120,941	778,435	899,376	-127,793	-12%
	2004	86,144	652,032	738,176	87,490	561,685	649,175	-89,002	-12%
	2005	119,794	906,732	1,026,526	121,140	777,717	898,857	-127,669	-12%
	Total	1,172,211	7,902,071	9,074,281	1,149,285	7,726,524	8,875,809	-198,473	-2%

Table HA-23. Effects of NPA1 Historic SWP Table A Allocations To M&I Contractors With No Table A Changes (Group One)

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Santa Clara Valley WD	1996	100,000	0	100,000	100,000	0	100,000	0	0%
	1997	100,000	0	100,000	100,000	0	100,000	0	0%
	1998	100,000	0	100,000	100,000	0	100,000	0	0%
	1999	100,000	0	100,000	100,000	0	100,000	0	0%
	2000	100,000	0	100,000	100,000	0	100,000	0	0%
	2001	53,000	0	53,000	53,000	0	53,000	0	0%
	2002	76,000	0	76,000	76,000	0	76,000	0	0%
	2003	88,885	0	88,885	88,932	0	88,932	47	0%
	2004	64,000	0	64,000	64,000	0	64,000	0	0%
	2005	89,000	0	89,000	89,000	0	89,000	0	0%
	Total	870,885	0	870,885	870,932	0	870,932	47	0%
Santa Barbara	1996	45,486	0	45,486	45,486	0	45,486	0	0%
	1997	38,986	0	38,986	38,986	0	38,986	0	0%
	1998	38,986	0	38,986	38,986	0	38,986	0	0%
	1999	45,486	0	45,486	45,486	0	45,486	0	0%
	2000	45,486	0	45,486	45,486	0	45,486	0	0%
	2001	24,108	0	24,108	24,108	0	24,108	0	0%
	2002	34,569	0	34,569	34,569	0	34,569	0	0%
	2003	40,430	0	40,430	40,452	0	40,452	21	0%
	2004	29,111	0	29,111	29,111	0	29,111	0	0%
	2005	40,483	0	40,483	40,483	0	40,483	0	0%
	Total	383,131	0	383,131	383,152	0	383,152	21	0%
MWD	1996	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1997	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1998	2,011,500	0	2,011,500	2,011,500	0	2,011,500	0	0%
	1999	1,180,000	0	1,180,000	1,180,000	0	1,180,000	0	0%
	2000	1,507,136	0	1,507,136	1,507,136	0	1,507,136	0	0%
	2001	1,066,095	0	1,066,095	1,066,095	0	1,066,095	0	0%
	2002	1,528,740	0	1,528,740	1,528,740	0	1,528,740	0	0%
	2003	1,787,916	0	1,787,916	1,788,866	0	1,788,866	950	0%
	2004	1,287,360	0	1,287,360	1,287,360	0	1,287,360	0	0%
	2005	1,701,235	0	1,701,235	1,701,235	0	1,701,235	0	0%
	Total	16,092,982	0	16,092,982	16,093,932	0	16,093,932	950	0%

Table HA-24. Effects of NPA1 on SWP Table A Allocations To Agricultural Contractors With No Table A Changes (Group Two)

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Empire West Side	1996	0	3,000	3,000	0	3,000	3,000	0	0%
	1997	0	3,000	3,000	0	3,000	3,000	0	0%
	1998	0	3,000	3,000	0	3,000	3,000	0	0%
	1999	0	2,820	2,820	0	2,880	2,880	60	2%
	2000	0	2,490	2,490	0	2,520	2,520	30	1%
	2001	0	90	90	0	90	90	0	0%
	2002	0	1,590	1,590	0	1,590	1,590	0	0%
	2003	0	2,667	2,667	0	2,668	2,668	1	0%
	2004	0	1,920	1,920	0	1,920	1,920	0	0%
	2005	0	2,670	2,670	0	2,670	2,670	0	0%
	Total	0	23,247	23,247	0	23,338	23,338	91	0%
Oak Flat Irrigation District	1996	0	5,700	5,700	0	5,700	5,700	0	0%
	1997	0	5,700	5,700	0	5,700	5,700	0	0%
	1998	0	5,700	5,700	0	5,700	5,700	0	0%
	1999	0	5,358	5,358	0	5,472	5,472	114	2%
	2000	0	4,731	4,731	0	4,788	4,788	57	1%
	2001	0	171	171	0	171	171	0	0%
	2002	0	3,021	3,021	0	3,021	3,021	0	0%
	2003	0	5,066	5,066	0	5,069	5,069	3	0%
	2004	0	3,648	3,648	0	3,648	3,648	0	0%
	2005	0	5,073	5,073	0	5,073	5,073	0	0%
	Total	0	44,168	44,168	0	44,342	44,342	174	0%

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Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Kings	1996	0	4,000	4,000	0	4,000	4,000	0	0%
	1997	0	4,000	4,000	0	4,000	4,000	0	0%
	1998	0	4,000	4,000	0	4,000	4,000	0	0%
	1999	0	3,760	3,760	0	3,840	3,840	80	2%
	2000	0	3,320	3,320	0	3,360	3,360	40	1%
	2001	0	120	120	0	120	120	0	0%
	2002	0	2,120	2,120	0	2,120	2,120	0	0%
	2003	0	8,000	8,000	0	8,004	8,004	4	0%
	2004	0	5,760	5,760	0	5,760	5,760	0	0%
	2005	0	8,010	8,010	0	8,010	8,010	0	0%
	Total	0	43,090	43,090	0	43,214	43,214	124	0%
Tulare	1996	0	118,500	118,500	0	118,500	118,500	0	0%
	1997	0	118,500	118,500	0	118,500	118,500	0	0%
	1998	0	118,500	118,500	0	118,500	118,500	0	0%
	1999	0	111,390	111,390	0	113,760	113,760	2,370	2%
	2000	0	98,355	98,355	0	99,540	99,540	1,185	1%
	2001	0	3,555	3,555	0	3,555	3,555	0	0%
	2002	0	59,109	59,109	0	59,109	59,109	0	0%
	2003	0	98,775	98,775	0	98,827	98,827	52	0%
	2004	0	61,585	61,585	0	61,585	61,585	0	0%
	2005	0	85,642	85,642	0	85,642	85,642	0	0%
	Total	0	873,912	873,912	0	877,519	877,519	3,607	0%

Table HA-25. Effects of NPA1 on SWP Table A Allocations To M&I Contractors With Table A Changes (Group Three)

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Napa County	1996	10,425	0	10,425	10,425	0	10,425	0	0%
	1997	11,065	0	11,065	11,065	0	11,065	0	0%
	1998	11,710	0	11,710	11,710	0	11,710	0	0%
	1999	15,850	0	15,850	15,850	0	15,850	0	0%
	2000	16,325	0	16,325	16,325	0	16,325	0	0%
	2001	8,851	0	8,851	8,851	121	8,972	121	1%
	2002	12,977	0	12,977	12,977	2,133	15,110	2,133	16%
	2003	15,510	0	15,510	15,519	3,580	19,098	3,588	23%
	2004	11,408	0	11,408	11,408	2,576	13,984	2,576	23%
	2005	16,198	0	16,198	16,198	3,582	19,780	3,582	22%
	Total	130,319	0	130,319	130,328	11,992	142,319	12,000	9%
Solano County	1996	37,800	0	37,800	37,800	0	37,800	0	0%
	1997	38,250	0	38,250	38,250	0	38,250	0	0%
	1998	38,710	0	38,710	38,710	0	38,710	0	0%
	1999	39,170	0	39,170	39,170	0	39,170	0	0%
	2000	39,620	0	39,620	39,620	0	39,620	0	0%
	2001	21,242	0	21,242	21,242	173	21,415	173	1%
	2002	30,810	0	30,810	30,810	3,051	33,861	3,051	10%
	2003	36,443	0	36,443	36,462	5,119	41,581	5,138	14%
	2004	26,528	0	26,528	26,528	3,684	30,212	3,684	14%
	2005	36,935	0	36,935	36,935	5,123	42,058	5,123	14%
	Total	345,509	0	345,509	345,528	17,149	362,677	17,168	5%
Alameda Zone 7	1996	44,000	0	44,000	44,000	0	44,000	0	0%
	1997	46,000	0	46,000	46,000	0	46,000	0	0%
	1998	46,000	0	46,000	46,000	0	46,000	0	0%
	1999	46,000	0	46,000	46,000	0	46,000	0	0%
	2000	46,000	0	46,000	46,000	18,480	64,480	18,480	40%
	2001	24,380	0	24,380	24,380	960	25,340	960	4%
	2002	34,960	212	35,172	34,960	16,960	51,920	16,748	48%
	2003	40,887	0	40,887	40,909	28,458	69,367	28,480	70%
	2004	29,440	256	29,696	29,440	22,156	51,596	21,900	74%
	2005	40,940	356	41,296	40,940	30,811	71,751	30,455	74%
	Total	398,607	824	399,431	398,629	117,825	516,454	117,023	29%

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Mojave	1996	50,800	0	50,800	50,800	0	50,800	0	0%
	1997	50,800	0	50,800	50,800	0	50,800	0	0%
	1998	50,800	0	50,800	50,800	25,000	75,800	25,000	49%
	1999	20,000	0	20,000	20,000	24,000	44,000	24,000	120%
	2000	20,000	0	20,000	20,000	21,000	41,000	21,000	105%
	2001	26,924	0	26,924	26,924	750	27,674	750	3%
	2002	38,608	0	38,608	38,608	13,250	51,858	13,250	34%
	2003	45,153	0	45,153	45,177	22,233	67,410	22,257	49%
	2004	32,512	0	32,512	32,512	16,000	48,512	16,000	49%
	2005	45,212	0	45,212	45,212	22,250	67,462	22,250	49%
	Total	380,809	0	380,809	380,833	144,483	525,316	144,507	38%
Castaic	1996	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1997	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1998	41,500	12,700	54,200	41,500	12,700	54,200	0	0%
	1999	41,500	11,938	53,438	41,500	12,192	53,692	254	0%
	2000	41,500	10,541	52,041	41,500	45,108	86,608	34,567	66%
	2001	21,995	381	22,376	21,995	1,611	23,606	1,230	5%
	2002	31,540	6,731	38,271	31,540	28,461	60,001	21,730	57%
	2003	36,887	11,288	48,176	36,907	47,756	84,663	36,488	76%
	2004	26,560	8,128	34,688	26,560	34,368	60,928	26,240	76%
	2005	36,935	11,303	48,238	36,935	47,793	84,728	36,490	76%
	Total	361,417	98,410	459,828	361,437	255,389	616,826	156,999	34%
Palmdale	1996	17,300	0	17,300	17,300	0	17,300	0	0%
	1997	17,300	0	17,300	17,300	0	17,300	0	0%
	1998	17,300	0	17,300	17,300	0	17,300	0	0%
	1999	17,300	0	17,300	17,300	0	17,300	0	0%
	2000	17,300	0	17,300	17,300	3,360	20,660	3,360	19%
	2001	9,169	0	9,169	9,169	120	9,289	120	1%
	2002	13,148	0	13,148	13,148	2,120	15,268	2,120	16%
	2003	15,377	0	15,377	15,385	3,557	18,943	3,565	23%
	2004	11,072	0	11,072	11,072	2,560	13,632	2,560	23%
	2005	15,397	0	15,397	15,397	3,560	18,957	3,560	23%
	Total	150,663	0	150,663	150,671	15,277	165,949	15,285	10%

Table HA-26. Effects of NPA1 on SWP Table A Allocations To Agricultural Contractors With Project-Related Table A Changes (Group Four)

Contractor	Year	Baseline Table A Allocation (AF)			NPA1 Allocation (AF)			Change in Table A Allocation	
		M&I	AG	Total	M&I	AG	Total	AF	%
Dudley Ridge	1996	0	57,700	57,700	0	57,700	57,700	0	0%
	1997	0	57,700	57,700	0	57,700	57,700	0	0%
	1998	0	57,700	57,700	0	57,700	57,700	0	0%
	1999	0	54,238	54,238	0	55,392	55,392	1,154	2%
	2000	0	47,891	47,891	0	48,468	48,468	577	1%
	2001	0	1,731	1,731	0	1,731	1,731	0	0%
	2002	0	32,687	32,687	0	32,687	32,687	0	0%
	2003	0	54,818	54,818	0	54,847	54,847	29	0%
	2004	0	39,471	39,471	0	39,471	39,471	0	0%
	2005	0	54,889	54,889	0	54,889	54,889	0	0%
	Total	0	458,824	458,824	0	460,584	460,584	1,760	0%
KCWA	1996	134,600	1,023,130	1,157,730	134,600	1,023,130	1,157,730	0	0%
	1997	134,600	1,018,800	1,153,400	134,600	1,018,800	1,153,400	0	0%
	1998	134,600	1,018,800	1,153,400	134,600	993,800	1,128,400	-25,000	-2%
	1999	134,600	957,672	1,092,272	134,600	954,048	1,088,648	-3,624	0%
	2000	134,600	845,604	980,204	134,600	778,512	913,112	-67,092	-7%
	2001	71,338	30,631	101,969	71,338	27,211	98,549	-3,420	-3%
	2002	102,296	541,140	643,436	102,296	480,720	583,016	-60,420	-9%
	2003	119,639	907,530	1,027,169	119,702	806,630	926,332	-100,837	-10%
	2004	86,144	652,032	738,176	86,144	579,072	665,216	-72,960	-10%
	2005	119,794	906,732	1,026,526	119,794	805,272	925,066	-101,460	-10%
	Total	1,172,211	7,902,071	9,074,281	1,172,274	7,467,194	8,639,469	-434,813	-5%

Table HA-27. Effects of CNPA3 on SWP Allocations To Selected M&I Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNP3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA[32]	Total	AF	%
Santa Clara Valley WD	1996	100,000	0	100,000	45,713	0	53,204	98,917	-1,083	-1%
	1997	100,000	0	100,000	46,006	0	52,904	98,910	-1,090	-1%
	1998	100,000	0	100,000	45,993	0	52,917	98,911	-1,089	-1%
	1999	100,000	0	100,000	45,622	0	32,036	77,658	-22,342	-22%
	2000	100,000	0	100,000	45,600	0	36,603	82,203	-17,797	-18%
	2001	53,000	0	53,000	44,662	0	301	44,962	-8,038	-15%
	2002	76,000	0	76,000	45,563	0	23,669	69,232	-6,768	-9%
	2003	88,885	0	88,885	45,963	0	42,393	88,356	-529	-1%
	2004	64,000	0	64,000	45,522	0	18,777	64,299	299	0%
	2005	89,000	0	89,000	45,556	0	43,473	89,029	29	0%
	Total	870,885	0	870,885	456,202	0	356,277	812,478	-58,407	-7%
Santa Barbara	1996	45,486	0	45,486	20,793	0	24,200	44,994	-492	-1%
	1997	38,986	0	38,986	17,936	0	20,625	38,561	-425	-1%
	1998	38,986	0	38,986	17,931	0	20,630	38,561	-425	-1%
	1999	45,486	0	45,486	20,752	0	14,572	35,323	-10,163	-22%
	2000	45,486	0	45,486	20,742	0	16,649	37,391	-8,095	-18%
	2001	24,108	0	24,108	20,315	0	137	20,451	-3,656	-15%
	2002	34,569	0	34,569	20,725	0	10,766	31,491	-3,078	-9%
	2003	40,430	0	40,430	20,907	0	19,283	40,190	-240	-1%
	2004	29,111	0	29,111	20,706	0	8,541	29,247	136	0%
	2005	40,483	0	40,483	20,722	0	19,774	40,496	13	0%
	Total	383,131	0	383,131	201,528	0	155,178	356,705	-26,425	-7%
MWD	1996	2,011,500	0	2,011,500	919,523	0	1,070,199	1,989,722	-21,778	-1%
	1997	2,011,500	0	2,011,500	925,417	0	1,064,165	1,989,582	-21,918	-1%
	1998	2,011,500	0	2,011,500	925,159	0	1,064,430	1,989,588	-21,912	-1%
	1999	1,180,000	0	1,180,000	917,689	0	644,399	1,562,088	382,088	32%
	2000	1,507,136	0	1,507,136	917,252	0	736,261	1,653,512	146,376	10%
	2001	1,066,095	0	1,066,095	898,367	0	6,047	904,414	-161,681	-15%
	2002	1,528,740	0	1,528,740	916,504	0	476,106	1,392,610	-136,130	-9%
	2003	1,787,916	0	1,787,916	924,549	0	852,734	1,777,283	-10,633	-1%
	2004	1,287,360	0	1,287,360	915,674	0	377,704	1,293,378	6,018	0%
	2005	1,701,235	0	1,701,235	870,804	0	830,984	1,701,788	553	0%
	Total	16,092,982	0	16,092,982	9,130,937	0	7,123,029	16,253,967	160,985	1%

[32] XA as used in this table refers to ex-Table A water.

Table HA-28. Effects of CNPA3 on SWP Allocations To Selected M&I Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA	Total	AF	%
Alameda	1996	42,000	0	42,000	19,200	0	22,346	41,545	-455	-1%
	1997	42,000	0	42,000	19,323	0	22,220	41,542	-458	-1%
	1998	42,000	0	42,000	19,317	0	22,225	41,542	-458	-1%
	1999	42,000	0	42,000	19,161	0	13,455	32,616	-9,384	-22%
	2000	42,000	0	42,000	19,152	0	15,373	34,525	-7,475	-18%
	2001	22,260	0	22,260	18,758	0	126	18,884	-3,376	-15%
	2002	31,920	0	31,920	19,137	0	9,941	29,078	-2,842	-9%
	2003	37,332	0	37,332	19,305	0	17,805	37,110	-222	-1%
	2004	26,880	0	26,880	19,119	0	7,886	27,006	126	0%
	2005	37,380	0	37,380	19,134	0	18,259	37,392	12	0%
	Total	365,772	0	365,772	191,605	0	149,636	341,241	-24,531	-7%
Santa Clara Valley	1996	100,000	0	100,000	45,713	0	53,204	98,917	-1,083	-1%
	1997	100,000	0	100,000	46,006	0	52,904	98,910	-1,090	-1%
	1998	100,000	0	100,000	45,993	0	52,917	98,911	-1,089	-1%
	1999	100,000	0	100,000	45,622	0	32,036	77,658	-22,342	-22%
	2000	100,000	0	100,000	45,600	0	36,603	82,203	-17,797	-18%
	2001	53,000	0	53,000	44,662	0	301	44,962	-8,038	-15%
	2002	76,000	0	76,000	45,563	0	23,669	69,232	-6,768	-9%
	2003	88,885	0	88,885	45,963	0	42,393	88,356	-529	-1%
	2004	64,000	0	64,000	45,522	0	18,777	64,299	299	0%
	2005	89,000	0	89,000	45,556	0	43,473	89,029	29	0%
	Total	870,885	0	870,885	456,202	0	356,277	812,478	-58,407	-7%
SLO	1996	25,000	0	25,000	11,428	0	13,301	24,729	-271	-1%
	1997	6,215	0	6,215	2,859	0	3,288	6,147	-68	-1%
	1998	6,215	0	6,215	2,858	0	3,289	6,147	-68	-1%
	1999	25,000	0	25,000	11,406	0	8,009	19,414	-5,586	-22%
	2000	25,000	0	25,000	11,400	0	9,151	20,551	-4,449	-18%
	2001	13,250	0	13,250	11,165	0	75	11,241	-2,009	-15%
	2002	19,000	0	19,000	11,391	0	5,917	17,308	-1,692	-9%
	2003	22,221	0	22,221	11,491	0	10,598	22,089	-132	-1%
	2004	16,000	0	16,000	11,380	0	4,694	16,075	75	0%
	2005	22,250	0	22,250	11,389	0	10,868	22,257	7	0%
	Total	180,151	0	180,151	96,768	0	69,191	165,959	-14,192	-8%

Contractor	Year	Baseline Table A Allocation (AF)			CNPA3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA	Total	AF	%
Santa Barbara	1996	45,486	0	45,486	20,793	0	24,200	44,994	-492	-1%
	1997	38,986	0	38,986	17,936	0	20,625	38,561	-425	-1%
	1998	38,986	0	38,986	17,931	0	20,630	38,561	-425	-1%
	1999	45,486	0	45,486	20,752	0	14,572	35,323	-10,163	-22%
	2000	45,486	0	45,486	20,742	0	16,649	37,391	-8,095	-18%
	2001	24,108	0	24,108	20,315	0	137	20,451	-3,656	-15%
	2002	34,569	0	34,569	20,725	0	10,766	31,491	-3,078	-9%
	2003	40,430	0	40,430	20,907	0	19,283	40,190	-240	-1%
	2004	29,111	0	29,111	20,706	0	8,541	29,247	136	0%
	2005	40,483	0	40,483	20,722	0	19,774	40,496	13	0%
	Total	383,131	0	383,131	201,528	0	155,178	356,705	-26,425	-7%
Crestline	1996	5,800	0	5,800	2,651	0	3,086	5,737	-63	-1%
	1997	5,800	0	5,800	2,668	0	3,068	5,737	-63	-1%
	1998	5,800	0	5,800	2,668	0	3,069	5,737	-63	-1%
	1999	5,800	0	5,800	2,646	0	1,858	4,504	-1,296	-22%
	2000	5,800	0	5,800	2,645	0	2,123	4,768	-1,032	-18%
	2001	3,074	0	3,074	2,590	0	17	2,608	-466	-15%
	2002	4,408	0	4,408	2,643	0	1,373	4,015	-393	-9%
	2003	5,155	0	5,155	2,666	0	2,459	5,125	-31	-1%
	2004	3,712	0	3,712	2,640	0	1,089	3,729	17	0%
	2005	5,162	0	5,162	2,642	0	2,521	5,164	2	0%
	Total	50,511	0	50,511	26,460	0	20,664	47,124	-3,388	-7%

Table HA-29. Effects of CNPA3 SWP Allocations To AG Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA[33]	Total	AF	%
Dudley Ridge	1996	0	57,700	57,700	0	26,377	30,699	57,075	-625	-1%
	1997	0	57,700	57,700	0	26,546	30,526	57,071	-629	-1%
	1998	0	57,700	57,700	0	26,538	30,533	57,071	-629	-1%
	1999	0	54,238	54,238	0	26,324	18,485	44,809	-9,429	-17%
	2000	0	47,891	47,891	0	26,311	21,120	47,431	-460	-1%
	2001	0	1,731	1,731	0	6,574	173	6,747	5,016	290%
	2002	0	32,687	32,687	0	28,100	14,598	42,698	10,011	31%
	2003	0	54,818	54,818	0	28,347	26,145	54,492	-326	-1%
	2004	0	39,471	39,471	0	28,075	11,580	39,655	185	0%
	2005	0	54,889	54,889	0	28,096	26,811	54,907	18	0%
	Total	0	458,824	458,824	0	251,287	210,669	461,957	3,132	1%
Kings	1996	0	4,000	4,000	0	1,829	2,128	3,957	-43	-1%
	1997	0	4,000	4,000	0	1,840	2,116	3,956	-44	-1%
	1998	0	4,000	4,000	0	1,840	2,117	3,956	-44	-1%
	1999	0	3,760	3,760	0	1,825	1,281	3,106	-654	-17%
	2000	0	3,320	3,320	0	1,824	1,464	3,288	-32	-1%
	2001	0	120	120	0	456	12	468	348	290%
	2002	0	2,120	2,120	0	1,823	947	2,769	649	31%
	2003	0	8,000	8,000	0	4,137	3,815	7,952	-48	-1%
	2004	0	5,760	5,760	0	4,097	1,690	5,787	27	0%
	2005	0	8,010	8,010	0	4,100	3,913	8,013	3	0%
	Total	0	43,090	43,090	0	23,769	19,483	43,253	163	0%
Empire West Side	1996	0	3,000	3,000	0	1,371	1,596	2,968	-32	-1%
	1997	0	3,000	3,000	0	1,380	1,587	2,967	-33	-1%
	1998	0	3,000	3,000	0	1,380	1,588	2,967	-33	-1%
	1999	0	2,820	2,820	0	1,369	961	2,330	-490	-17%
	2000	0	2,490	2,490	0	1,368	1,098	2,466	-24	-1%
	2001	0	90	90	0	342	9	351	261	290%
	2002	0	1,590	1,590	0	1,367	710	2,077	487	31%
	2003	0	2,667	2,667	0	1,379	1,272	2,651	-16	-1%
	2004	0	1,920	1,920	0	1,366	563	1,929	9	0%
	2005	0	2,670	2,670	0	1,367	1,304	2,671	1	0%
	Total	0	23,148	23,148	0	13,051	11,512	24,563	1,415	6%

[33] XA as used in this table refers to ex-Table A water.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA3 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	XA	Total	AF	%
Oak Flat Irrigation District	1996	0	5,700	5,700	0	2,606	3,033	5,638	-62	-1%
	1997	0	5,700	5,700	0	2,622	3,016	5,638	-62	-1%
	1998	0	5,700	5,700	0	2,622	3,016	5,638	-62	-1%
	1999	0	5,358	5,358	0	2,600	1,826	4,426	-932	-17%
	2000	0	4,731	4,731	0	2,599	2,086	4,686	-45	-1%
	2001	0	171	171	0	649	17	667	496	290%
	2002	0	3,021	3,021	0	2,597	1,349	3,946	925	31%
	2003	0	5,066	5,066	0	2,620	2,416	5,036	-30	-1%
	2004	0	3,648	3,648	0	2,595	1,070	3,665	17	0%
	2005	0	5,073	5,073	0	2,597	2,478	5,075	2	0%
	Total	0	44,168	44,168	0	24,107	20,308	44,415	247	1%
Tulare	1996	0	118,500	118,500	0	54,170	63,047	117,217	-1,283	-1%
	1997	0	118,500	118,500	0	54,518	62,691	117,209	-1,291	-1%
	1998	0	118,500	118,500	0	54,502	62,707	117,209	-1,291	-1%
	1999	0	111,390	111,390	0	54,062	37,962	92,025	-19,365	-17%
	2000	0	98,355	98,355	0	54,036	43,374	97,410	-945	-1%
	2001	0	3,555	3,555	0	13,501	356	13,857	10,302	290%
	2002	0	59,109	59,109	0	50,815	26,398	77,213	18,104	31%
	2003	0	98,775	98,775	0	51,077	47,110	98,188	-587	-1%
	2004	0	61,585	61,585	0	43,804	18,069	61,873	288	0%
	2005	0	85,642	85,642	0	43,837	41,833	85,670	28	0%
	Total	0	873,912	873,912	0	474,324	403,547	877,871	3,959	0%

Table HA-30. Effects of CNPA4 on SWP Allocations To Selected M&I Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA4 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	SS	Total	AF	%
Santa Barbara	1996	45,486	0	45,486	20,793	0	23,766	44,559	-927	-2%
	1997	38,986	0	38,986	17,936	0	20,247	38,183	-803	-2%
	1998	38,986	0	38,986	17,931	0	20,253	38,184	-802	-2%
	1999	45,486	0	45,486	20,752	0	21,791	42,542	-2,944	-6%
	2000	45,486	0	45,486	20,742	0	18,297	39,039	-6,447	-14%
	2001	24,108	0	24,108	20,315	0	0	20,315	-3,793	-16%
	2002	34,569	0	34,569	20,725	0	0	20,725	-13,844	-40%
	2003	40,430	0	40,430	20,907	0	15,099	36,005	-4,425	-11%
	2004	29,111	0	29,111	20,706	0	0	20,706	-8,405	-29%
	2005	40,483	0	40,483	20,722	0	14,874	35,596	-4,887	-12%
	Total	383,131	0	383,131	201,528	0	134,326	335,854	-47,277	-12%
MWD	1996	2,011,500	0	2,011,500	919,523	0	1,062,048	1,981,571	-29,929	-1%
	1997	2,011,500	0	2,011,500	925,417	0	1,055,841	1,981,258	-30,242	-2%
	1998	2,011,500	0	2,011,500	925,159	0	1,056,144	1,981,303	-30,197	-2%
	1999	1,180,000	0	1,180,000	917,689	0	239,522	1,157,211	-22,789	-2%
	2000	1,507,136	0	1,507,136	917,252	0	477,681	1,394,933	-112,203	-7%
	2001	1,066,095	0	1,066,095	898,367	0	2,986	901,352	-164,743	-15%
	2002	1,528,740	0	1,528,740	916,504	0	234,797	1,151,301	-377,439	-25%
	2003	1,787,916	0	1,787,916	924,549	0	780,895	1,705,444	-82,472	-5%
	2004	1,287,360	0	1,287,360	915,674	0	183,757	1,099,431	-187,929	-15%
	2005	1,701,235	0	1,701,235	870,804	0	737,288	1,608,092	-93,143	-5%
	Total	16,092,982	0	16,092,982	9,130,937	0	5,830,959	14,961,897	-1,131,086	-7%
Palmdale	1996	17,300	0	17,300	7,908	0	9,039	16,947	-353	-2%
	1997	17,300	0	17,300	7,959	0	8,985	16,944	-356	-2%
	1998	17,300	0	17,300	7,957	0	8,987	16,944	-356	-2%
	1999	17,300	0	17,300	7,893	0	8,288	16,180	-1,120	-6%
	2000	17,300	0	17,300	7,889	1,824	5,610	15,323	-1,977	-11%
	2001	9,169	0	9,169	7,726	911	0	8,638	-531	-6%
	2002	13,148	0	13,148	7,882	1,823	0	9,705	-3,443	-26%
	2003	15,377	0	15,377	7,952	0	5,743	13,694	-1,683	-11%
	2004	11,072	0	11,072	7,875	1,821	0	9,696	-1,376	-12%
	2005	15,397	0	15,397	7,881	1,822	4,563	14,266	-1,131	-7%
	Total	150,663	0	150,663	78,923	8,201	51,214	138,338	-12,325	-8%

Contractor	Year	Baseline Table A Allocation (AF)			CNPA4 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	SS	Total	AF	%
Mojave	1996	50,800	0	50,800	23,222	0	27,578	50,800	0	0%
	1997	50,800	0	50,800	23,371	0	27,429	50,800	0	0%
	1998	50,800	0	50,800	23,365	11,498	15,937	50,800	0	0%
	1999	20,000	0	20,000	20,000	11,406	0	31,406	11,406	57%
	2000	20,000	0	20,000	20,000	11,400	0	31,400	11,400	57%
	2001	26,924	0	26,924	22,688	5,697	164	28,549	1,625	6%
	2002	38,608	0	38,608	23,146	11,391	12,916	47,453	8,845	23%
	2003	45,153	0	45,153	23,349	11,491	15,960	50,800	5,647	13%
	2004	32,512	0	32,512	23,125	11,380	10,120	44,626	12,114	37%
	2005	45,212	0	45,212	23,142	11,389	16,269	50,800	5,588	12%
	Total	380,809	0	380,809	225,409	85,652	126,372	437,433	56,623	15%
Coachella	1996	23,100	0	23,100	10,560	0	12,540	23,100	0	0%
	1997	23,100	0	23,100	10,627	0	12,473	23,100	0	0%
	1998	23,100	0	23,100	10,624	0	12,476	23,100	0	0%
	1999	23,100	0	23,100	10,539	0	12,561	23,100	0	0%
	2000	23,100	0	23,100	10,534	0	12,566	23,100	0	0%
	2001	12,243	0	12,243	10,317	0	127	10,444	-1,799	-15%
	2002	17,556	0	17,556	10,525	0	9,987	20,512	2,956	17%
	2003	20,532	0	20,532	10,617	0	12,483	23,100	2,568	13%
	2004	14,784	6,336	21,120	10,516	4,507	11,165	26,188	5,068	24%
	2005	98,968	8,811	107,779	50,658	4,510	65,932	121,100	13,321	12%
	Total	279,583	15,147	294,730	145,517	9,017	162,309	316,843	22,113	8%

Table HA-31. Effects of CNPA4 on SWP Allocations To AG Contractors.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA4 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	SS[34]	Total	AF	%
Empire West Side	1996	0	3,000	3,000	0	1,371	1,629	3,000	0	0%
	1997	0	3,000	3,000	0	1,380	1,620	3,000	0	0%
	1998	0	3,000	3,000	0	1,380	1,620	3,000	0	0%
	1999	0	2,820	2,820	0	1,369	1,631	3,000	180	6%
	2000	0	2,490	2,490	0	1,368	1,632	3,000	510	20%
	2001	0	90	90	0	684	20	703	613	682%
	2002	0	1,590	1,590	0	1,367	1,566	2,932	1,342	84%
	2003	0	2,667	2,667	0	1,379	1,621	3,000	333	13%
	2004	0	1,920	1,920	0	1,366	1,255	2,621	701	36%
	2005	0	2,670	2,670	0	1,367	1,633	3,000	330	12%
	Total	0	23,247	23,247	0	13,030	14,227	27,256	4,010	17%
Oak Flat Irrigation District	1996	0	5,700	5,700	0	2,606	3,094	5,700	0	0%
	1997	0	5,700	5,700	0	2,622	3,078	5,700	0	0%
	1998	0	5,700	5,700	0	2,622	3,078	5,700	0	0%
	1999	0	5,358	5,358	0	2,600	3,100	5,700	342	6%
	2000	0	4,731	4,731	0	2,599	3,101	5,700	969	20%
	2001	0	171	171	0	1,299	38	1,337	1,166	682%
	2002	0	3,021	3,021	0	2,597	2,975	5,572	2,551	84%
	2003	0	5,066	5,066	0	2,620	3,080	5,700	634	13%
	2004	0	3,648	3,648	0	2,595	2,384	4,979	1,331	36%
	2005	0	5,073	5,073	0	2,597	3,103	5,700	627	12%
	Total	0	44,168	44,168	0	24,757	27,031	51,787	7,619	17%
Dudley Ridge	1996	0	57,700	57,700	0	26,377	31,323	57,700	0	0%
	1997	0	57,700	57,700	0	26,546	31,154	57,700	0	0%
	1998	0	57,700	57,700	0	26,538	31,162	57,700	0	0%
	1999	0	54,238	54,238	0	26,324	31,376	57,700	3,462	6%
	2000	0	47,891	47,891	0	26,311	31,389	57,700	9,809	20%
	2001	0	1,731	1,731	0	13,148	381	13,529	11,798	682%
	2002	0	32,687	32,687	0	28,100	32,184	60,285	27,598	84%
	2003	0	54,818	54,818	0	28,347	33,326	61,673	6,855	13%
	2004	0	39,471	39,471	0	28,075	25,798	53,872	14,402	36%
	2005	0	54,889	54,889	0	28,096	33,577	61,673	6,784	12%
	Total	0	458,824	458,824	0	257,861	281,671	539,532	80,708	18%

[34] SS as used in this table refers to scheduled surplus water.

Contractor	Year	Baseline Table A Allocation (AF)			CNPA4 Allocation (AF)				Change in Total Allocation	
		M&I	AG	Total	M&I TA	AG TA	SS	Total	AF	%
KCWA	1996	134,600	1,023,130	1,157,730	61,530	467,706	626,134	1,155,370	-2,360	0%
	1997	134,600	1,018,800	1,153,400	61,925	468,713	620,387	1,151,025	-2,375	0%
	1998	134,600	1,018,800	1,153,400	61,907	457,083	631,994	1,150,984	-2,416	0%
	1999	134,600	957,672	1,092,272	61,407	453,393	631,000	1,145,800	53,528	5%
	2000	134,600	845,604	980,204	61,378	422,624	651,955	1,135,958	155,754	16%
	2001	71,338	30,631	101,969	60,114	206,678	7,445	274,237	172,268	169%
	2002	102,296	541,140	643,436	61,328	413,267	587,574	1,062,170	418,733	65%
	2003	119,639	907,530	1,027,169	61,866	469,293	600,374	1,131,533	104,364	10%
	2004	86,144	652,032	738,176	61,273	411,883	470,080	943,235	205,059	28%
	2005	119,794	906,732	1,026,526	61,318	412,191	652,737	1,126,247	99,721	10%
	Total	1,172,211	7,902,071	9,074,281	614,047	4,182,830	5,479,680	10,276,558	1,202,276	13%
Kings	1996	0	4,000	4,000	0	1,829	2,171	4,000	0	0%
	1997	0	4,000	4,000	0	1,840	2,160	4,000	0	0%
	1998	0	4,000	4,000	0	1,840	2,160	4,000	0	0%
	1999	0	3,760	3,760	0	1,825	2,175	4,000	240	6%
	2000	0	3,320	3,320	0	1,824	2,176	4,000	680	20%
	2001	0	120	120	0	911	26	938	818	682%
	2002	0	2,120	2,120	0	1,823	2,087	3,910	1,790	84%
	2003	0	8,000	8,000	0	4,137	4,863	9,000	1,000	13%
	2004	0	5,760	5,760	0	4,097	3,765	7,862	2,102	36%
	2005	0	8,010	8,010	0	4,100	4,900	9,000	990	12%
	Total	0	43,090	43,090	0	24,225	26,484	50,710	7,620	18%
Tulare	1996	0	118,500	118,500	0	54,170	64,330	118,500	0	0%
	1997	0	118,500	118,500	0	54,518	63,982	118,500	0	0%
	1998	0	118,500	118,500	0	54,502	63,998	118,500	0	0%
	1999	0	111,390	111,390	0	54,062	64,438	118,500	7,110	6%
	2000	0	98,355	98,355	0	54,036	64,464	118,500	20,145	20%
	2001	0	3,555	3,555	0	27,002	783	27,785	24,230	682%
	2002	0	59,109	59,109	0	50,815	58,201	109,016	49,907	84%
	2003	0	98,775	98,775	0	51,077	60,050	111,127	12,352	13%
	2004	0	61,585	61,585	0	43,804	40,251	84,056	22,471	36%
	2005	0	85,642	85,642	0	43,837	52,390	96,227	10,585	12%
	Total	0	873,912	873,912	0	487,825	532,887	1,020,712	146,800	17%

J. TERRESTRIAL BIOLOGICAL RESOURCES

Introduction

This document provides additional information on special status plant and wildlife species and sensitive habitats that could occur within the Monterey Amendment project areas (Table 1, in back). These species and habitats were determined based on a review of the following sources:

- A California Natural Diversity Database (CNDDB) query and United States Fish and Wildlife Service (USFWS) official species lists for the following 7.5 minute topographic quadrangle maps, including the Department facility and surrounding quads in an approximately 10-mile radius:
  - For Lake Perris – Riverside East, Sunnymead, El Casco, Steele Peak, Perris, Lakeview, Lake Elsinore, Romoland, and Winchester quads;
  - For Castaic Lake - Black Mountain, Liebre Mountain, Burnt Peak, Lake Hughes, Green Valley, Warm Springs Mountain, Whitaker Peak, Cobblestone Mountain, Piru, Val Verde, Newhall, and Mint Canyon quads;
  - For San Luis Reservoir – Mustang Peak, Crevison Peak, Howard Ranch, Ingomar, Pacheco Peak, Pacheco Pass, San Luis Dam, Volta, Three Sisters, Mariposa Peak, Los Banos Valley, and Ortigalita Peak NW quads; and
  - For the Kern Fan Element – Lokern, Buttonwillow, Rio Bravo, Rosedale, Stevens, Tupman, East Elk Hills, West Elk Hills, Fellows, Taft, Mouth of Kern and Millux quads;
- A CNDDB query and USFWS official species lists of Plumas County; and
- A CNDDB query for a 200-foot wide corridor along the Feather River, from Lake Oroville to where it joints the Sacramento River; and the Sacramento River from where it joins the Feather River to the Delta.

South San Joaquin Valley

The Monterey Amendment resulted in the transfer or retirement of Table A amounts that ultimately resulted in a reduction of irrigation water for the following water districts in the southern San Joaquin Valley: Belridge WSD, Berrenda Mesa WD, Lost Hills WD, Wheeler Ridge-Maricopa WD, the Kings County WD, the Dudley Ridge WD and the Tulare Lake Basin WD. The Belridge WSD, Berrenda Mesa WD, Lost Hills WD, and Wheeler Ridge-Maricopa WD are located within the KCWA boundaries along western Kern County. The Kings County WD, the Dudley Ridge WD and the Tulare Lake Basin WD are located in Kings County, although a small portion of the Tulare Lake Basin WD is located in Tulare County.

Sensitive Communities

Northern Hardpan Vernal Pool

Northern hardpan vernal pool habitat consists of shallow ephemeral water bodies found in depressions (up to several hectares in size) occurring in grasslands and open woodlands throughout intermountain valleys of California and Oregon. Northern hardpan vernal pools are formed by an indurated clay or cemented hardpan that retains water from surface runoff through winter and some portion of the spring, but typically dry down entirely by the early summer months. This habitat typically occurs in areas with a hummocky micro-relief. Characteristic plant species include downingia (*Downingia* spp.), quillwort (*Isoetes orcuttii*), America pillwort (*Pilularia*

americana), white brodiaea (*Triteleia hyacinthina*), spikerush (*Eleocharis* spp.), coyote thistle (*Eryngium* ssp.), popcornflower (*Plagiobothrys* spp.), speedwell (*Veronica peregrina*), annual hairgrass (*Deschampsia* sp.), and water starwort (*Callitriche* spp.) As these pools dry in the spring and early summer, the plants grow and bloom often forming concentric rings of similar vegetation. Due to their isolation in upland-dominated landscapes, many endemic plant species are common in vernal pools. Northern hardpan vernal pool habitat has been recorded approximately nine miles east of the Kings County WD.

Valley Saltbush Scrub

Valley saltbush scrub is found in the southern and southwestern San Joaquin Valley on dissected alluvial fans with low relief. Soils are typically sandy to loamy without surface alkalinity. This vegetation community is dominated by gray-green or blue-gray shrubs of the Goosefoot family *(Chenopodiaceae)* and a low herbaceous annual understory. Characteristic shrubs include alkali saltbrush *(Atriplex polycarpa),* spinescale *(A. spinifera),* arrow saltbush *(A. phyllostegia),* alkali heath *(Frankenia salina)* and alkali goldenbush *(Haplopappus acradenius).* Understory species include recurved larkspur *(Delphinium recurvatum),* bird's eyes *(Gilia tricolor),* spikeweed *(Hemizonia pungens),* and cream cups *(Platystemon californicus).* Valley saltbrush scrub habitat has been recorded within the Dudley Ridge WD and the Belridge WSD.

Valley Sacaton Grassland

Valley sacaton grassland habitat is largely vegetation by alkali sacaton *(Sporobolus airoides),* a tussock, or tuft forming grass. Additional species include saltgrass *(Distichlis spicata),* and low barley *(Hordeum depressum).* This habitat is found in areas with fine textured, poorly drained and usually alkaline soils, that have either seasonally high water tables or are flooded during the winter. Valley sacaton grassland is greatly reduced from its historically extensive range in the Tulare Lake Basin and along the San Joaquin Valley trough. Valley sacaton grassland habitat has been recorded in the Kings County WD.

Special Status Plants

Bakersfield Cactus (*Opuntia basilaris* var, *treleasei*)

Bakersfield cactus is a state and federal endangered species and is listed as a CNPS 1B plant (rare, threatened or endangered in California and elsewhere). A recovery plan for this species is provided in *The Recovery Plan for the Upland Species of the San Joaquin Valley*. Bakersfield cactus is a perennial low growing cactus (Cactaceae). It typically spreads to form extensive thickets. It generally forms fleshy, flattened green beavertail-like pads (flattened stems) 3 to 4 inches wide by 5 to 7 inches long that produce showy magenta flowers. The eye-spots on the pads contain spines in addition to bristles. The species occurs on flood plains, ridges, bluffs and rolling hills in saltbush scrub plant communities, and occasionally in blue oak woodland or riparian woodland at elevations from 460 to 1,800 feet. Distribution is restricted to a limited area of central Kern County near Bakersfield. The most serious threats are residential development near Bakersfield and habitat conversion to agriculture. Bakersfield cactus has been recorded within the Wheeler Ridge-Maricopa WSD.

Brittlescale (*Atriplex depressa*)

Brittlescale is a CNPS List 1B plant. A dicot in the family Chenopodiaceae, it is an annual herb that is native to California and is endemic to California. *Atriplex* ssp. are herbs or shrubs, usually grayish or whitish. Brittlescale is found on alkaline or clay soils in alkali flats in largely grassland areas of the Sacramento Valley and San Joaquin Valley less than 650 feet in elevation. It has been recorded in the Kings County WD.

California Jewel-flower (*Caulanthus californicus*)

The California jewel-flower is a state and federal endangered species and is listed as a CNPS List 1B plant. A recovery plan for this species is provided in *The Recovery Plan for the Upland Species of the San Joaquin Valley*. California jewel-flower is an annual herb in the mustard family (Brassicaceae), with flattened, sword-shaped fruits. Its stems are erect, up to about 1 foot tall, and produce several flowering branches. The leaves are wavy-margined and most are in a basal rosette. Known populations of California jewel-flower occur in nonnative grassland, upper sonoran subshrub scrub, and cismontane juniper woodland and scrub communities. Potential threats to remaining populations include competition from nonnative plants, pesticide effects on pollinators, small population size and development on private land in the Santa Barbara Canyon area. California jewel-flower has been recorded in the Berrenda Mesa WD and Belridge WSD.

Comanche Point Layia (*Layia leucopappa*)

Comanche Point layia is a CNPS List 1B plant. It has glandular stems that grow up to 24 inches tall. The leaves are oblong, fleshy, and lobed. Comanche Point layia is distinguished from other members of the genus that have white ray flowers by the fleshy leaves and microscopic characteristics of the flower head and achenes. The typical flowering period for Comanche Point layia, an annual, is March to April. Comanche Point layia is endemic to Kern County. It occurred historically in three general areas of the extreme southern San Joaquin Valley and adjacent hills to the east: (1) the Comanche and Tejon Hills (including the type locality), (2) between Edison and Bena, and (3) on the Valley floor near the southern end of Kern Lake. The formerly extensive occurrences of Comanche Point layia on the Valley floor apparently have been eliminated by conversion to agriculture. Populations in the Comanche and Tejon Hills potentially are threatened by urban development and are subject to grazing. This species has been recorded in the Wheeler Ridge-Maricopa WSD.

Earlimart Orache (*Atriplex erecticaulis*)

Earlimart orache is a CNPS List 1B plant. It grows at elevations below 100 meters in dry areas between vernal pools, but not actually in the pools or depressions, and along roadsides. This plant is endemic to California and known from Tulare, Kern and Kings counties in uncultivated areas. While its distribution is presently restricted, it was likely more broadly distributed before the implementation of current agricultural practices, which removed its habitat. This species has been recorded in Kings County WD.

Kern Mallow (*Eremalche kernensis*)

Kern mallow is a federally endangered species and is listed as a CNPS List 1B plant. Recovery of this species is addressed in *The Recovery Plan for the Upland Species of the San Joaquin Valley*. Kern mallow is a small, annual herb belonging to the mallow family (Malvaceae). It has predominantly white to sometimes pale lavender, hollyhock-like flowers. The species typically

occurs in valley saltbush scrub communities, where it grows under and around spiny and common saltbushes and in patches with other herbaceous plants. Kern mallow is known from a single metapopulation consisting of intermittent occurrences within an area of approximately 40 square miles at the eastern base of the Temblor Range in the Lokern area of western Kern County. The distribution runs from the vicinity of McKittrick to near Buttonwillow. This species has been recorded in the Belridge WSD and Lost Hills WD.

Lemmon's Jewel-flower (*Caulanthus coulteri* var. *lemmonii*)

Lemmon's jewel-flower is a CNPS List 1B plant. This is an annual herb, with whitish or cream-colored, purple or dark veined flowers that bloom March to May. It is found in valley and foothill grassland and pinyon and juniper woodland habitats at elevations between 250 and 4,000 feet. Threats include loss of habitat, primarily through development. This species has been documented in the Wheeler Ridge-Maricopa WD.

Lost Hills Crownscale (*Atriplex vallicola*)

Lost Hills crownscale is a CNPS List 1B plant. This species is an annual that flowers from May to August. The short stems have few branches and alternate, egg-shaped leaves with entire margins. The individual flowers are inconspicuous because they are tiny and have no petals. Lost Hills crownscale typically grows in the dried beds of alkaline pools within scrub or annual grassland communities, although one population in southern Kern County occurs on exposed slopes rich in gypsum. Historical locations for Lost Hills crownscale were in Fresno, Kern, and San Luis Obispo counties. Two large centers of concentration remain today. One overlaps the Kern-Kings county boundary near the community of Lost Hills, and the other is on the Carrizo Plain in San Luis Obispo County. Much smaller populations are known from the Kerman Ecological Reserve in Fresno County, the Lokern-McKittrick area of Kern County, and southwestern Merced County. Other historically-known occurrences and much suitable valley-floor habitat have been destroyed by conversion to agriculture. This species has been recorded in the Lost Hills WD and Belridge WSD.

Recurved Larkspur (*Delphinium recurvatum*)

Recurved larkspur is a CNPS List 1B plant. This perennial herb in the buttercup (Ranunculaceae) family occurs in chenopod scrub and valley grassland on alkaline, poorly drained soils in scattered locations throughout the Central Valley and Central Coast. Recurved larkspur produces flowers with light blue sepals and white lower petals from March through June. Occurrences of recurved larkspur have been recorded in Kings County WD, Lost Hills WD and Belridge WSD.

San Joaquin Woollythreads (*Lembertia congdonii*)

San Joaquin woollythreads are a federally endangered and CNPS List 1B plant. It is an annual herb in the sunflower family (Asteraceae) that produces small yellow disk flowers from March to April. It is associated with the valley saltbrush scrub habitat, often found in drifted sand or clayey, alkaline soil. San Joaquin woollythreads have been documented in the Dudley Ridge WD, Lost Hills WD, and Belridge WSD.

Subtle Orache (*Atriplex subtilis*)

Subtle orache is a CNPS List 1B species. It is a member of the goosefoot family that blooms from August to October. It inhabits valley and foothill grassland from elevations between 40 to 100 meters and is known from the southern San Joaquin Valley, from Merced County in the north to Kern County in the south. Subtle orache has been recorded in Kings County WD.

Tejon Poppy (*Eschscholzia lemmonii* ssp. *kernensis*)

Tejon poppy is a CNPS List 1B plant. It is an annual herb that flowers from March to April. The deeply-divided leaves of Tejon poppy are mostly clustered at the base of the plant. Each flowering stem is taller than the leaves and bears a single, erect, hairless bud that develops into a showy orange flower with four petals. It grows on adobe clay soils in sparsely-vegetated grasslands between 250 and 600 meters in elevation. Tejon poppy is restricted to Kern County. It occurred historically in six areas in the low hills that surround the southern tip of the San Joaquin Valley, from Dry Bog Knoll (between Bakersfield and Woody) on the northeast to Elk Hills on the northwest. Tejon poppy has not been reported since 1969 but is assumed to remain in all areas where it was reported formerly because habitats have not been modified substantially. It has been recorded in the Wheeler Ridge Maricopa WD.

Special Status Wildlife

Invertebrates

Doyen's Trigonoscuta Dune Weevil (*Trigonoscuta* sp.)

Doyen's trigonoscuta dune weevil is not a state or federally listed or species of concern, but is included on the CDFG Special Animals list. Little is known about the biology or habits of dune weevils of the genus *Trigonoscuta* other than they are restricted to sandy soils of unstabilized dunes or similar accumulations of sand. Flightless and nocturnal, weevils in this genus are associated with a wide variety of plant types; the larvae feed on the roots and the adults on the leaves. All *Trigonoscuta* species are associated with either coastal, desert, or other inland sand dunes. Most inland species of the genus are found in the southwestern deserts. The primary threats to this species are the random effects of environmental and population processes facing all small, single populations. Other threats include off-road vehicle use and road widening, sand stabilization, or other highway maintenance activities by Caltrans. It has been recorded in the Dudley Ridge WD.

Molestan Blister Beetle (*Lytta molesta*)

The Molestan blister beetle is not a state or federally listed or species of concern, but is included on the CDFG Special Animals list. It is a member of the family Meloidae. Beetles of this family are variable in form, but generally have a down-turned head, soft bodies, and leathery wings. Species of the genus *Lytta* are believed to be parasites of ground-nesting bees of the genus *Anthophora*. Adults eat the flowers and pollen of various flowers, including *Lupinus* sp. and *Erodium cicutarium*. Adult Lytta beetles are typically observed in March and April, in non-native grassland and vernal pool habitats at localities in the San Joaquin Valley from Contra Costa County south to Kern and Tulare counties. CNDDB records indicate a distribution along the grassy plains and low foothills of the Sierra Nevada along the east side of the Central Valley, and throughout the Coast Ranges, from Kern County to Brentwood in Contra Costa County.

Little is known about the status of the molestan blister beetle due to the lack of definitive studies of its distribution. The specific habitat requirements for the molestan blister beetle would be the presence of beetle-type wildflowers for adults and anthophorid bee nests for larvae in a grassland setting; proximity to vernal pools may be important, but this may not be an essential requirement. This species has been recorded in the Lost Hills WD.

San Joaquin Dune Beetle (*Coelus gracilis*)

The San Joaquin dune beetle is not a state or federally listed or species of concern, but is included on the CDFG Special Animals list. Little information exists on the feeding habitats of this species, though it is probably a detritivore, feeding on decomposing vegetation buried in the sand. The hot summer climate of the San Joaquin Valley prevents a majority of beetles from emerging from the sand, so active periods range from about November through April. Activity also coincides with the growth period of the winter ephemeral plants under which San Joaquin dune beetles reside. Historically, the range of the San Joaquin dune beetle extended from Antioch, Contra Costa County, in the north to the Kettleman Hills, Kings County in the south. They inhabited inland sand dunes within this range. Currently, this beetle is restricted to small isolated sand dunes (250 - 10,000 m^2) along the western edge of the San Joaquin Valley. Although no direct evidence exists of a population decline of San Joaquin dune beetles, it is inferred from the widespread loss of sand dune communities in the Valley and apparent disappearance from near Antioch, Contra Costa County, California. This species has been recorded at the Dudley Ridge WD.

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

Vernal pool fairy shrimp are federally listed as threatened. They are small (11 to 27 mm) crustaceans adapted to survive the annual flooding and drying of vernal pools. They grow for about two weeks, breed, and produce eggs that the females carry in an egg sac until they mature. As the vernal pool dries, the adults die, and the eggs become embedded in the mud at the bottom of the pool. These “resting” eggs are protected by thick outer coverings that resist cold, heat, and desiccation during the summer months. The egg bank in the soil may contain eggs from several years of breeding. Vernal pool fairy shrimp occur throughout most of the length of California's Central Valley, from the Millville Plains and Stillwater Plains in Shasta County to Pixley in Tulare County with disjunct populations in the Santa Rosa Plateau near Rancho Santa California in Riverside County. They are threatened by commercial and residential development; conversion of land to agricultural uses; habitat fragmentation (which leads to the loss of genetic variability and related problems of inbreeding); off-road vehicle use; disposal of garbage into their habitat; water, flood control, highway, and utility projects; changes in the hydrologic patterns of their vernal pool and swale habitat; inadequate regulatory mechanisms that protect sites inhabited by these species; overgrazing; and potential extinction by virtue of the small isolated nature of the remaining populations. This species has been recorded in the Kings County WD.

Vernal Pool Tadpole Shrimp (*Lepidurus packardi*)

Vernal pool tadpole shrimp are federally listed as endangered. Vernal pool tadpole shrimp are small to moderate sized crustaceans adapted to survive in deeper or longer lasting vernal pools and other seasonal wetlands. Like the fairy shrimp, they grow over a period of a few weeks, breed, and produce eggs that the females carry in an egg sac until they mature. As the vernal pool dries, the adults die, and the eggs become embedded in the mud at the bottom of the pool.

These “resting” eggs are protected by thick outer coverings that resist cold, heat, and desiccation during the summer months. Vernal pool tadpole shrimp are found throughout the Central Valley. This species has been recorded in the Kings County WD.

Amphibians

California Tiger Salamander (*Ambystoma californiense*)

The California tiger salamander (CTS) is federally listed as threatened and a California species of special concern. CTS is most commonly found in annual grassland habitat, but also occurs in grassy understory of open valley-foothill hardwood habitats. The species occurs from near Petaluma, Sonoma County, east through the Central Valley to Yolo and Sacramento counties and south to Tulare County, and from the vicinity of San Francisco Bay south at least to Santa Barbara County. Adults spend most of the year in subterranean refugia, especially burrows of California ground squirrels (*Spermophilus beecheyi*) and occasionally man-made structures. The primary cause of decline of CTS populations is the loss and fragmentation of habitat from human activities and the encroachment of nonnative predators. All of the estimated seven genetic populations of this species have been significantly reduced because of urban and agricultural development, land conversion, and other human-caused factors. This species has been recorded in the Kings County WD.

Western Spadefoot (*Scaphiopus hammondii*)

Western spadefoot is a California species of special concern. This species occurs primarily in grasslands, but occasional populations also occur in valley-foothill hardwood woodlands. Grasslands with shallow temporary pools are optimal habitats for this species. Breeding and egg laying occur in shallow temporary pools. They spend most of their time in underground burrows, which they construct themselves or that have been constructed by burrowing mammals. During the first rains of fall, this species initiates surface movements. Breeding activities normally conclude by the end of March. This species has been recorded in Belridge WSD and Kings County WD.

Reptiles

Blunt-nosed Leopard Lizard *(Gambelia sila)*

Blunt-nosed leopard lizard (BNLL) is a federal and state-listed endangered species and a state “fully protected” species. BNLL are endemic to the San Joaquin Valley and not found above 800 meters in elevation. BNLL are generally found in sparsely vegetated alkali and desert scrub habitats throughout scattered locations in the San Joaquin Valley and adjacent foothills. They do not excavate their burrows, seeking cover in mammal burrows, under shrubs, or under structures such as fence posts. In the southern San Joaquin Valley, extent populations of BNLL are known to occur on the Pixley National Wildlife Refuge, Liberty Farms, Allensworth, Kern National Wildlife Refuge, Antelope Plain, Buttonwillow, Elk Hills, and Tupman Essential Habitat Areas, on the Carrizo and Elkhorn Plains, north of Bakersfield around Poso Creek, and in western Ken County. This species has been recorded in Belridge WSD, Berrenda Mesa WD, Lost Hills WD, Wheeler-Ridge Maricopa WD, Dudley Ridge WD and Tulare Lake Basin WD.

San Joaquin Whipsnake (*Masticophis flagellum ruddocki*)

The San Joaquin whipsnake is listed as a California species of special concern. The San Joaquin whipsnake's range extends from Colusa County in the Sacramento Valley southward to the Grapevine in the Kern County portion of the San Joaquin Valley and westward into the inner South Coast Ranges and the Carrizo Plain. The San Joaquin whipsnake occurs in open, dry, vegetative associations with little or no tree cover. In the western San Joaquin Valley, it occurs in valley grassland and saltbush scrub associations and is known to climb bushes for viewing prey and potential predators. The San Joaquin whipsnake requires one or more mammal associates as prey and uses burrows for refuge and probably for egg-laying sites. This species has been recorded in the Lost Hills WD.

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles, including both the northwestern (ssp. *marmorata*) and southwestern (ssp. *pallida*) subspecies, are California species of special concern. The drab brown or khaki-colored turtle lacks prominent markings on its carapace. Western pond turtles occur in a variety of permanent and intermittent aquatic habitats, such as ponds, marshes, rivers, streams, and ephemeral pools. Pond turtles require suitable basking and haul-out sites, such as emergent rocks or floating logs, and an upland nest site in the vicinity of the aquatic habitat, often within 200 meters. Western pond turtles range throughout the state of California, from southern coastal California and the Central Valley, east to the Cascade Range and Sierra Nevadas. They have been recorded in the Kings County WD.

Birds

Burrowing Owl *(Athene cunicularia)*

Burrowing owl is a California species of special concern. They are found in open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Burrowing owls are subterranean nesters that are dependent on burrowing mammals (e.g., California ground squirrel) to create their burrows. It breeds from March through August. This species has been recorded in the Wheeler Ridge Maricopa WD, Belridge WSD, Berrenda Mesa WD, Lost Hills WD, Tulare Basin WD and Kings County WD.

Le Conte's Thrasher (*Toxostoma lecontei)*

The Le Conte's thrasher is a California species of special concern. It is pale gray-brown on the upperparts and pale buff on the underparts. The long tail is dark brown to blackish, and contrasts with the pale body. The undertail coverts are buffy. The wings are short and rounded, typical of sedentary, terrestrial birds. The Le Conte's Thrasher inhabits desert flats, washes and alluvial fans with sandy and/or alkaline soil and scattered shrubs. Loss of habitat throughout its range is the main threat to the Le Conte's Thrasher. This species has been recorded in the Belridge WSD.

Mountain Plover (*Charadrius montanus*)

The mountain plover is a California species of special concern. It is endemic to North America and nests in the High Plains of the West. After nesting, it migrates southwest-ward to spend the winter in California and the U.S./Mexico borderlands. One of the most important wintering sites is the Imperial Valley where up to 40 percent of the global population may spend the winter in

agricultural fields and pastures, especially those recently burned or grazed. Significant numbers of mountain plovers also winter in upland areas of the Sacramento-San Joaquin Delta, the western San Joaquin Valley, the Carrizo Plain and Antelope Valley, north of Los Angeles. This species has been recorded in the Berenda Mesa WD.

Swainson's Hawk (*Buteo swainsoni*)

Swainson's hawk is a state-listed threatened species. It breeds in stands with few trees in juniper-sage flats, riparian areas, or oak savannah adjacent to suitable foraging habitat such as grasslands, alfalfa or grainfields with rodent populations. Threats to Swainson's hawk include development, resulting in the loss of foraging and nesting habitat. It breeds from March to October. This species has been recorded in the Kings County WD.

Tricolored Blackbird (*Agelaius tricolor*)

The tricolored blackbird is a California species of special concern. Although tricolored blackbirds occur sparingly in northwestern Baja California and south central Oregon, they are primarily endemic to the Central Valley and coastal valleys of California. They are a highly gregarious bird, forming large flocks in both breeding and non-breeding seasons. Nests are built near or over water, and occasionally in agricultural fields. Recently, tricolored blackbirds have displayed tendencies toward increased nesting in patches of blackberry, willows, mustard, thistles, nettles, and even grasses. It breeds from April through July. This species has been recorded in the Wheeler Ridge Maricopa WD, Lost Hills WD and Dudley Ridge WD.

White-faced ibis (*Plegadis chihi*)

The white-faced ibis is a California species of special concern. It is a medium-sized wading bird with an iridescent bronze-brown overall color, a thin band of white feathers around a bare red face, and a long, down curved bill. It breeds from Oregon, sporadically east to Minnesota, and south to southeastern New Mexico and Texas, and east to coastal Louisiana. It winters from southern California and the Gulf coast of Texas and Louisiana to El Salvador. Preferred habitats include salt and freshwater marshes in the west, and coastal marshes and brushy islands in Louisiana and Texas. This species has been recorded in the Tulare Basin WD and Lost Hills WD.

Mammals

American Badger (*Taxidea taxus*)

The American badger is a California species of special concern. The badger is a heavy-bodied, short-legged mammal with long fore claws, long yellowish gray to reddish brown fur, a short bushy tail and a white middorsal stripe that often extends down the back. They are most abundant in the drier open stages of most shrub, forest, and herbaceous habitats with friable soils. Badgers are basically solitary, nocturnal creatures, foraging at night and then remaining underground during the daylight hours. Historically, badgers ranged throughout California except for the humid coastal forests of the northwestern state. This species has been recorded in the Wheeler Ridge Maricopa WD and Dudley Ridge WD.

Buena Vista Lake Shrew *(Sorex ornatus relictus)*

The Buena Vista lake shrew is a federal-listed endangered species and a California species of special concern. Critical habitat for this species was designated on January 24, 2005, and is located just north of the Wheeler Ridge Maricopa WD. It is distinctly darker, grayish-black (not brown), slightly larger, and has a shorter tail than the other shrews that inhabit the same area. It historically inhabited wetlands around Buena Vista Lake and presumably throughout the Tulare Basin. The draining of the natural wetlands and lakes resulting in the decline of this species and its current status is largely unknown. The Buena Vista Lake shrew is a limited local endemic species that is restricted to areas of marshy wetland habitat. This species has been recorded in the Wheeler Ridge Maricopa WD.

Giant Kangaroo Rat (*Dipodomys ingens*)

The giant kangaroo rat is state and federally listed as endangered. Its recovery is addressed in *The Recovery Plan for the Upland Species of the San Joaquin Valley*. The giant kangaroo rat is the largest of more than 20 species in the genus *Dipodomys*, which is in the family Heteromyidae. Adult giant kangaroo rats range from 4.6 to 6.4 ounces in weight and 12.2 to 13.7 inches in length. Giant kangaroo rats are distinguished from the similar San Joaquin kangaroo rats (*D. nitratoides*) by the number of toes on their hind feet. Giant kangaroo rats have five toes, San Joaquin kangaroo rats have four. Giant kangaroo rats prefer annual grassland on gentle slopes of generally less than 10 degrees, with friable, sandy-loam soils. However, most remaining populations are on poorer, marginal habitats which include shrub communities on a variety of soil types and on slopes up to about 22 degrees. The historical distribution of giant kangaroo rats encompassed a narrow band of gently sloping ground along the western edge of the San Joaquin Valley, with occasional colonies on steeper slopes and ridge tops, from the base of the Tehachapi Mountains, Kern County, in the south, to near Los Banos, Merced County, in the north. The population is currently fragmented into six major geographic units. The units located in the southern San Joaquin Valley are: the Kettleman Hills in Kings County; and western Kern County in the area of the Lokern, Elk Hills, and other uplands around McKittrick, Taft, and Maricopa. This species has been recorded in the Belridge WSD and Dudley Ridge WD.

Nelson's (San Joaquin) Antelope Squirrel *(Ammospermophilus nelsoni)*

Nelson's (San Joaquin) antelope squirrel is a state-listed threatened species. This species is found in the western San Joaquin Valley on dry, sparsely vegetated loam soils from elevations of 200 to 1,200 feet above mean sea level. San Joaquin antelope squirrels dig their burrows or use the burrows of kangaroo rats. They typically occur in association with widely scattered shrubs, forbs, and grasses in broken terrain with gullies and washes. Antelope squirrels had been nearly eliminated from the floor of the Tulare basin, and existed mainly in marginal habitat in the mountainous areas bordering its western edge. Substantial populations were found only in and around Lokern and Elk Hills in western Kern County, and on the Carrizo and Elkhorn Plains in eastern San Luis Obispo County. This species has been recorded at the Dudley Ridge WD, Lost Hills WD, Berenda Mesa WD, Belridge WSD, and Wheeler Ridge Maricopa WD.

San Joaquin Kit Fox *(Vulpes macrotis mutica)*

San Joaquin kit fox (SJKF) is listed as a federal-listed endangered and state-listed threatened species. SJKF typically occupy annual grasslands or grassy open stages within scattered shrubby vegetation throughout the semi-arid habitats of the San Joaquin Valley. This species

requires loose-textured soils for burrowing and a suitable prey base. SJKF dens usually range between 11 to 21 cm at the narrowest measurable horizontal breadth, and are typically higher than they are wide. However, SJKF dens can vary greatly in size and shape. Historically, SJKF were found throughout the San Joaquin Valley and western portions of the Sacramento Valley. Due to the loss of suitable habitat, the SJKF's range has been highly fragmented to remaining areas of natural habitat. This species' range includes portions of all seven water districts.

San Joaquin Pocket Mouse (*Perognathus inornatus inornatus*)

The San Joaquin pocket mouse has no state or federal listing, but is included on the CDFG Special Animals list. This species is endemic to California's Central Valley. It constructs burrows in grassy and weedy areas where fine textured or sandy soils are present. Pocket mice are in the same family (Heteromyidae) as kangaroo rats, and many aspects of their biology and life history are similar. Like kangaroo rats, pocket mice are graniverous and nocturnal. During periods of intense weather or food shortage, pocket mice may enter an inactive state of torpor. This species has been recorded in the Wheeler Ridge Maricopa WD, Belridge WSD and Lost Hills WD.

Short-nosed Kangaroo Rat (Dipodomys nitratoides brevinasus)

The short-nosed kangaroo rat is California species of special concern. This species is one of three subspecies of the San Joaquin kangaroo rat. Typically, short-nosed kangaroo rats inhabit grasslands with scattered shrubs and desert-shrub associations on powdery soils. Their historic distribution is unknown, but they have been documented in arid grassland and shrubland associations along the western half of the San Joaquin Valley floor and hills on the western edge of the Valley floor from the Los Banos area, Merced County, south to the foothills of the Tehachapi Range and extending east and northward inland above the edges of the Valley floor to near Poso Creek, north of Bakersfield. They also occurred on the Carrizo Plain and the upper Cuyama Valley. The extent of its current distribution is also unknown. Populations are known from the Coalinga area, Fresno County, a few scattered locations in the Kettlemen and Lost Hills, Kings and Kern counties, the Lokern, Elk Hills, San Emigdio, and Wheeler Ridge regions of western Kern County, the Carrizo Plain Natural Area, and the Caliente Mountains at the edge of the Cuyama Valley. The extensive agricultural development of the 1960's and 1970's within its historic range is the main cause of the decline of the short-nosed kangaroo rat. This species has been recorded in the Belridge WD.

Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*)

The Tipton kangaroo rat is a federal and state-listed endangered species. It is one of three subspecies of the San Joaquin kangaroo rat, differing from the other two in range and size (the Tipton kangaroo rat is larger than the Fresno kangaroo rat and smaller than the short-nosed kangaroo rat). Historically this rat lived within the area of the Tulare Basin floor in the southern San Joaquin Valley, spreading east and south to the foothills of the Tehachapi Mountains in arid-land vegetative communities with level or nearly level terrain. The current range is restricted to scattered populations, west of Tipton, Pixley, and Earlimart and in areas in southern Kern County. This species has been recorded in the Wheeler Ridge Maricopa WD, and Lost Hills WD.

Tulare Grasshopper Mouse (*Onychomys torridus tularensis*)

The Tulare grasshopper mouse is a California species of special concern. The Tulare grasshopper mouse, a subspecies of the southern grasshopper mouse, fits the general description of the genus *Onychomys* by having a stout body with a short, club-like tail. They are sharply bicolored with the head and upperparts pale brown to gray or pinkish-cinnamon and the underparts white. The tail is usually bicolored with a white tip. Typically, Tulare grasshopper mice inhabit arid shrubland communities in hot, arid grassland and shrubland associations, including blue oak woodlands, upper sonoran subshrub scrub community; alkali sink and mesquite associations on Valley Floor; and grasslands associations on the sloping margins of the San Joaquin Valley and Carrizo Plain region. Specific habitat requirements are unknown. Like most of the other sensitive species of the San Joaquin Valley, habitat reduction, fragmentation, and degradation are the principal causes of the decline of the Tulare grasshopper mouse. Historically, the Tulare grasshopper mouse ranged from western Merced and eastern San Benito counties east to Madera County and south to the Tehachapi Mountains. Currently, they are known to occur in these areas: along the western margin of the Tulare Basin, including western Kern County; Carrizo Plain Natural Area; along the Cuyama Valley side of the Caliente Mountains, San Luis Obispo County; and the Ciervo-Panoche Region, in Fresno and San Benito counties. This species has been recorded in the Tulare Lake Basin WD, Belridge WSD, and Wheeler Ridge Maricopa WD.

Kern Fan Element

The Kern Fan Element, now known as the Kern Water Bank (KWB), was established in 1997, after approval of the Kern Water Bank Habitat Conservation Plan/Natural Community Conservation Plan in October of that year. The KWB consists of a water recharge and recovery operation, farming, and conservation bank and habitat conservation activities for 19,900 acres in Kern County.

Of the 19,000 acres, 5,900 are used for routine recharge activities, 960 acres will be in preserved for known populations of special status plants, 5,592 acres will revert to natural habitat, 530 acres will be preserved and managed for mitigation of DWR projects, 481 acres will be used for permanent water banking facilities, 3,170 acres for farming, and 3,267 acres for a conservation bank. At this time, 4,853 acres have been developed as permanent water recharge basins, and an additional 2,349 acres have been developed for recharge to relieve emergency flood conditions during El Nino weather events. Water recharge basins were constructed through the creation of approximately 63 miles of levees that were approximately three feet high along natural contour lines. 73 wells are currently on the site and more may be built or recovered in the future.

Prior to DWR's purchase of the KFE, approximately 17,068 acres of the property was under extensive cultivation. The remaining property was leased for oil recovery facilities and contained 1,515 acres of isolated sensitive native plant communities (valley saltbush scrub, Great Valley mesquite scrub and valley sacaton grassland) and 1,317 acres of non-native grassland. No wetland habitat was present in the project area except canals used to convey agricultural water.

In 1994, approximately 16,500 acres were undesignated, previously irrigated farmland. 288 acres were actively irrigated for agriculture. Approximately 2,690 acres were native or disturbed farmland, including open areas, and land maintained under dry farming for vegetation management. The additional 490 acres consisted of roads, canals, and oil and gas facilities on disturbed lands containing non-native vegetation.

Sensitive Communities

Great Valley Mesquite Scrub

Great Valley mesquite scrub is primarily vegetated by honey mesquite *(Prosopis glandulosa torreyana),* a perennial deep-rooted shrub that requires a high water table. Additional vegetation includes alkali saltbush and introduced annual grasses, which are more abundant in good rainfall years. Honey mesquite cover is usually low with densities of two to three per acre. The soils are sandy loams, of alluvial origin, often with wind modified micro-topography. Climate conditions consist of moist, foggy winters and hot dry summers. Great Valley mesquite scrub habitat was historically extensive in the southern San Joaquin Valley from Bakersfield to the Inner South Coast Ranch at Tupman and Buena Vista Lake, but has been virtually extirpated by flood control, agricultural development and groundwater pumping. Recorded occurrences of this habitat type are located along the north, east and south boundaries of the KWB.

Valley Sacaton Grassland

Valley sacaton grassland habitat is described above in the South San Joaquin Valley discussion. This habitat has been recorded approximately 1.5 miles south of the KWB.

Special Status Plants

Hoover's Woolly Star (*Eriastrum hooveri*)

The Hoover's woolly star was delisted from the federal threatened species list on October 7, 2003 and is CNPS List 4 species (plants of limited distribution- Watch list). This annual herb blooms from March through July and is in the phlox (Polemoniaceae) family. Habitat for this plant has been better defined as alkali sinks, washes, on both north-and south-facing slopes and on ridge tops in the southern San Joaquin Valley and adjoining coastal ranges. Hoover’s woolly start occurs within the KWB in small native plant communities located around historic oil field facilities. These areas are either designated as sensitive habitat areas, or compatible habitat, with one questionable occurrence in an area designated as a recharge basin, which had been established prior to DWR's purchase of the land. It was observed on approximately 620 acres of the KWB during the 1990-1991 *DFG/DWR* surveys.

Recurved Larkspur (*Delphinium recurvatum*)

Recurved larkspur was described above under the South San Joaquin Valley discussion. This species was observed on the KWB during the 1990-1991 DFG/DWR surveys within the KWB. Plants occurred in small remnant native plant communities, located around historic oil field facilities. Most areas have been included in designated sensitive habitat areas, or in designated compatible habitat. Recuvred larkspur was listed as a Group 1 species under the USFWS HCP.[1]

[1] Group 1 species are those species, which, due to their rarity and smaller preferred habitats have a significant chance of both becoming established in the KWB and being listed during the life of the permit.

San Joaquin Woollythreads *(Lembertia congdonii)*

San Joaquin woollythreads were described above under the South San Joaquin Valley discussion. This species has been found on approximately 160 acres at the KWB in small remnant native plant communities located around historic oil field facilities. Its location has been designated as sensitive habitat areas under the HCP. San Joaquin woollythreads were listed as a Group 1 species under the USFWS HCP.

Slough Thistle (*Cirsium crassicaule*)

Slough thistle is a CNPS List 1B plant. The genus Cirsium, in the sunflower (Asteraceae) family, contains thistle like plants with more than one white, pink or purplish flowers per head. Slough thistle is an annual or biennial herb, one to three meters high, endemic to California and only found in Kern, Kings, and San Joaquin counties. It blooms from May to August and its habitat is sloughs, riverbanks, and marshy areas in chenopod and riparian scrub. Slough thistle has been found in mesic areas throughout Kern County, and one population has been recorded by DWR at the KWB. Slough thistle was listed as a Group 1 species under the USFWS HCP.

Special Status Wildlife

Wildlife monitoring has occurred at the KWB since 1996, in order to measure population trends of sensitive wildlife species, their competitors, and predators, as well as water associated bird species. Surveys were targeted for San Joaquin kit fox and Tipton kangaroo rat, and also documented other large and small mammals or birds encountered. Additional special status species that could be located on the KWB are described below.

Amphibians

Western Spadefoot (*Scaphiopus hammondii*)

Described above in the South San Joaquin Valley discussion, western spadefoot has been recorded within the KWB. The closest recorded occurrence in the CNDDB is approximately 2.5 miles east of the KWB boundary. Western spadefoot was listed as a Group 1 species under the USFWS HCP.

Reptiles

Blunt-nosed Leopard Lizard *(Gambelia sila)*

Blunt-nosed leopard lizards were described above in the South San Joaquin Valley discussion. This species has been recorded within the KWB during the 1991 DWR surveys, associated with poor soils, sparse vegetation and areas of open ground. Blunt-nosed leopard lizard was listed as a Group 1 species under the USFWS HCP.

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. They were observed during the 1991 DWR surveys on the north side of the Kern River in the KWB. Western pond turtle was listed as a Group 1 species under the USFWS HCP.

Birds

Burrowing Owl *(Athene cunicularia)*

Burrowing owls were described above in the South San Joaquin Valley discussion. This species has been observed throughout the KWB and there has been an increase in observations of this species in the KWB according to the 2004 Annual Wildlife Monitoring Report, prepared by Quad Knopf. The burrowing owl was listed as a Group 1 species under the USFWS HCP.

Double-crested Cormorant (*Phalacrocorax auritus*)

The double-crested cormorant is California species of special concern. This cormorant is a yearlong resident along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters. They feed on fish, crustaceans and amphibians and prefers hunting in waters less than 30 feet deep with rocky or gravel bottoms. The birds rests in the daytime and roost overnight beside the water on offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or even transmission lines. Perching sites must be barren of vegetation, and the birds must visit the perches periodically in the day to dry its plumage. Many nesting colonies in California have been abandoned after human disturbance and habitat destruction. It breeds from April to July or August. The double-crested cormorant is associated with both fresh and marine bodies of water, such as lakes, ponds, coastal bays and shorelines, and was observed at the KWB during the Kern Audubon Society Christmas Bird Count in December, 2002. It was listed as a Group 2 species under the USFWS HCP.[2]

Loggerhead Shrike *(Lanius ludovicianus)*

The loggerhead shrike is a California species of special concern. This bird has a stout, hooked, all-dark bill, a bluish-gray head and back, a broad black mask extending above eye and thinly across top of bill, a gray to whitish rump, a black tail with white tip and large white patches in black wings. The breeding range of loggerhead shrikes extends from southern Canada to southern Mexico. Loggerhead shrikes prefer open habitat characterized by grasses interspersed with shrubs or low trees, although they occur in a wide variety of habitats such as prairies, grazed grasslands, fencerows of agricultural fields, riparian areas, open woodlands, suburban areas, mowed roadsides, and golf courses. They prefer "edge" habitats and frequently nest along roadsides and hedgerows in agricultural areas. Loggerhead shrikes forage primarily on mice and small birds in the winter and grasshoppers, beetles and other large insects in the summer. It breeds from March to August. This bird was observed during the 1990 DFG/DWR surveys of the KWB. It was listed as a Group 1 species under the USFWS HCP.

Northern Harrier *(Circus cyaneus)*

Northern harrier is a California species of special concern. This bird is a slim, medium-sized hawk with long, broad wings, long legs and tails and a characteristic facial ruff that gives them an owl-like appearance. The adult female is dark brown above and buffy below, with some streaking on the underparts and a barred tail. The adult male is pale gray above and white below with reddish spots on the underparts. The wingtips are edged with black. Harriers occur throughout the state except for the Sierra Nevada and the Cascade Range. Loss of wetland and

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[2] Group 2 species are those species which, due to a larger current population or larger or incompatible (compared to that found at the KWB) preferred habitat, are relatively unlikely to both be listed and become established at the KWB during the life of the permit.

grassland habitats has reduced the harrier population in California. Breeding usually occurs between April and September in shrubby vegetation within marshes although nesting may also occur in grasslands or other dry habitats away from water. Harriers forage primarily on small mammals that inhabit a variety of wet and dry habitats. This bird was observed in the KWB during the Kern Audubon Society Christmas Bird Count in December 2002. The northern harrier was listed as a Group 2 species under the USFWS HCP.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbirds were discussed above under the South San Joaquin Valley. There are two recorded occurrences of this species in the CNDDB within half a mile. Tricolored blackbirds were listed as a Group 1 species under the USFWS HCP.

Mammals

American Badger (*Taxidea taxus*)

The American badger was described above under the South San Joaquin Valley discussion and has been recorded within the KWB. This species was listed as a Group 1 species under the USFWS HCP.

Buena Vista Lake Shrew *(Sorex ornatus relictus)*

The Buena Vista lake shrew was described above under the South San Joaquin Valley discussion. It has been recorded at the Kern Fan Water Recharge Area, which is adjacent to the KWB. Critical habitat was designated on January 24, 2005 but excluded the KWB. This species was listed as a Group 1 species under the USFWS HCP.

Nelson's (San Joaquin) Antelope Squirrel *(Ammospermophilus nelsoni)*

A description of the San Joaquin antelope squirrel was provided above under the South San Joaquin Valley discussion. This species has been documented in the KWB.

San Joaquin Kit Fox *(Vulpes macrotis mutica)*

The San Joaquin kit fox was described above in the South San Joaquin Valley discussion. This species has been regularly surveyed for since 1996 and has been documented within the KWB.

Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*)

The Tipton kangaroo rat was described above in the South San Joaquin Valley discussion. This species has been regularly surveyed for since 1996 and has been documented within the KWB.

Castaic Lake

Castaic Lake is located in southern California at the confluence of Castaic Creek and Elizabeth Lake Canyon Creek, approximately 45 miles northwest of the City of Los Angeles. This facility consists of two bodies of water - the lagoon, or lower lake is for non-power boating or canoeing,

and the upper lake is used for sailing, power boating, and water and jet skiing. Castaic Lake has approximately 29 miles of shoreline.

Vegetation communities surrounding Castaic Lake include coastal scrub, chamise-redshank chaparral, and mixed chaparral. Due to the steep topography, fluctuating water levels and minimal shoreline, little aquatic vegetation is associated with the lake margin. Castaic Lagoon, surrounded by coastal scrub habitat, is located below Castaic Dam, and has gentler slopes and constant water levels, which allows for the establishment of vegetation. In addition, the lagoon has maintained public beaches and campgrounds vegetated with grasses, shrubs and trees, such as pines and eucalyptus. No sensitive habitats are known to occur within the lake margin of Castaic Lake that would be affected by the proposed project. Castaic Lake provides habitat for a variety of waterfowl, and foraging habitat for raptors. The upland surrounding the lake provides habitat for those species adapted to the arid conditions of southern California, similar to the species found at Lake Perris.

Sensitive Communities

No sensitive communities are known to occur in the vicinity of Castaic Lake.

Special Status Plants

No special status plants are known to occur in the vicinity of Castaic Lake.

Special Status Wildlife

Reptiles

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. Western pond turtles have not been observed at Castaic Lake, but they are likely to occur there since they have been reported upstream in Castaic Creek.

Birds

Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle is a federal-listed threatened species, proposed for delisting, and is a state-listed endangered and fully protected species. In 1995, the bald eagle was reclassified from federally endangered to threatened. Bald eagle nesting and wintering habitat is afforded protection under both federal and State ESAs. In California, bald eagles breed almost exclusively within Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties. Wintering activity occurs throughout the state except for the desert regions east of the Los Angeles Basin. Suitable nesting and foraging habitat is usually associated with large bodies of water including reservoirs, natural lakes, or rivers and nesting almost never occurs more than 3 kilometers (2 miles) from water. It breeds from February to June. This species has been observed wintering at Castaic Lake.

Mammals

Western Mastiff Bat (*Eumops perotis californicus)*

The western mastiff bat is a California species of special concern. he largest bat occurring in the United States, this species weighs from 60 to 70 grams (2.1 to 2.5 ounces), and has a wingspan of 53 to 58 centimeters (21 to 23 inches). It has been recorded at locations throughout much of the Central Valley and adjacent foothills, along the coast from Sonoma County south to San Diego County, and throughout the southern portion of the state from Kern and San Bernardino Counties south into Baja California. Western mastiff bats roost in cliff-face crevices and other high perches such as large trees and bridges that can provide them enough vertical distance to become airborne. Western mastiff bats forage over a wide variety of habitat types such as grasslands, deserts, woodlands and forests. Factors that limit the suitability of habitat for this species include the presence of suitable roost sites and large bodies of surface water for drinking. The western mastiff bat has been recorded near Lake Piru, which is approximately seven miles west of Castaic Lake. Given the presence of this large body of water, the bats could use Castaic Lake as foraging habitat.

Lake Perris

Lake Perris is located in Riverside County, approximately 13 miles southeast of the City of Riverside and 65 miles east of the City of Los Angeles. Vegetation communities surrounding Lake Perris include riparian vegetation on the northeast and eastern border, and sage scrub habitat along the northern and southern borders. The eastern border has a significant stand of riparian vegetation, containing willows *(Salix* sp.) and mulefat *(Baccharis salicifolia).* Beyond the riparian stand is annual grassland habitat. The immediate northern shoreline is maintained as part of the Lake Perris State Recreation Area (SRA), containing grassy lawns and shade trees such as pepper, eucalyptus, cypress, palm and pine trees. The Russell Mountains, located beyond the tended areas to the north, contains primarily sage scrub habitat, dominated by brittlebush *(Encelia farniosa).* The Bernasconi Hills, located to the south is primarily sage scrub habitat, dominated by California sagebrush *(Artemisia californica).*

The riparian habitat located along the northeastern side of Lake Perris is approximately 100 acres in size and can best be described as southern willow scrub. Riparian habitats throughout the state have been greatly reduced and have been identified as rare communities by CDFG. The riparian habitat at Lake Perris is dominated by several willow species *(Salix sp.)* growing thick as to prevent much understory growth. The limited understory present contains mulefat and stinging nettles *(Urtica holosencea).* The soils commonly found at this habitat are loose, sandy, or fine gravelly alluvium deposited near stream channels during flood flows. Southern willow scrub was formerly extensive along the rivers of coastal southern California, but has been greatly reduced by urban expansion, flood control and channel "improvements."

Terrestrial wildlife at Lake Perris is associated with the aquatic habitat, the riparian habitat on the northeast and eastern shore and the upland habitats. Creation of the reservoir provided a large body of water in the generally arid region of southern California, which now provides habitat for large numbers of waterfowl, such as western grebes *(Aechmophoru occidentalis),* Canada geese *(Branta canadensis),* mallards *(Anas playrbynchos)* and American coots *(Fulica americana).* The upland habitat surrounding the lake supports wildlife species adapted to arid, rocky conditions such as lizards and snakes, and birds and mammals that do not need permanent water or much vegetated cover. The riparian zone provides contrasting conditions to

the arid uplands, providing shade, shelter, food and perch sites for a number of bird species, many of which migrate through the area. It also provides nesting habitat for waterfowl.

The vegetation communities at Lake Perris are the same under current conditions as they were in 1994. The riparian vegetation community has remained stable and healthy and now provides habitat for least Bell's vireo, a federal and state-listed endangered species. Efforts to improve the habitat include tamarisk and Arundo removal. A thorough assessment of the habitat has never occurred, but should if changes in water levels would be significant.

Sensitive Communities

No sensitive communities are known to occur in the vicinity of Lake Perris.

Special Status Plants

No special status plants are known to occur in the vicinity of Lake Perris.

Special Status Wildlife

Reptiles

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. They have not been recorded at Lake Perris, but have been recorded in the San Jacinto River. According to the Western Riverside Multiple Species Habitat Conservation Plan (MSHCP),[3] it is potential habitat as the western pond turtle has been found at other lakes in the area. Lake Perris is one of several potential conservation areas according to the MSHCP.

Birds

Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle was described above under the Castaic Lake discussion. This bird has been observed wintering at the Lake Perris State Recreation Area. The closest recorded CNDDB occurrence is approximately 10 miles west at Lake Matthews. Lake Perris was included in the Western Riverside MSHCP as a conservation area for this species.

Cooper's Hawk (*Accipiter cooperii*)

The Cooper's hawk is California species of special concern. Cooper's hawk are medium-sized raptors with blue-gray upperparts and reddish barred underparts, have short, rounded wings and proportionately long, banded tails. Historically, the Cooper's hawk nested throughout most of California, primarily in riparian zones from valley river bottoms up to an elevation of

[3] The County of Riverside Transportation and Land Management Agency has prepared the Western Riverside MSHCP which serves as an HCP pursuant to Section 10(a)(1)(B) of the 1973 FESA, as well as a Natural Communities Conservation Plan (NCCP) under the California NCCP Act of 2001. This plan, similar in function to the Kern Water Bank HCP/NCCP, covers an area of 1.26 million acres in western Riverside County, including Lake Perris.

approximately 6,500 feet. During the winter months, Cooper's hawks primarily inhabit the bottomlands and foothills of California. Cooper's hawks in California demonstrate a preference for lowland riparian forests where nest stands typically include scattered stands of live or blue oaks. It breeds from March through August. The closest recorded CNDDB occurrence is approximately eight miles west. Lake Perris was included in the MSHCP as a conservation area.

Double-crested Cormorant (*Phalacrocorax auritus*)

The double-crested cormorant was described under the Kern Fan Element discussion. This species has been observed at Lake Perris.

Golden Eagle (*Aquila chrysaetos*)

The golden eagle is a California species of special concern and a state fully protected species. Habitat for golden eagles includes rolling foothills, mountain areas, sage-juniper flats, and desert areas. Grasslands, deserts, savannahs, and early successional stages of forest and shrub habitats are primary foraging habitats for this species. It nests on cliffs of all heights and in large trees in open areas. The breeding season for golden eagle is from January through July. Golden eagles have been observed at Lake Perris State Recreation Area and there is a recorded occurrence approximately eight miles south of Lake Perris.

Lawrence's Goldfinch (*Carduelis lawrencei*)

Lawrence's goldfinch is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. This species breeds in central California (west of the Sierra Nevadas) south to northern Baja California, often nesting in dense foliage in conifers 1 to 12 meters above ground. It winters in north-central California, central Arizona, southwestern New Mexico and (at least formerly) extreme western Texas south to northern Baja California, northern Sonora, and southern Arizona. They use oak woodland, chaparral, riparian woodland, pinyon-juniper associations and weedy areas in arid regions but usually near water. The closest recorded occurrence is approximately seven miles northwest from Lake Perris.

Least Bell's Vireo *(Vireo bellii pusillus)*

Least Bell's vireo is a federal and state-listed endangered species. This small songbird is relatively nondescript, colored gray above and white below, with one or two faint pale wing bars on otherwise dark wings and indistinct spectacles. Its nesting habitat consists of cottonwood-willow forest, oak woodland, shrubby thickets, and dry washes with willow thickets at the edges, in arid areas, but often near water. They prefer dense cover within one to two meters of the ground and a dense stratified canopy. Peak egg laying occurs from May to June. Wintering habitat consists of open woodland and brush. The species was historically found throughout California and northern Baja. Its range has been restricted to southern California south of the Tehachapi Mountains and northwestern Baja California. Least Bell's vireo has been observed at Lake Perris State Recreation Area during surveys of the riparian habitat located on the east margin of the lake.

Loggerhead Shrike *(Lanius ludovicianus)*

The loggerhead shrike was described above in the Kern Fan Element discussion. The closest recorded occurrence for this species is approximately five miles west of Lake Perris.

Northern Harrier *(Circus cyaneus)*

Northern harrier was described above in the Kern Fan Element discussion. It has been observed at the Lake Perris State Recreation Area and could use the riparian area to nest.

Osprey *(Pandion haliaetus)*

Osprey is a California species of special concern. This almost eagle-sized bird is dark brown above, and white underneath, with a white head and prominent dark brown eye stripe. Inhabiting every continent except Antarctica, osprey can be found near large bodies of water that support fish and have forest habitats nearby. They build nests in exposed locations, often in the tops of old trees, or in snags in beaver swamps. In California, breeding populations are found in the Cascade and Sierra mountain ranges and wintering populations can be found throughout the state. It breeds from March to September. Although there is no evidence of breeding populations at Lake Perris, this species has been observed there.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Southwestern willow flycatcher (SWWF) is a federal and state-listed endangered species. This almost sparrow sized bird is greenish or brownish gray above, with a white throat that contrasts with a pale olive breast, and pale yellow belly. The SWWF is insectivorous and catches insects in mid-flight. The habitat of the SWWF is extensive willow thickets. Breeding populations are found only in isolated meadows of the Sierra Nevada, and along the Kern, Santa Margarita, San Luis Rey, and Santa Ynez Rivers in southern California. SWWF breed from June to August. Loss and degradation of riparian habitat is the principal reason for the decline of SWWF populations and the decrease in geographic range of the species. Threats to SWWF include livestock grazing and nest parasitism by brown-headed cowbirds. The closest recorded occurrence is approximately nine miles north of Lake Perris.

White-tailed Kite *(Elanus leucurus)*

White-tailed (or black-shouldered) kite is a state fully protected species. This mostly white bird, with black shoulders, is a common to uncommon resident in coastal and valley lowlands throughout California. Nests are usually constructed of loosely piled sticks placed near the tops of dense oak, willow, or other tree stands. Kites forage over grasslands, marshes, agricultural areas, and wetlands where they prey mostly on small mammals. It breeds from February to October. White-tailed kites have been observed at the Lake Perris State Recreation Area, but the closest CNDDB recorded occurrence is approximately 10 miles west of Lake Perris.

Yellow Warbler (*Dendroica petechia brewsteri*)

Yellow warbler is a California species of special concern. This short-tailed and plump small bird (total body length of five inches) is primarily yellow with yellowish-olive wings, back, and tail and a prominent dark eye. The historical breeding distribution of the yellow warbler included riparian habitat throughout the western portion of the state, from Modoc west to Del Norte counties and south to San Diego County along the coast excluding the deserts of southeastern California.

Currently, the California yellow warbler nests throughout its historical range, but has been greatly reduced in the Sacramento and San Joaquin valleys, southern coastal area, and San Francisco, Marin, and Siskiyou counties. Preferred foraging and nesting habitat is streamside thickets of tangled, thick underbrush interspersed among alders, cottonwoods, and willows. It breeds from April to August. Yellow warblers have been observed at the Lake Perris State Recreation Area and could use the riparian habitat to nest. The closest recorded CNDDB occurrence is approximately 8.5 miles north of Lake Perris.

Mammals

Western Mastiff Bat (*Eumops perotis californicus)*

The western mastiff bat was described above under the Castaic Lake discussion. This bat has been recorded approximately 10 miles southwest of Lake Perris.

Stephens' Kangaroo Rat (*Dipodomys stephensi*)

Stephens' kangaroo rat is a federal-listed endangered and state-listed threatened species. This species is associated with sparsely vegetated habitats and frequently found in close association with dirt roads, previously and currently disturbed areas, and/ or sites with a high percentage of bare ground. It is primarily found in annual grassland or sparse sage scrub habitats were perennial cover is less than 30 percent. Certain non-native grasses (e.g. *Bromus diandrus)* can exclude this species from otherwise suitable habitat. As a fossorial (burrowing) animal, the Stephens' kangaroo rat typically is found in sandy and sandy loam soils with a low clay to gravel content. The geographic distribution of the Stephens' kangaroo rat includes the San Jacinto Valley and adjacent areas of western Riverside, southwestern San Bernardino, and northwestern San Diego counties. Lake Perris is identified as a core recovery area for this species, which has been documented just north of the lake, along its northern edge.

Yuma Myotis *(Myotis yumanensis)*

Yuma myotis is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. This small bat has short fur, shaded tan or brown on top, while their underparts are whitish or buffy. They are similar to the little brown myotis *(M. lucifugus)* and the two species have been known to interbreed. The range of this species extends north to British Columbia, Canada, through the western United States (as far east as Oklahoma) and south into central Mexico. It is more closely associated with water than most other North American bats and can be found in a wide variety of upland and lowland habitats, including riparian, desert scrub, moist woodlands and forests. Nursery colonies usually are in buildings, caves and mines, and under bridges. Little information regarding its habitat in California is available, but this bat has been observed at the Lake Perris State Recreation Area.

San Luis Reservoir

The San Luis Reservoir is located in western Merced County, just east of the Merced/Santa Clara County line. Vegetation habitats surrounding the San Luis Reservoir and the O'Neill Forebay include annual grassland, coastal sage scrub and riparian habitats. Terrestrial wildlife at the San Luis Reservoir and O'Neill Forebay is associated with the aquatic habitat, the riparian habitat and the surrounding upland habitats. Although development has significantly changed the habitats that were historically present, the San Luis Reservoir State Recreation Area

supports a variety of wildlife species including jackrabbits, ground squirrels, raccoons, opossums, skunks, feral pigs, and various snakes. It provides wintering habitat for migratory birds including golden eagles, white-tailed kites, the occasional bald eagle, geese and several species of ducks.

Sensitive Communities

No sensitive communities are known to occur in the vicinity of the San Luis Reservoir.

Special Status Plants

No special status plants are known to occur in the vicinity of the San Luis Reservoir.

Special Status Wildlife

Amphibians

California Red-legged Frog (*Rana aurora draytonii*)

The California red-legged frog (CRLF) is a federal-listed threatened species and a California species of special concern. The San Luis Reservoir is located within the critical habitat designation, finalized in 2001. A recovery plan for this species was published in 2002. This large brown to reddish-brown frog historically occurred over much of the state from the Sierra Nevada foothills to the Coast. CRLF inhabit ponds, slow moving creeks, and streams with deep pools that are lined with dense emergent marsh or shrubby riparian vegetation. Submerged root masses and undercut banks are important habitat features for this species. However, this species is capable of inhabiting a wide variety of perennial aquatic habitats as long as there is sufficient cover, and bullfrogs or non-native predatory fish are not present. CRLF is known to survive in ephemeral streams, although only if deep pools with vegetative cover persist through the dry season. Factors that have contributed to the decline of CRLF include destruction of riparian habitat due to development, agriculture, or flood control practices, and the introduction of exotic predators such as bullfrogs, crayfish, and a variety of non-native fishes. CRLF have been recorded in the streams that feed into the reservoir.

Reptiles

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. They have been documented approximately two miles west of the San Luis Reservoir.

Birds

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was described above in the Castaic Lake discussion. The closest recorded occurrence of this bird is approximately 40 miles northwest at Lake Del Valle.

Osprey *(Pandion haliaetus)*

Osprey are described above under the Lake Perris discussion. This species has been recorded approximately 40 miles west of the San Luis Reservoir.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbirds were described above under the South San Joaquin Valley discussion. This bird has been recorded along the southeastern edge of the San Luis Reservoir.

White-tailed Kite *(Elanus leucurus)*

White-tailed kites were described above in the Lake Perris discussion. The closest recorded occurrence is approximately 25 miles west of the San Luis Reservoir.

Mammals

San Joaquin Kit Fox (*Vulpes macrotis mutica*)

The San Joaquin kit fox was described above in the South San Joaquin Valley discussion. This species' range follows the eastern edge of the San Luis Reservoir.

Western Mastiff Bat (*Eumops perotis californicus)*

The western mastiff bat was described above under the Castaic Lake discussion. This bat has been recorded approximately 35 miles southeast of the San Luis Reservoir.

Yuma Myotis *(Myotis yumanensis)*

Yuma myotis was described above under the Lake Perris discussion. This species has been recorded approximately three miles south of the San Luis Reservoir.

Lake Oroville

Lake Oroville, with a maximum surface area of 15,000 acres is located on the Feather River, in Butte County, approximately 75 miles north of Sacramento. The reservoir is fed by the North, Middle, and South Forks of the Feather River and was formed in 1964 by the construction of the Oroville Dam. Other facilities associated with the lake include the Thermalito Forebay, the Thermalito Afterbay, the Feather River Hatchery, and the Feather River Low Flow Channel. Vegetation at the lake is limited due to loss of soil from wave action and periodic inundation followed by severe desiccation.

Sensitive Communities

No sensitive communities are known to occur in the vicinity of Lake Oroville.

Special Status Plants

Brandegee's Clarkia (*Clarkia biloba* ssp. *brandegeeae*)

Brandegee's clarkia is a CNPS List 1B plant. It is a member of the evening primrose (Onagraceae) family and blooms from May to July. This annual herbaceous plant grows less than one meter tall, has linear to lanceolate leaves, and lavender-colored petals. It grows in chaparral cismontane woodlands often along roadcuts at elevations between 225 and 915 meters. This species is threatened by road maintenance and fire suppression. This species has been recorded along the banks of Lake Oroville, with several occurrences along the South Fork of the Feather River, after it enters Lake Oroville.

Cut-leaved Ragwort (*Senecio eurycephalus* var. *lewisrosei*)

Cut-leaved ragwort is a CNPS List 1B plant. This herbaceous perennial belongs to the sunflower (Asteraceae) family and blooms from March to July. The plant occurs in Butte and Plumas counties at elevations ranging from 285 to 1,890 meters above mean sea level. It grows in chaparral, cismontane woodland, and lower montane coniferous forest habitats with serpentinite soil. It is threatened by mining and road maintenance. This species has been recorded along the West Branch of the Feather River, after it enters Lake Oroville.

Mildred's Clarkia (*Clarkia mildrediae* ssp. *mildrediae*)

Mildred's clarkia is a CNPS List 1B plant. This herbaceous annual belongs to the evening primrose (Onagraceae) family and blooms from May to August. The plant occurs in Butte and Plumas counties at elevations ranging from 245 to 1,710 meters above mean sea level. It grows in cismontane woodland to lower montane coniferous forest habitats with sandy or granitic soils. It is threatened by roadway construction. This species has been recorded along the North Fork of the Feather River, after it enters Lake Oroville.

Mosquin's Clarkia (*Clarkia mosquinii*)

Mosquin's clarkia is a CNPS List 1B plant. This herbaceous annual belongs to the evening primrose (Onagraceae) family and blooms from May to July. The plant occurs in Butte and Plumas counties at elevations ranging from 185 to 1,170 meters above mean sea level. It grows in cismontane woodland to lower montane coniferous forest habitats with rocky soil, or along roadsides. It is threatened by roadway construction. This species has been recorded along the South and Middle Forks of the Feather River, after they enter Lake Oroville.

White-stemmed Clarkia (*Clarkia gracilis* ssp. *albicaulis*)

White-stemmed clarkia is a CNPS List 1B plant. This herbaceous annual belongs to the evening primrose (Onagraceae) family and blooms from May to July. The plant occurs in Butte, Lake, and Tehama counties at elevations ranging from 245 to 1,085 meters above mean sea level. It grows in chaparral cismontane woodland habitats, usually with serpentinite soil. This plant is known from fewer than twenty occurrences and is threatened by urbanization. This species has been recorded along the North and Middle Forks of the Feather River, after they enter Lake Oroville.

Birds

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was described above in the Castaic Lake discussion. This species has been recorded along the North and Middle Forks of the Feather River, after they enter Lake Oroville.

Northern Goshawk (*Accipiter gentilis*)

The northern goshawk is a California species of special concern. It is largest of the three accipiters at 19 to 26 inches in length and a wingspan of 40 to 48 inches. The female is significantly larger than the male. The northern goshawk inhabits old-growth forests throughout the United States, Canada, and northern Mexico. Nesting begins in late March or early April, with two to four bluish-white eggs laid in April that are incubated by both sexes for about 30 days. This species has been recorded along the South Fork of the Feather River, after it enters Lake Oroville.

Sacramento River

The lower Sacramento River, from where it meets the Feather River to where it enters the Sacramento/San Joaquin Delta, is predominantly channelized, leveed, and bordered by agricultural lands. Aquatic habitat in the lower Sacramento River is characterized primarily by slow-water glides and pools, is depositional in nature, and has reduced water clarity and habitat diversity, relative to the upper portion of the river. The American River joins the Sacramento River in the City of Sacramento. As with the Feather River, the Sacramento River supports a fragmented and narrow riparian forest.

Sensitive Communities

Coastal Brackish Marsh

Coastal brackish marsh is dominated by perennial, emergent, herbaceous monocots up to two meters tall. Cover is often complete and dense. This community is similar to both salt marshes and freshwater marshes with some plant characteristics from each. Salinity may vary considerably, and may increase at high tide or during seasons of low freshwater runoff or both. This community usually intergrades with coastal salt marshes toward the ocean and occasionally with freshwater marshes at the mouths of rivers, especially in the Sacramento-San Joaquin River Delta. This community is usually at the interior edges of coastal bays and estuaries or in coastal lagoons. Characteristic species include Harford's sedge (*Carex harfordii*), slough sedge (*Carex obnupta*), *Carex* ssp., saltgrass *(Distichlis spicata* var. *spicata*), *Juncus* spp., pickleweed (*Salicornia* spp.), *Scirpus* spp*.,* and broad-leaved cattail (*Typha latifolia*)*.* This community has been recorded within the Delta near the confluence of the Sacramento and San Joaquin Rivers.

Elderberry Savanna

Elderberry savanna is an open, winter-deciduous shrub savanna dominated by blue elderberry (*Sambucus mexicana)*, usually with an understory of introduced annual grasses and forbs. This community rapidly succeeds to Great Valley Mixed Riparian Forest without grazing, flooding, or fire. Old stands of this community are frequently overrun by wild grape (*Vitis californica*). The distribution of this community is scattered among surviving stands of riparian vegetation

throughout the Sacramento and northern San Joaquin valleys. The elderberry savanna occurs some distance from the active channel but still be subject to flooding during high water. This community has been recorded just west of the confluence of the Sacramento and American rivers.

Great Valley Cottonwood Riparian Forest

The Great Valley cottonwood riparian forest has a diverse, and typically dense mixture of tall mature cottonwood (*Populus fremontii*) and willows (*Salix* spp.), as well as California sycamore (*Platanus racemosa*), box elder (*Acer negundo* var. *californicum*), black walnut (*Juglans hindsii*), and white alder (*Alnus rhombifolia*). The understory includes shrub species such as California button bush (*Cephalanthus occidentalis*), Himalayan blackberry (*Rubus discolor*), poison oak (*Toxicodendron diversilobum*), wild grape and California Dutchman's pipe (*Aristolochia debilis*). Perennial grasses such as creeping wild rye (*Leymus triticoides*), and sedges may form dense pockets in the understory. Openings within this community may also support elderberry savanna. The Great Valley cottonwood riparian forest may occur some distance from the active channel but may still be subject to over bank flooding. This community has been recorded just west of the confluence of the Sacramento and American rivers.

Great Valley Mixed Riparian Forest

Great Valley mixed riparian forest is a tall, dense, winter-deciduous, broad-leafed riparian forest. The tree canopy usually is fairly well closed and moderately to densely stocked with several species including box elder, black walnut, sycamore, cottonwood, Goodding's black willow (*Salix gooddingii*), red willow (*Salix laevigata*), and shining willow (*Salix lasiandra*). Understories consist of these taxa plus shade-tolerant shrubs like California button bush and Oregon ash (*Fraxinus latifolia*). This community is found on relatively fine-textured alluvium somewhat back from active river channels and is subject to overbank flooding. It occurs in the floodplains of low-gradient, depositional streams of the Great Valley, usually below about 500 feet mean sea level. Formerly very extensive in the Sacramento and northern San Joaquin valleys, this forest largely has been cleared for agriculture, flood control, and urban expansion. This habitat has been recorded along the Sacramento River, just west of its confluence with the Feather River.

Special Status Plants

Carquinez Goldenbush (*Isocoma arguta*)

Carquinez goldenbush is a CNPS List 1B plant. This perennial herb is a member of the sunflower (Asteraceae) family, and occurs in valley and foothill grasslands with alkaline substrates. The flowering period for this species is August to December, and it occurs at elevations ranging from 1 to 20 meters. It is threatened by development and agriculture. This species has been recorded within the Delta near the confluence of the Sacramento and San Joaquin Rivers.

Delta Mugwort (*Limosella subulata*)

Delta mudwort is a CNPS List 2 plant (rare, threatened, or endangered in California, but more common elsewhere). It is a perennial rhizomatous herbaceous plant in the figwort (Scrophulariaceae) family found on mud banks of the Sacramento/San Joaquin River Delta in marshy or scrubby riparian associations, often with Mason's lilaeopsis. Its blooming period is

from May through August and its elevation range is zero to four meters. Threats to Delta mudwort include habitat destruction. This species has been recorded along the Sacramento River, in various locations starting approximately 11 miles upstream from the confluence of the Sacramento and San Joaquin Rivers.

Delta Tule Pea (*Lathyrus jepsonii* var. *jepsonii*)

Delta tule pea is a CNPS List 1B plant. It is a perennial herbaceous plant in the legume (Fabaceae) family found in freshwater and brackish marshes and seasonal wetlands with cattails, Suisun Marsh aster, and rushes (*Juncus* spp). Most of its distribution is restricted to the Sacramento/San Joaquin River Delta at elevations of zero to four meters. Its blooming period is from May through September. The Delta tule pea is threatened by agriculture, water diversions, and erosion. This species has been recorded along the Sacramento River, in various locations starting approximately 18 miles upstream from the confluence of the Sacramento and San Joaquin rivers.

Mason's Lilaeopsis (*Lilaeopsis masonii*)

Mason's lilaeopsis is a state-listed rare and CNPS List 1B plant. It is a member of the carrot (Apiaceae) family, and occurs in tidal freshwater and brackish marshes and riparian scrub habitats, with muddy or silty soil formed through river deposition or riverbank erosion. Endemic (restricted) to California, Mason's lilaeopsis is known to occur in six counties. It occurs at elevations ranging from 0 to 10 meters, and the flowering period is April through November. Threats to the continued existence of this species include erosion, channel stabilization, developing flood control projects, recreation, agriculture, shading resulting from marsh succession and competition with non-native plants. This species has been recorded along the Sacramento River, in various locations starting approximately 16 miles upstream from the confluence of the Sacramento and San Joaquin Rivers.

Northern California Black Walnut (*Juglans hindsii*)

Northern California black walnut is CNPS List 1B plant. It is a member of the walnut (Juglandaceae) family and is a perennial deciduous tree that occurs in riparian forests and woodlands. Its blooming period is from April through May and it occurs at elevations ranging from 0 to 440 meters above mean sea level. Threats include hybridization with orchard trees, urbanization, and conversion to agriculture. This species has been recorded along the Sacramento River from just south of the town of Freeport to the Delta.

Rose Mallow (*Hibiscus lasiocarpus*)

Rose mallow is a CNPS List 2 plant. It is perennial rhizomatous emergent herb in the mallow (Malvaceae) family, and occurs in freshwater marshes and swamps, preferring moist freshwater-soaked riverbanks and low peat islands in sloughs. It blooms from June through September, at elevations ranging from 0 to 150 meters. Threats include development, agriculture, recreation, and channelization of the Sacramento River and its tributaries. This species has been recorded along the Sacramento River, in various locations starting approximately 12 miles upstream from the confluence of the Sacramento and San Joaquin rivers.

San Joaquin Spearscale (*Atriplex joaquiniana*)

San Joaquin spearscale is a CNPS List 1B plant. It is a member of the goosefoot (Chenopodiaceae) family, and occurs in chenopod scrub, meadows and seeps, playas, and valley and foothill grasslands with alkaline soils. It is an annual herb, blooming from April to October that occurs at elevations ranging from 0 to 835 meters. Threats include agriculture and competition between non-native plants. This species has been recorded along the Sacramento River, in various locations starting approximately 12 miles upstream from the confluence of the Sacramento and San Joaquin rivers.

Suisun Marsh Aster (*Aster lentus*)

Suisun Marsh aster is a CNPS List 1B plant. It is a perennial rhizomatous herb in the sunflower (Asteraceae) family that blooms May through November. A species endemic to the Sacramento/San Joaquin River Delta, the Suisun Marsh aster is most often seen along sloughs with reeds, bulrush, blackberry and cattails in brackish and freshwater marshes and swamps. Threats to this plant include marsh habitat alteration and loss. Elevations range from 0 to 3 meters. This species has been recorded along the Sacramento River, in various locations starting just east of the town of Franklin.

Special Status Wildlife

Invertebrates

Antioch Dunes Anthicid Beetle (*Anthicus antiochensis*)

Antioch Dunes anthicid beetle is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. Habitat for this species includes interior sand dunes and sand bars. It is commonly collected in pitfall traps in bare, unvegetated sand. This species is apparently extirpated from the type locality at Antioch Dunes. Stabilization of the dunes in the 1950s may have eliminated the loose, sandy substrate preferred by this species. In the early 1990s it was collected along the Sacramento River in Glenn, Tehama, Shasta, and Solano counties, and from one site at Nicolaus on the Feather River in Sutter County. This species has been recorded just west of the confluence of the Deep Water Channel and the Sacramento River.

Sacramento Anthicid Beetle (*Anthicus sacramento*)

Sacramento anthicid beetle is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. Habitat for this species includes interior sand dunes and sand bars, but has also been found in dredge spoil heaps. It is found along the Sacramento and San Joaquin rivers, from Shasta to San Joaquin counties, and at one site along the Feather River in Nicolaus. This species may once have been more widely distributed in loose sands along the Sacramento River, but man-made alterations to the riverbank have probably reduced its preferred habitat. However, dredging of the river channel has also created suitable habitat by depositing loose dredge material along the banks. This species has been recorded in three locations along the Sacramento River: (1) just before its confluence with the Deep Water Channel; (2) just west of the confluence of the Deep Water Channel and the Sacramento River and (3) approximately 2.5 miles south of the confluence of the Deep Water Channel and the Sacramento River.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

Valley elderberry longhorn beetle (VELB) is a federal-listed threatened species that occurs throughout the year in riparian woodlands and other Central Valley habitats containing elderberry shrubs (*Sambucus* spp.), upon which the VELB are completely dependent for all stages of their life cycle. The females lay their eggs in crevices in the bark. After hatching, the larvae burrow into the stems of the tree where they will feed on the interior wood for the next one to two years. The larvae then form pupae from which the adults emerge. The adults then bore their way out of the stems, leaving a distinctive oval shaped hole. As the larvae and adults are rarely seen, these bore holes are often the only evidence of this species' presence. After emergence from the stems, the adults remain in association with the elderberries, where they will feed on the elderberry foliage and eventually reproduce. All elderberry shrubs within the known range of the VELB, which have one or more stems with diameters of one inch or greater at ground level, are considered potential habitat for this species. This species or its habitat has been documented along the Sacramento River.

Reptiles

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. Although not documented in the CNDDB, this species has been observed along the Sacramento River.

Birds

Bank Swallow (*Riparia riparia*)

The bank swallow is a state-listed threatened species. The bird builds nests in deep burrows that it digs perpendicularly into nearly vertical earthen banks along streams, coastal bluffs, and sand and gravel pits. In California, it relies on naturally eroding habitats of major lowland river systems. The species is colonial and migratory, breeding in California from April to August in the Central Valley and wintering in South America. The bank swallow once bred throughout the lowlands of the state with major populations on the broad river valleys of central California. The current population is restricted to portions of the upper Sacramento River, primarily between Redding and Colusa, about four or five central and north coast colonies, and scattered colonies in northern and northeastern California. This species has been recorded along the Sacramento River, upstream from its confluence with the Feather River.

Burrowing Owl *(Athene cunicularia)*

Burrowing owls were described above in the South San Joaquin Valley discussion. This species has been recorded along the Sacramento River just north of the Town of Freeport.

Great Blue Heron (*Ardea herodias*)

The great blue heron is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. This heron is a colonial nester in tall trees, cliff sides, and sequestered spots on marshes. The rookery sites are close in proximity to foraging habitat, such as marshes, lake margins, tide-flats, rivers and streams, and wet meadows. It breeds from February through July. This species is commonly observed along the Sacramento River and a rookery has been

recorded along the Sacramento River, at a location approximately seven miles upstream from the confluence of the Sacramento and San Joaquin Rivers.

Great Egret (*Ardea albus*)

Great egret is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. It is a common yearlong resident throughout California, except for high mountains and deserts. It requires groves of trees suitable for nesting and roosting, relatively isolated from human activities, near aquatic foraging areas. Nests are built of sticks and stems of marsh plants and usually occur near water, at a height of 6 to 12 meters above ground and are sheltered from prevailing winds. The nesting season is between March and July. This species is commonly observed along the Sacramento River and a rookery has been recorded within a mile of the river, approximately five miles south of its confluence with the Feather River.

Swainson's Hawk (*Buteo swainsoni*)

Swainson's hawk was described above under the South San Joaquin Valley discussion. Recorded nest sites are all along the Sacramento River.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbirds were described above under the South San Joaquin Valley discussion. This species has been recorded along the Sacramento River, near its confluence with the Feather River.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

The western yellow-billed cuckoo is a state-listed endangered species and a federal-listed candidate species. Historically, the yellow-billed cuckoo bred throughout much of North America. They breed from mid- to late-May to July in dense willow and cottonwood stands in river floodplains. The greatest threat to the species is loss of riparian habitat. It has been estimated that 90% of the cuckoo's stream-side habitat has been lost. Habitat loss in the west is attributed to agriculture, dams and river flow management, overgrazing and competition from exotic plants such as tamarisk. This species has been recorded along the Sacramento River, near the Town of Clarksburg.

Feather River

Sensitive Communities

<u>Great Valley Mixed Riparian Forest</u>

The Great Valley mixed riparian forest habitat was described above under the Sacramento River discussion. It is located along the Feather River, in a couple of different locations, the largest of which is approximately eight miles south of Marysville/Yuba City.

Special Status Plants

Hartweg's Golden Sunburst (*Pseudobahia bahiifolia*)

Hartweg's golden sunburst is a federal and state-listed endangered species and a CNPS 1B plant. It is an herbaceous annual in the sunflower (Asteraceae) family that blooms in March and April. The plant is known to occur mostly in the San Joaquin Valley at elevations ranging from 15 to 150 meters above mean sea level. It grows in valley and foothill grasslands and woodland habitats with clay soils. It is seriously threatened by development, agriculture, overgrazing, and trampling. CNDDB contains one record of this plant from 1848 in the vicinity of the Yuba and Feather River confluence.

Pink Creamsacs (*Castillieja rubicundula ssp. rubicundula*)

Pink creamsacs is a CNPS List 1B plant. This annual herb belongs to the Scrophulariaceae (Figwort) family. It occurs in open areas of chaparral, in cismontane woodland, meadows and seeps and on serpentinite substrate in valley and foothill grasslands. It is found at elevations between 20 and 900 meters and blooms from April to June. This species has been recorded at the Thermalito Diversion Pool.

Veiny Monardella (*Mondardella douglasii* ssp. *venosa*)

Veiny monardella is a CNPS List 1B plant. This herbaceous annual belongs to the mint (Lamiaceae) family and blooms from May to July. It occurs in valley and foothill grasslands and woodland habitats at elevations ranging from 60 to 410 meters above mean sea level. It is threatened by development of wastewater treatment plants. There is one record for veiny monardella from 1854 near Corduas Farm, on the north bank of the Yuba River near the confluence of the Yuba and Feather rivers.

Special Status Wildlife

Invertebrates

Sacramento Valley Tiger Beetle (*Cicindela hirticollis abrupta*)

Sacramento Valley tiger beetle is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. It is a littoral-riparian species that inhabits fine-grained sandy shorelines of lakes and rivers. Since the 1970's, this beetle has been known only from the shoreline and sand bars of the Feather River near the town of Nicolaus in Sutter County. This species can be distinguished from related subspecies by the maculation patter on its elytra.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)

The valley elderberry longhorn beetle was described above under the Sacramento River discussion. This species has been recorded along the Feather River in several locations – at Star Bend, in the Oroville Wildlife Area, and approximately two miles south of the Feather River/Honcut Creek confluence.

Reptiles

Giant Garter Snake (*Thamnophis gigas*)

The giant garter snake (GGS) is a federal and state-listed threatened species. Habitat requirements for GGS include adequate water during the snake's active season (early spring through mid-fall) to provide food and cover; emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season; grassy banks and openings in waterside vegetation for basking; and higher elevation uplands for cover and refuge from flood waters during the snake's winter dormant season. Permanent freshwater marshes, agricultural canals, ditches and drains associated with rice fields, streams, and sloughs, particularly with mud bottoms provide habitat. To avoid inundation in the winter, giant garter snake (GGS) overwinter in upland, non-marsh sites in small mammal burrows or under debris in close proximity to summer habitat. This species has been recorded along the Feather River approximately three miles north of its confluence with the Sacramento River.

Western Pond Turtle *(Emys (Clemmys) marmorata)*

Western pond turtles were described above in the South San Joaquin Valley discussion. This species has been documented in the Feather River, just south of the Oroville Dam and just north of the Feather River/Bear River confluence.

Birds

Bank Swallow (*Riparia riparia*)

Bank swallows were described above under the Sacramento River discussion. This species has been recorded at more than 25 locations along the Feather River.

Osprey *(Pandion haliaetus)*

Osprey were described above under the Lake Perris discussion. They have been recorded along the Thermalito Diversion Pool.

Swainson's Hawk (*Buteo swainsoni*)

Swainson's hawk was described above under the South San Joaquin Valley discussion. This species has been recorded at more than 25 locations along the Feather River.

Tricolored Blackbird (*Agelaius tricolor*)

Tricolored blackbirds were described above under the South San Joaquin Valley discussion. This species has been recorded along the Sacramento River, near its confluence with the Feather River.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

Western yellow-billed cuckoo was described above under the Sacramento River discussion. This species has been recorded in four locations along the Feather River – two near Marysville and two near the Feather River/Bear River confluence.

Mammals

Silver-haired Bat (*Lasionycteris noctivagans*)

Silver-haired bat is not a federal or state-listed species, but it is listed on the CDFG Special Animals List. It is a medium sized bat that is nearly black, with silvery-tipped hairs on its back. It is a solitary, tree roosting species of deciduous and coniferous forests. In summer, it roosts in protected spots such as under bark or in dead trees, woodpecker holes, or bird nests. This species migrates south during the winter and hibernates in trees, crevices, buildings, and other protected places. This species has been recorded along the Feather River, south of the Thermilato Diversion Pool.

Plumas County

Plumas County is located in northeastern California, where the Sierra Nevada and Cascade mountain ranges meet. It boasts more than 100 lakes, 1,000 miles of rivers and streams with over a million acres of national forest, including portions of the Plumas National Forest and Lassen Volcanic National Park.

The various lakes throughout Plumas County, which include Bucks, Almanor, Davis, and Frenchman's Reservoir, provide numerous activities such as water-skiing, swimming, and canoeing. Feather River is designated as a National Wild & Scenic River through Plumas County.

The CNDDB was queried for all of Plumas County, but only species and habitats that occur along streams are discussed below.

Sensitive communities

No sensitive communities are known to occur along stream habitats in Plumas County.

Special Status Plants

Cut-leaved Ragwort (*Senecio eurycephalus* var. *lewisrosei*)

Cut-leaved ragword was described above under the Sacramento River discussion. This species has been recorded along the North Fork of the Feather River in western Plumas County.

Mildred's Clarkia (*Clarkia mildrediae* ssp. *mildrediae*)

Mildred's clarkia was described above under the Sacramento River discussion. This species has been recorded along the North Fork of the Feather River in western Plumas County.

Mingan moonwort (*Botrychium minganense*)

The mingan moonwort is a CNPS List 2 plant. It is found in montane coniferous forests between elevations of 1,500 and 2,055 meters along creek banks, mesic woods, meadows, and sand dunes. This perennial fern consists of an upright stem that terminates in a cluster of tiny ball-like structures, resembling a bunch of grapes (hence the nickname "grapefern"). Fern-like leaf blades of a dull green color measure approximately 10 centimeters long and 2.5 centimeters

wide. Leaflets are fan-shaped. It is located throughout northern North America, extending south to the western mountains of southern California and northern Arizona, and to Minnesota, Wisconsin, and Michigan. This species has been recorded in five locations in Plumas County, but the locations are suppressed.

Mosquin's Clarkia (*Clarkia mosquinii*)

Mosquin's clarkia was described above under the Sacramento River discussion. This species has been recorded along the Fall River at the western Plumas County line.

Northwestern moonwort (*Botrychium pinnatum*)

The northwestern moonwort is a CNPS List 2 plant. It is found in creek banks, meadows, seeps, and the shrubby slopes of montane coniferous forests between elevations of 1,770 and 2,010 meters. This perennial fern has bright green, deeply-lobed leaves which measure approximately 8 centimeters long and 5 centimeters wide, and are doubly-pinnate. Its range is the Klamath Mountain Range and the High Cascade Range, and extends as far north as Alaska and east to Colorado. This species has been recorded at one location in Plumas County, but it is suppressed.

Nuttall's pondweed (*Potamogeton epihydrus* ssp. *nuttallii*)

Nuttall's pondweed is a CNPS List 2 plant. It is found in shallow freshwater marshes and swamps, as well as ponds, lakes, streams, and irrigation ditches. This monocot favors elevations between 370 and 2,110 meters. It is a perennial rhizomatous herb that is less than 170 centimeters in height, with submersed, sessile leaves that are from 5 to 25 centimeters in length and less than 1 centimeter in width. Leaves are ribbon-like and linear, with a rounded tip and a long petiole. The range of this native Californian plant is the outer northern coastal mountain ranges of California, the high Sierra Nevada, and the Modoc Plateau. Outside California, it is found in areas throughout Oregon and Washington to southeastern Alaska, and extends eastward as far as Colorado. It has been recorded in one location in eastern Plumas County.

Sheldon's sedge (*Carex sheldonii*)

Sheldon's sedge is a CNPS List 2 plant. It is found along creeks, wet meadows, marshes, swamps, and montane coniferous forests between elevations of 1,065 to 1,755 meters. It is a perennial herb with a three-sided stem, and parallel-veined leaf blades which measure approximately three to six centimeters wide and are notably hairy. Its range is the northern portion of the high Sierra Nevada Mountain Range and the Modoc Plateau. It has been recorded in 14 locations throughout Plumas County.

Western Goblin (*Botrychium montanum*)

The western goblin is a CNPS List 2 plant. It is found along creek banks where the soil is very moist and very high in organic matter, in dark, old growth montane coniferous forests between elevations of 1,500 and 1,830 meters. It also grows in meadows and seeps with high mineral contents. This rhizomatous herb is gray-green and usually 4 to 12.5 centimeters in height, with oblong, pointed leaves that have 2 to 4 teeth or lobes at the blade tip. Its range is the northern portion of California, through Oregon and Washington to southeastern Alaska, and extends eastward as far as Idaho and Montana. It has been recorded at Milkhouse Flat in Plumas County.

Yellow Willowherb (*Epilobium luteum*)

The yellow willowherb is a CNPS List 2 plant. Yellow willowherb is an upright, bushy wildflower with slender stalks and numerous finely toothed alternate leaves each about three inches long. Its leaf shape is lanceolate (narrow, pointed at each end) to ovate (egg-shaped). The 4-petaled creamy-yellow flowers grow singly from the upper leaf axils on a plant that grows from 6 to 28 inches high. The native range of yellow willowherb is from Alaska south to Vancouver Island, Oregon, Washington, and parts of California. It is found in lower montane forests along streams and seeps between 1,500 and 1,750 meters in elevation. This species has been recorded along a U.S. Forest Service road in southern Plumas County.

Special Status Wildlife

Amphibians

California Red-legged Frog (*Rana aurora draytonii*)

The California red-legged frog was described under the San Luis Reservoir discussion. They have been recorded in Plumas County, approximately 4.5 miles southeast of Janesville in Plumas National Forest.

Cascades Frog (*Rana cascadae*)

The Cascades frog is a California species of special concern. This moderate-sized brown, red-brown, or slightly greenish brown frog has prominent dorsolateral folds and a distinct light jaw stripe. In California, this species was distributed from the Shasta-Trinity region eastward toward the Modoc Plateau and southward to the Lassen region and the upper Feather River system. It occurs and reproduces in both ephemeral and permanent ponds or streams but probably cannot survive in ephemeral situations where at least some of the substrate does not remain saturated. This species has been recorded at 10 locations in northwestern Plumas County.

Foothill yellow-legged Frog (*Rana boylii*)

The foothill yellow-legged frog is a California species of concern. It is a moderate-sized, variably colored frog, but usually dark to light gray, brown, green, or yellow with a somewhat mottled appearance. The underside surfaces of the legs and lower belly are yellow or orangish-yellow. Historically, this species was known to occur in most Pacific drainages from the Santiam River system in Oregon (Mehama, Marion County) to the San Gabriel River system (Los Angeles County) in California. It requires shallow, flowing water, apparently prefering small to moderate-sized streams situations with at least some cobble-sized substrate. It needs at least 15 weeks to attain metamorphosis. This species has been recorded in Slate Creek, three miles southeast of Little Grass Valley Reservoir and in Spanish Creek, 200 meters north of Forest Road 24N30.

Mountain Yellow-legged Frog (*Rana muscosa*)

The mountain yellow-legged frog is federally-listed as endangered for the populations in the San Gabriel, San Jacinto, and San Bernardino Mountains, and a California species of special concern. This moderate-sized, highly variably colored frog has a dorsal pattern that ranges from discrete dark spots that can be few and large to smaller and more numerous ones with a mixture of size and shapes. The belly and undersurfaces of the high limbs are yellow, which ranges in hue from pale lemon yellow to an intense sun yellow. This near endemic to California is distributed more or less continuously in the Sierra Nevada from the vicinity of La Porte (southern Plumas County) southward to Taylor and French Joe Meadows (southern Tulare County). This species is inhabits ponds, lakes, and streams at moderate to high elevations. This species has been recorded at 12 locations throughout Plumas County.

Birds

Bald Eagle (*Haliaeetus leucocephalus*)
The bald eagle was described above in the Castaic Lake discussion. There are over 20 occurrences of this species throughout Plumas County.

Bank Swallow (*Riparia riparia*)
Bank swallows were described above under the Sacramento River discussion. This species has been recorded in Lights and Indian Creeks.

Osprey *(Pandion haliaetus)*
Osprey were described above under the Lake Perris discussion. This species has been recorded at over 30 locations throughout Plumas County.

Willow Flycatcher (*Empidonaz trailii*)
The willow flycatcher is state-listed endangered species. It is found in extensive swampy thickets of low, dense willows on the edge of wet meadows. It also occurs in upland pastures, abandoned orchards, wooded lakeshores, ponds, and along streams and floodplains. Standing only 15 centimeters in height, this species features dull gray-green feathers above and whitish-yellow feathers below, with two dull white wing bars and an almost undetectable narrow white eye ring on each side. Its range starts at the northern boundaries of British Columbia, Alberta, North Dakota, New York, and Maine, and extends south to central California, Nevada, Arkansas, and Virginia. It favors elevations between 2,000 and 8,000 meters. Winters are spent in the tropics. It breeds from June to August, and requires dense willow thickets for nesting and roosting. A small clutch of three to four eggs are incubated for an average of 13 days by the female in a nest built the fork of a small shrub. This species has been recorded 12 locations throughout Plumas County.

Mammals

American Badger (*Taxidea taxus*)
The American badger was described above under the South San Joaquin Valley discussion. This species has been recorded in four locations throughout Plumas County.

TABLE 1

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Plants												
Bakersfield cactus *Opuntia basilaris* var. *treleasei*		E/E/1B	Flood plains, ridges, bluffs and rolling hills in saltbush scrub plant communities.	X								
Brittlescale *Atriplex depressa*		-/-/1B	Alkaline or clay soils in alkali flats.	X								
Brandegee's clarkia *Clarkia biloba* ssp. *brandegeeae*	-/-/-	-/-/1B	Chaparral cismontane woodland often in roadcuts.						X			
California jewel-flower *Caulanthus californicus*		E/E/1B	Nonnative grasslands, upper sonoran subshrub scrub, and cismontane juniper woodland and scrub communities	X								
Comanche Point Layia *Layia leucopappa*		-/-/1B	Sparsely-vegetated microhabitats in nonnative grassland	X								
Carquinez goldenbush *Isocoma arguta*	C2/-/1B	-/-/1B	Valley and foothill grassland with alkaline soils.							X		
Cut-leaved ragwort *Senecio eurycephalus* var. *lewisrosei*	-/-/1B	-/-/1B	Chaparral, cismontane woodland in lower montane coniferous forest with serpentinite soil.						X		X	X
Delta mudwort *Limosella subulata*	-/-/2	-/-/2	Freshwater and brackish marshes and swamps.							X		
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	C2/-/1B	-/-/1B	Freshwater and brackish marshes and swamps.							X		
Earlimart orache *Atriplex erecticaulis*		-/-/1B	In dry areas between vernal pools and along roadsides	X								

TABLE 1

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Hartweg's golden sunburst *Pseudobahia bahiifolia*	E/E/1B	E/E/1B	Cismontane woodland, valley and foothill grassland with clay soils.	X							X	
Hoover's wolly-star (eriastrum) *Eriastrum hooveri*	T/-/4	D/-/4	Alkali sinks, washes. Usually on silty to sandy soils.		X							
Kern mallow *Eremalche kernensis*		E/-/1B	Valley saltbush scrub	X								
Lemmon's jewel-flower *Caulanthus coulteri* var. *lemmonii*		-/-/1B	Valley and foothill grassland and pinyon and juniper woodland habitats	X								
Lost Hills crownscale *Atriplex vallicola*		-/-/1B	Dried beds of alkaline pools within scrub or annual grassland communites	X								
Mason's lilaeopsis *Lilaeopsis masonii*	C2/R/ 1B	-/R/1B	Freshwater or brackish marshes, swamps, or riparian scrub.							X		
Midred's clarkia *Clarkia mildrediae* ssp. *mildrediae*	-/-/4	-/-/1B	Cismontane woodland, lower montane coniferous forest with sandy usually granitic soils.						X		X	X
Mingan moonwort *Botrychium minganense*		-/-/2	Creek banks, mesic woods meadows and sand dunes									X
Mosquin's clarkia *Clarkia mosquinii*	C2/-/1B	-/-/1B	Cismontane woodland in lower montane coniferous forest with rocky soils, and along roadsides.						X		X	X

TABLE 1

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Northern California black walnut *Juglans hindsii*	C2/-/1B	-/-/1B	Riparian forests and woodlands.							X		
Northwestern moonwort *Botrychium pinnatum*		-/-/2	Creek banks, meadows, seeps and shrubby slopes of montane coniferous forests									X
Nuttall's ponweed *Potamogeton epihydrus* ssp. *nuttallii*		-/-/2	Shallow freshwater marshes, and swamps, ponds, lakes, streams and irrigation ditches									X
Pink creamsacs *Castillieja rubicundula* ssp. *rubicundula*		-/-1B	Open areas of chaparral, in cismontane woodlands, meadows and seeps on sepentinite substrate								X	
Recurved larkspur *Delphinium recurvatum*	C2/-/1B	-/-/1B	Chenopod scrub and valley grassland with alkaline soils.	X	X							
Rose mallow *Hibiscus lasiocarpus*	C2/-/2	-/-/2	Freshwater marshes and swamps.							X		
San Joaquin spearscale *Atriplex joaquiniana*	C2/-/1B	-/-/1B	Chenopod scrub, meadows and seeps, playas, valley and foothill grasslands with alkaline soil.							X		
San Joaquin woollythreads *Monolopia* (*Lembertia*) *congdoni*	E/-/1B	E/-/1B	Alkaline or loamy plains, sandy soils.	X	X							
Sheldon's sedge *Carex sheldonii*		-/-/2	Creeks, wet meadows, marshes, swamps, and montane coniferous forests									X

TABLE 1

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Slough thistle *Cirsium crassicaule*	C2/-/1B	SC/-/1B	Sloughs, riverbanks, and marshy areas.		X							
Subtle orache *Atriplex subtilis*		-/-/1B	Valley and foothill grassland	X								
Suisun marsh aster *Aster lentus*	C2/-/1B	-/-/1B	Freshwater and brackish marshes and swamps.							X		
Tejon poppy *Eschscholzia lemmonii* ssp. *kernensis*		-/-/1B	Adobe clay soils in sparsely-vegetated grasslands	X								
Veiny monardella *Monardella douglasii var. venosa*	C2/-/1B	-/-/1B	Cismontane woodland, valley and foothill grasslands with heavy clay soils.								X	
Western goblin *Botyrchium montanum*		-/-/2	Moist creek banks with high organic matter									X
White-stemmed clarkia *Clarkia gracilis* ssp. *albicaulis*	-/-/1B	-/-/1B	Chaparral cismontane woodland, sometimes with serpentinite soil.						X			
Yellow willowherb *Epilobium luteum*		-/-/2	Along streams and seeps in lower montane forests									X
Invertebrates												
Antioch Dunes anthicid beetle *Anthicus antiochensis*	C2/-	-/SAL	Found in loose sand of sand bars and sand dunes.							X		

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SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Doyen's trigonoscuta dune weevil *Trigonoscuta* sp.		-/SAL	Sand dunes	X								
Molestan blister beetle *Lytta molesta*		-/SAL	Non-native grassland; vernal pools	X								
Sacramento anthicid beetle *Anthicus sacramento*	C2/-	-/-	Found in sand slip-faces among willows; associated with riparian and other aquatic habitats.							X		
Sacramento Valley tiger beetle *Cicindela hirticollis abrupta*	C2/-	-/-	Found in association with fine-grained sands along river shorelines and sand bars.								X	
San Joaquin dune beetle *Coelus gracilis*		-/SAL	Sand dunes	X								
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/-	T/-	Riparian and oak savanna habitats with elderberry shrubs; its hold plant is elderberry (*Sambucus* sp.).	X						X	X	
Vernal pool fairy shrimp *Branchinecta lynchi*		T/-	Vernal pool and seasonal wetland habitats	X								
Vernal pool tadpole shrimp *Lepidurus packardi*		E/-	Vernal pools and seasonal wetland habitats	X								

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Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Amphibians												
California red-legged frog *Rana aurora draytonii*	C2/CSC	T/CSC	Slow-flowing portions of perennial streams, ephemeral streams, and hillside seeps that maintain pool environments (including ponds) or saturated soils throughout the summer months.					X				X
California tiger salamander *Ambystoma californiense*		T/CSC	Annual grassland habitat; understory of open valley-foothill hardwood habitats	X								
Cascades frog *Rana cascadae*		-/SCS	Ephemeral and permanent ponds and streams									X
Foothill yellow-legged frog *Rana boylii*		-/CSC	Small to moderate sized streams with cobble sized substrate									X
Mountain yellow-leeged frog *Rana muscosa*		E/CSC	Ponds, lakes and streams at moderate to high elelvations									X
Western spadefoot *Scaphiopus hammondii*	C2/CSC	-/CSC	Primarily grassland habitats, requires vernal pools for breeding and egg-laying.	X	X							
Reptiles												
Blunt-nosed leopard lizard *Gambelia sila*	E/E, FP	E/E, FP	Sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief.	X	X			X				

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SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Giant garter snake *Thamnophis gigas*	PE/E	T/T	Sloughs, canals, low gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter.								X	
San Joaquin whipsnake *Masticophis flagellum ruddocki*		-/CSC	Open, dry vegetative associations with little or no tree cover. Valley grassland and saltbush scrub.	X								
Western pond turtle *Clemmys marmorata (includes both subspecies)*	C2/CSC	-/CSC	Permanent or nearly permanent bodies of water; requires basking sites, and suitable nesting sites.	X	X	X	X			X	X	
Birds												
Bald eagle *Haliaeetus leucocephalus*	E/E	PD,T/ E, FP	Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. General habitats include ocean shore, lake margins, and rivers for both nesting and wintering.			X	X	X	X			X
Bank swallow *Riparia riparia*	-/T	-/T	Require fine-textured or sandy banks or cliffs to dig horizontal nesting tunnels along large rivers.							X	X	X

TABLE 1

SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Burrowing owl *Athene cunicularia*	C2/CSC	-,BCC/ CSC	Subterranean nester, dependant upon burrowing mammals, Burrow sites typically in open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation.	X	X					X		
California thrasher *Toxostoma redivivum*	-/-	-/-	Lowland and coastal chaparral, riparian thickets							X		
Cooper's hawk *Accipiter cooperii*	-/CSC	-/CSC	Nests in riparian growths of deciduous trees, as in canyon bottoms of river floodplains, within open, interrupted or marginal woodland.				X					
Double-crested cormorant *Phalacrocorax auritus*	-/CSC	-/CSC	Fresh, brackish, and salt water, along coastal regions and inland lakes		X		X					
Golden eagle *Aquila chrysaetos*	--/CSC	-,BCC/ CSC,FP	Found in open country with rolling foothills, mountain areas, sage-juniper flats, and desert habitats. Nests sites are often on rock ledges of cliffs or large trees.				X					
Great blue heron *Ardea herodias*	-/-	-/-	Estuaries and coastal areas with tree groves for nesting.							X		
Great egret *Ardea albus*	-/-	-/-	Nests and roosts in mixed colonies in low trees. Forages in shallow water or in grassy marshes.							X		

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SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Lawrence's goldfinch *Carduelis lawrencei*	-/-	-,BCC/ -	Oak and riparian woodland, chaparral, pinion/juniper woodland, and weedy areas near water.				X					
Le Conte's thrasher *Toxostoma lecontei*		-/CSC	Desert flats, washes and alluvial fans with sand and/or alkaline soil and scatter shrubs	X								
Least bell's vireo *Vireo bellii pusillus*	E/E	E,BCC/E	Summer resident of southern California, in low riparian habitat in the vicinity of water or in dry river bottoms; nests placed along margins of bushes or on twigs projecting into pathways, usually on willow, baccharis, or mesquite.				X					
Loggerhead Shrike *Lanius ludovicianus*	C2/CSC	-,BCC/ CSC	Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting. Typically nests in broken woodlands, savannah, pinyon-juniper, Joshua tree, and riparian woodlands, desert oases, scrub, and wash.		X		X					
Mountain Plover *Charadrius montanus*		-/CSC	Winters in agricultural fields and pastures	X								
Northern Goshawk Accipiter gentiles		-/CSC	Old growth forests						X			

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Northern Harrier *Circus cyaneus*	-/CSC	-/CSC	Breeds in shrubby vegetation within marshes, or grasslands.		X		X					
Osprey *Pandion haliaetus*	-/CSC	-/CSC	Large bodies of water supporting fish. Nest in exposed locations, often in the tops of trees or in snags in beaver swamps.				X				X	X
Southwestern willow flycatcher *Empidonax traillii extimus*	PE/E	E/E	Riparian woodlands in southern California.				X					
Swainson's hawk *Buteo swainsoni*	-/T	-,BCC/T	Breeds in stands with few trees in Juniper-sage flats, riparian areas and oak savannahs. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	X						X	X	
Tricolored blackbird *Agelaius tricolor*	C2/CSC	-,BCC/ CSC	Marshes with dense stands of cattails, blackberries, or dense stands of tall herbs such as thistles.	X	X					X	X	

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Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	-/E	C,BCC/E	Requires dense, large tracts of riparian woodlands with well developed understories for breeding. Occurs in deciduous trees and shrubs, especially willows which are required for roost and nest sites. During the breeding season, associated with moist habitats along slow-moving watercourses where humidity is high.							X	X	X
White-faced ibis *Plegadis chihi*		-/CSC	Salt and freshwater marshes; flooded agricultural fields	X								
White-tailed (black shouldered) kite *Elanus leucurus*	-/*	-/FP	Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching. General nesting habitat is rolling foothill/valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland.				X					
Willow flycatcher *Empidonaz trailii*		-/E	Dense willow thickets for nesting									X
Yellow headed blackbird *Xanthocephalus xanthocephalus*	-/-	-/-	Nests in colonies in emergent marsh, such as tules and cattails. Forages in marshes, agricultural fields, and pastures.	X								

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Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Yellow warbler *Dendroica petechia brewsteri*	-/CSC	-/CSC	Nests in riparian habitat, often in willows, cottonwoods, aspens, sycamores and alders. Also nests in montane shrubbery in open conifer forests.				X					
Mammals												
American badger Taxidea taxus	-/CSC	-/SA (CSC in 2006)	Need friable soils and open, uncultivated ground in drier open stages of most shrub, forest, and herbaceous habitats.	X	X			X X				X
Buena Vista Lake shrew *Sorex ornatus relictus*	C1/CSC	E/CSC	Marshlands and riparian areas in the Tulare Basin. Prefers moist soil. Uses stumps, logs and litter for cover.	X	X							
Giant kangaroo rat *Dipodomys ingens*		E/E	Annual grassland on gentle slopes of generally less than 10 degrees, with friable, sandy-loam soils	X								
Western mastiff bat *Eumops perotis californicus*	C2/CSC	-/CSC	Roosts in crevices in cliff faces, high buildings, trees and tunnels; uses many open, semi-arid to arid habitats including conifer and deciduous woodlands, coastal scrub, grasslands, chaparral, etc.			X	X					

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SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Nelson's (San Joaquin) antelope squirrel *Ammospermophilus nelsoni*	C2/T	-/T	Western San Joaquin Valley on dry, sparsely vegetated loam soils. Need widely scattered shrubs, forbs and grasses in broken terrain with gullies and washes	X	X							
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	E/T	Needs loose-textured sandy soils for burrowing, and suitable prey base, in annual grasslands or grassy open stages with scattered shrubby vegetation.	X	X							
San Joaquin pocket mouse *Perognathus inornatus inornatus*		-/SAL	Fine textured or sandy soils	X								
Short-nosed kangaroo rat *Dipodomys nitratoides brevinasus*		/CSC	Arid grasslands with scattered shrubs and desert-shrub associations	X								
Silver-haired bat *Lasionycteris noctivagans*	-/-	-/-	Deciduous and coniferous forests. In summer roosts under bark or in dead trees, woodpecker holes, or bird nests. In winter hibernates in trees, crevices, buildings, and other protected places.								X	

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Species Name	Status[1] Federal/State/CNPS 1994	Status[1] Federal/State/CNPS 2006	Habitat	So. San Joaquin Valley	Kern Fan Element	Castaic Lake	Lake Perris	San Luis Reservoir	Lake Oroville	Sacramento River	Feather River	Plumas County
Stephens' kangaroo rat *Dipodomys stephensi*	E/T	E/T	Open grasslands and sparse coastal sage scrub. Typical habitat consists of native and non-native annual herbs and grasses.				X					
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	E/E	E/E	Needs soft friable soils which escape seasonal flooding within saltbrush scrub and sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley.	X	X							
Tulare grasshopper mouse *Onychomys torridus tularensis*		-/CSC	Arid shrub land communities in hot, arid grassland and shrub land associations	X								
Yuma myotis *Myotis yumanensis*	C2/-/-	-/-	Optimal habitats are open forests and woodlands with sources of water over which to feed. Distribution in closely tied to the bodies of water. Maternity colonies in caves, mines, buildings or crevices.				X					
Natural Communities												
Coastal brackish marsh			Dominated by perennial, emergent, herbaceous monocots to 2 m tall. Cover is often complete and dense. Similar to coastal salt marshes, but brackish from freshwater input.							X		

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Elderberry savanna			An open, winter decidous shrub savanna dominated by elderberry shrubs (*Sambucus* ssp.). The understory is usually forbs and nonnative annual grasses.							X		
Great Valley cottonwood riparian forest			A dense, broad-leafed, winter deciduous riparian forest dominated by Fremont cottonwood (*Populus fremontii*) and one or more species of willow. The understory vegetation is dense and including seedlings and saplings of shade tolerant species.							X		
Great Valley Mesquite Scrub			Primarily vegetated by honey mesquite (*Prosopis glandulosa torreyana*), a perennial deep-rooted shrub that requires a high water table. Climate conditions consist of moist, foggy winters and hot dry summers.		X							
Great Valley mixed riparian forest			Dense mixture of tall mature cottonwood (*Populus fremontii*) and willows (*Salix* spp.), California sycamore (*Platanus racemosa*), box elder, black walnut and white alder (Alnus rhombifolia).							X	X	

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SPECIAL-STATUS SPECIES WITH KNOWN OCCURRENCES NEAR THE PROPOSED PROJECT, BY FACILITY OR REGION

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Northern hardpan vernal pool			Consists of shallow ephemeral water bodies found in depressions (up to several hectares in size) occurring in grasslands and open woodlands throughout intermountain valleys of California, and Oregon.	X								
Valley Sacaton Grassland			Vegetation dominated by alkali sacaton (*Sporobolus airoides*), a tussock, or tuft forming grass. This habitat is found in areas with fine textured, poorly drained and usually alkaline soils, that have either seasonally high water tables or are flooded during the winter.	X	X							
Valley saltbrush scrub			Valley saltbush scrub is found in the southern and southwestern San Joaquin Valley on dissected alluvial fans with low relief. Community is dominated by shrubs of the Goosefoot family (Chenopodiaceae) and a low herbaceous annual understory.	X								

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Notes 1. Status explanation

Federal

E Listed as endangered under the Federal Endangered Species Act.
T Listed as threatened under the Federal Endangered Species Act.
PE Proposed as endangered under the Federal Endangered Species Act.
C1 Category 1 Candidate for which the USFWS has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposed rules not yet issued because this action is precluded at present by other listing activity.
C2 Category 2 Candidate for which information now in the possession of the USFWS indicated that proposing to list and endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules.
SC Federal Species of Concern. The USFWS decided to no longer maintain C2 and C3 lists, and species formerly categorized as such were informally termed "Species of Concern." The Sacramento Fish & Wildlife Office maintains a list of *Species of Concern*. These species receive no legal protection and the use of the term does not mean that they will eventually be proposed for listing. In 2006, the USFWS stopped maintaining a Federal Species of Concern list.
D Delisted – Delisted species are monitored for five years after being delisted.
BCC US Fish and Wildlife Service, Bird of Conservation Concern
MNBMC US Fish and Wildlife Service, Migratory Nongame Bird of Management Concern
- No listing

State

E Listed as endangered under the California Endangered Species Act.
T Listed as threatened under the California Endangered Species Act.
CSC California Special Concern Species – categorized as such because of declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction.
FP Fully Protected – Fully protected species may not be taken or possessed without a permit from the Fish and Game Commission.
* Taxa listed with an asterisk (*) fall into one or more of the following categories – (1) Taxa that are biologically rare, very restricted in distribution , or declining throughout their range; (2) population(s) in California that are peripheral to the major portion of a taxon's range, but which are threatened with extirpation within California; and (3) taxa closely associated with a habitat that is declining in California (e.g. wetlands, riparian, old growth forest).
SAL Taxa found on the 2006 Special Animals List
- No listing.

Other – California Native Plant Society

1A Presumed Extinct in California
1B Rare, threatened or endangered in California and elsewhere
2 Rare, threatened, or endangered in California, but more common elsewhere.
4 Plants of limited distribution.

Sources:

USFWS List of Candidate Fauna from California and Nevada as of 31 August 1994 (59 FR 58982)
Endangered and Threatened Wildlife and Plants 50 CFR 17.11 and 17.12, August 20, 1994.
State and Federal Endangered Animals for California and Listing Dates, Department of Fish and Game, Revised January 1994.
California Department of Fish and Game Natural Diversity Data Base Special Animals, December 1992 (The 1994 version could not be located).

K. ANALYSIS OF HISTORICAL OPERATIONS (STUDY NO. 2)

EFFECTS OF

MONTEREY AMENDMENT

ON HISTORICAL

SWP OPERATIONS

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EFFECTS OF MONTEREY AMENDMENT ON HISTORICAL SWP OPERATIONS

1.0 INTRODUCTION

The Monterey Amendment contains a number of provisions that have the potential to result in changes in deliveries of State Water Project (SWP) and other water through SWP facilities. These delivery changes can result in changes in storage in the SWP share of San Luis Reservoir, which can in turn affect diversions from the Delta at Banks Pumping Plant. This study presents the results of two similar but separate analyses conducted to determine the historical effects of Monterey Amendment provisions on SWP operations, focusing on storage in the SWP share of San Luis Reservoir and diversions at Banks Pumping Plant.

The purpose of the first analysis is to estimate the actual impacts of the Monterey Amendment on SWP operations from 1996 through 2004. This analysis includes nearly all of the provisions of the Monterey Amendment, including the water management provisions and the permanent retirement of 45,000 acre-feet of Table A amount.

The purpose of the second analysis is to provide a basis for estimating the future effects of the water management provisions of the Monterey Amendment on SWP operations. The second analysis looks at the effects of only the water management provisions, considered in isolation from the remaining Monterey Amendment provisions. Like the first analysis, this analysis also uses data from 1996 through 2004. This period includes both a series of wet years and a series of drier years, and provides a reasonable estimate of the effects that might be anticipated in the future.

The purpose of both analyses is to evaluate the effects of certain Monterey Amendment provisions on historical SWP operations and water deliveries. The analyses start with historical monthly SWP operations and delivery data for 1996 through 2004, modify that historical monthly operation by removing or adding those deliveries that were determined to result from the Monterey Amendment provisions specified, and describe SWP water

supply and operational changes that would likely have occurred with the change in deliveries under these provisions.

2.0 MONTEREY AMENDMENT PROVISIONS

The Monterey Amendment contains a number of provisions, including provisions that: change the way SWP water is allocated among contractors, provide for the permanent transfer and retirement of Table A amounts, and provide water management opportunities for contractors to better manage the SWP supplies available to them. These provisions are briefly summarized and then described in more detail below.

2.1 Allocation and Table A Amount Transfer and Retirement Provisions

The original SWP contracts specified how available SWP supplies were to be allocated among contractors. The allocation of Table A supplies was specified in Article 18, and the allocation of surplus supplies was specified in Article 21. The Monterey Amendment revised the allocation provisions in both Articles 18 and 21. Article 53 of the Monterey Amendment provides for the SWP agricultural contractors to make available for permanent transfer to municipal and industrial (M&I) contractors 130,000 acre-feet of Table A amount, and for the permanent retirement of 45,000 acre-feet of Table A amount.

The current and future effects of these three provisions are analyzed in a set of separate analyses, under current and future demands over a range of hydrologic conditions, using the CALSIM II model (see Appendix F of the DEIR). However, those analyses do not capture the effects of these provisions on historical SWP operations, given the actual operations, demands, and hydrologic conditions that occurred from 1996 through 2004. Since that is the purpose of the first of the two analyses included in this study (i.e., the historical impact analysis), the first analysis includes those of the three provisions summarized above determined to have a potential effect, that can be included without undue speculation. For reasons discussed further below, of these three provisions, only the permanent retirement of Table A amount is included in the historical impact analysis included in this study.

2.1.1 Allocation of SWP Supplies

Article 18 of the original SWP contracts specified how Table A supplies would be allocated among contractors, during both temporary shortage conditions (in Article 18(a)) and permanent shortage conditions (in Article 18(b)). The Monterey Amendment revised the temporary shortage provision of Article 18(a) to eliminate the initial reduction in supplies for agricultural use, and specified that the available Table A supply would be allocated among all contractors in proportion to each contractor's Table A amount. The Monterey Amendment eliminated Article 18(b).

Article 21 of the SWP contracts specified how surplus water would be allocated among contractors. Surplus water was made available to contractors when the Department had supplies beyond what was needed to meet Table A deliveries, reservoir storage targets, and Delta regulatory requirements. The Monterey Amendment revised Article 21 to eliminate the category of "surplus water," which had been made available for scheduled delivery throughout the year. Article 21 was also revised to rename the category of "unscheduled water" as "interruptible water," and to change the allocation of this supply from being made available first to contractors for agricultural use or groundwater replenishment, to being allocated among all requesting contractors in proportion to each requesting contractor's Table A amount, regardless of use.

These allocation provisions do not affect the total amount of Table A or surplus water supplies made available by the Department, only how that total supply is divided up among the contractors. While the Monterey Amendment's revised allocation provisions affect how the available total supply is allocated to individual contractors, these changes would not have any noticeable effect on SWP operations at SWP San Luis Reservoir or Banks Pumping Plant. Therefore, the effect of these allocation changes is not included in the historical impact analysis included in this study. The effect of these allocation changes on historical SWP Table A supply allocations to individual contractors is included in a separate analysis (see Appendix I of the DEIR).

2.1.2 Transfers of Table A Amounts

Article 53 provides that SWP agricultural contractors will make available 130,000 acre-feet of Table A amounts and related transportation capacity, for permanent transfer to SWP M&I contractors or to non-contractors on a willing buyer - willing seller basis. Kern County Water Agency (KCWA) is responsible for making available any portion of the 130,000 acre-feet not previously made available under this article by the other agricultural contractors. By 2004, most of this Table A amount had been transferred from KCWA to various M&I contractors.

This provision has the potential to have some affect on SWP operations, related both to differences in the timing of deliveries between agricultural and M&I contractors during the year (agricultural contractors typically have lower winter demands and higher summer demands than M&I contractors), and temporary reductions in demand associated with the transferred Table A amounts (the M&I contractors acquired the transferred Table A amount primarily to meet future, not current demand, and to improve dry-year supply reliability). For this analysis, however, trying to discern how much of the transferred water was actually delivered and for what purpose, and how it would have been delivered in the absence of the transfer was deemed to require too many speculative assumptions. Therefore, this provision is not included in the historical impact analysis included in this study.

If this provision were included, it would likely show that some portion of the Table A water associated with the transferred Table A amount was not delivered to M&I contractors during this period which, in the absence of the transfer, would have been delivered to KCWA. This lower delivery would be reflected in higher storage at SWP San Luis Reservoir and potential reductions in diversions at Banks Pumping Plant, which would have offset some or all of the potential diversion increases resulting from the water management provisions. Because the inclusion of this provision would likely show a reduction in impacts (or even a benefit), the exclusion of this provision in the historical analysis in this study results in a conservative estimate of historical impacts.

2.1.3 Retirement of Table A Amounts

Article 53 required KCWA and Dudley Ridge WD to permanently retire a total of 45,000 acre-feet of Table A amount in exchange for the transfer of the Kern Fan Element property. Since KCWA and Dudley Ridge WD typically use all of the Table A supply allocated to them, the retirement of this Table A amount resulted in a permanent reduction in deliveries to them. Because this delivery reduction could affect SWP operations and that effect could be readily estimated, this provision is included in the historical impact analysis in this study.

2.2 Water Management Provisions

The water management provisions are intended to provide greater flexibility in SWP contractors' use of existing SWP storage and conveyance facilities and to encourage more efficient use of available SWP supplies by promoting groundwater banking, conjunctive use of local and SWP water sources, and voluntary annual transfers of Table A water. These provisions are included in Articles 52, 54, 55, and 56 of the Monterey Amendment.

Article 52 provides for the transfer of the Kern Fan Element property to KCWA for local development of the Kern Water Bank (KWB) water storage and recovery program. Article 54 of the Monterey Amendment provides certain contractors the flexibility to borrow water from Castaic Lake and Lake Perris, provided that those contractors replace that water within five years of withdrawal. Article 55 provides for conveyance of non-project water using SWP facilities. Article 56 of the Monterey Amendment gives prior Department approval for contractors to store allocated SWP water outside their service areas for later use within their service areas, including: storage in groundwater banks, storage in surface water reservoirs owned by the SWP (i.e., carryover storage), or storage in surface water reservoirs owned by others. Another provision of Article 56 establishes a turnback pool for annual transfers of allocated SWP Table A water.

2.2.1 Transfer of Kern Fan Element Property

Article 52 provides for the transfer by the Department of about 20,000 acres of state-owned property in the Kern Fan area, known as the Kern Fan Element property, to KCWA. As was intended, this property was then transferred by KCWA to the Kern Water Bank Authority and was developed into the locally owned and operated KWB.

2.2.2 Contractors' Use of Castaic Lake and Lake Perris

Article 54 provides certain contractors participating in repayment of capital costs of Castaic Lake and Lake Perris the flexibility to withdraw SWP water from these reservoirs in amounts in addition to their allocated SWP supplies, unless withdrawal of water would have adverse effects on other contractors participating in the repayment of that reach. The Metropolitan Water District of Southern California (MWDSC), Ventura County FC&WCD, and Castaic Lake WA participate in the repayment of capital costs for Castaic Lake and may collectively withdraw up to 160,000 acre-feet from the reservoir. MWDSC is the only contractor eligible to withdraw water from Lake Perris and may withdraw up to 65,000 acre-feet from the reservoir. The contractors' allocations for withdrawal may be adjusted among themselves providing there are no adverse impacts upon another contractor participating in the reach. Contractors are required to replace the withdrawn water within five years after the withdrawal occurs. The withdrawal and replacement delivery schedules are subject to approval by the Department.

2.2.3 Transport of Non-Project Water

Article 55 provides contractual terms for the conveyance and delivery of non-project water to the contractors' service areas through SWP facilities when sufficient capacity is available. Prior to the Monterey Amendment, the Department had conveyed and delivered non-project water for requesting contractors on a number of occasions (e.g., for delivery of contractor non-project water purchases under the Governor's 1991 and 1992 Drought Water Banks, and under the Department's 1994 dry-year water purchase program), as required under Water Code Sections 1810 through 1814. This article provides contractual approval for this conveyance and specifies details regarding delivery and costs of delivery. Because of the Water Code requirements for this type of

delivery, Department conveyance of non-project water for contractors would have occurred with or without the Monterey Amendment in effect. Since this provision does not result in any change in deliveries, it is not considered further in these analyses.

2.2.4 Storage Outside Contractors' Service Areas

Article 56(a) gives prior Department approval for SWP contractors to store SWP water outside their service area for later use within their service area. This water supply management practice was allowed prior to the Monterey Amendment (e.g., MWDSC had begun water storage in a groundwater bank in the Semitropic WD in 1993), but Department approval was provided on a case-by-case basis.

Under Article 56(c), contractors may store SWP water in SWP and non-project surface reservoirs or groundwater banks outside their service areas. Article 56(c) limits the amount of SWP water that can be added to storage each year in surface reservoirs outside contractors' service areas but places no limit on the amounts of SWP water that can be added to storage each year in groundwater banks outside contractors' service areas.

2.2.5 Carryover Storage

Article 56(c) also allows SWP contractors to store their allocated Table A water and non-project water in SWP conservation reservoirs when the storage capacity is not needed by the Department for SWP purposes. The most likely location of available SWP storage capacity is San Luis Reservoir. Contractors submit requests to the Department to carry over allocated Table A water from one year to the next and the Department allocates available storage among requesting contractors in proportion to their annual Table A amounts. As the Department needs the storage space for SWP purposes, the carryover water stored for contractors reverts to SWP supply at the same rate the Department would otherwise have been able to fill that storage.

2.2.6 Turnback Pool

Article 56(d) establishes a program that allows a contractor with more allocated SWP water than it needs in a particular year to offer its excess Table A water for sale to other contractors or to the Department. Contractors having excess allocated Table A water can turn back water to the SWP turnback pool program early in the year for sale to other SWP contractors for their use, or to the Department for SWP carryover storage for the following year. In return, that contractor is paid a rate equal to a percentage of the Delta water rate. Previously when a portion of a contractor's allocated Table A water was not taken, it became available, either late in the year or in the following year, for other SWP purposes including reallocation to other contractors with unmet needs. The turnback pool enables contractors to be partially compensated for unused allocated Table A water purchased by other SWP contractors and increases the likelihood that any excess allocated water would be available to other contractors early enough in the year to be managed and used more efficiently.

3.0 ANALYSIS METHODOLOGY

The general methodology followed in both the historical impact analysis and the separate water management provision analysis is the same. To determine the effects of the specified provisions of the Monterey Amendment on SWP operations and deliveries, the analyses use historical SWP operations and delivery data to determine actual monthly SWP operations from 1996 through 2004, modify that historical monthly operation by removing or adding those deliveries that were determined to result from those provisions, and describe SWP water supply and operational changes that would likely have occurred with the change in deliveries under these provisions. This analysis is then used to show: 1) the actual effects of the Monterey Amendment on SWP operations from 1996 through 2004, and 2) the actual effects on SWP operations of only the water management provisions, which then can be used in conjunction with the CALSIM II model results to estimate the future effects of the Monterey Amendment. The general steps in the analysis are described below.

1. Historical end-of-month storage data for SWP San Luis Reservoir and monthly contractor deliveries made under the Monterey Amendment water management

provisions were obtained for 1996 through 2004 (from the California Data Exchange Center and DWR water delivery files, respectively).

2. Contractor deliveries under each provision were reviewed and an assessment was made regarding whether these deliveries would or would not have been likely to occur in the absence of these provisions. For example, in the historical impact analysis, contractors that stored water outside their service areas that had other existing available storage would likely still have taken delivery of that water, but would have stored it elsewhere.

3. Those deliveries that it was determined would not have been made were backed out of actual SWP operations by initially assuming that this water was not delivered and instead remained in storage in SWP San Luis Reservoir.

4. Given this higher storage in SWP San Luis Reservoir, the amount of additional water the Department would likely have made available to contractors was estimated, including: a) increases in the amount of Table A water allocated to contractors, b) making scheduled surplus water available under the pre-Monterey Amendment contract provision of Article 21, or c) making Article 21 unscheduled water available sooner than it otherwise would have. Any estimated increases in supply were limited by estimated contractor demand for that water.

5. The effect on storage in SWP San Luis Reservoir resulting from the net change in deliveries of SWP water (i.e., the net difference between reductions in deliveries without Monterey Amendment water management provisions determined under step 2, and increases in deliveries of Table A and Article 21 water determined under step 4) was then determined.

6. Effects on diversions at Banks Pumping Plant were then determined. This was assumed to occur when all contractor demands for SWP water that would likely have been made available were already being met, and SWP San Luis storage was already full (with “full” here including any historical amount of surcharge into CVP San Luis Reservoir storage). In this situation, it was determined that diversions at Banks would have been reduced.

4.0 ANALYSIS ASSUMPTIONS

The assumptions that follow are specific to the delivery data used in the analysis, determinations made about deliveries that would or would not have been without the Monterey Amendment provisions analyzed, and estimated changes in SWP operations and supply decisions that would likely have been made. Assumptions specific to the historical impact analysis are described in Section 4.1, and those specific to the water management provision analysis are described in Section 4.2.

4.1 Historical Impact Analysis 1996 - 2004

The analysis of historical impacts of the Monterey Amendment on SWP Operations is shown in Table 1. References to specific columns in the assumptions described below refer to the column numbers shown in that table.

4.1.1. Historical Water Delivery Data

The following describe specific assumptions made with regard to the historical delivery data used in the analysis. In general, these assumptions were made to ensure an accurate assessment of the effects on SWP San Luis Reservoir storage and Banks Pumping Plant diversions resulting from the deliveries made under the Monterey Amendment provisions, and to avoid the double counting of deliveries of certain water types.

1. **KWB (column 4):** Because the purpose of this analysis is to determine potential effects on the SWP, the analysis considers only deliveries of SWP water to the KWB and excludes deliveries to the KWB from other sources. The deliveries shown include deliveries to the KWB by KWB participants located within Kern County (i.e., those located within the KCWA service area). Deliveries to the KWB from the only participant in the KWB located outside the KCWA service area, i.e., Dudley Ridge WD, are excluded here but are included in deliveries to storage outside of contractors' service areas (column 6).

2. **Contractor use of Castaic and Perris lakes (column 5):** Contractor borrowing and replacement of water from the terminal reservoirs of Castaic and Perris (sometimes referred to as flexible storage) may potentially affect upstream SWP operations or SWP supplies only when borrowed water is replaced. Therefore, the deliveries shown include only the delivery of replacement water to the Castaic and Perris lakes.

   When the replacement occurs in the same year as the withdrawal, the result is merely a shift in the timing of conveyance of that water to the terminal reservoirs. It is assumed that this same-year replacement has no effect on the availability of SWP supplies to other contractors or to SWP diversions from Banks Pumping Plant. Therefore, the deliveries shown include only the delivery of replacement water that occurred in a calendar year subsequent to that in which the withdrawal was made.

3. **Contractor storage outside service areas (column 6):** Contractors may store any source (SWP or non-project) or SWP type of water outside their service areas. The deliveries shown include all types of SWP water delivered to out-of-service area storage, including Table A water, Article 21 water, and contractor carryover water. As noted under assumption 1, deliveries by Dudley Ridge WD to the KWB are included in these deliveries.

   In the early 1990s, the Semitropic Water Storage District, a member agency of KCWA, developed a groundwater bank within its service area. MWDSC acquired a portion of the capacity in that water bank, stored water in the bank in 1993 with Department approval for temporary storage, and signed a long-term storage agreement with Semitropic in 1994. Because this all occurred prior to the Monterey Amendment, MWDSC's participation in and deliveries to Semitropic are assumed to occur with or without the Monterey Amendment. Therefore, MWDSC deliveries to Semitropic are excluded from total contractor deliveries to out-of-service area storage.

4. **Turnback Pool (column 7):** Table A water allocated to a contractor may be offered through the Turnback Pool for sale to other contractors or the

Department. In some years, the amount of Turnback Pool water that contractors purchased was more than was actually delivered to them. The deliveries shown are actual deliveries to contractors, since any water that was purchased but not delivered would have remained in SWP San Luis Reservoir and would be reflected in the historical storage data. Similarly, any purchase of Turnback Pool water by the Department would have remained in SWP San Luis and would be reflected in the historical storage data, and thus is excluded from the data shown.

5. **Carryover water (column 8):** Contractors may carry over allocated water from one year to the next under both Articles 12(e) and 56(c). Article 12(e) was available prior to the Monterey Amendment, so carryover deliveries under this provision were assumed to occur with or without the Monterey Amendment. The deliveries shown in column 8 are carryover deliveries under the Monterey Amendment's Article 56(c).

   Carryover water may be delivered to any location to which a contractor has approval to deliver any other SWP water, including to its service area, to out-of-service area storage, or to Castaic or Perris lakes for replacement of borrowed flexible storage. To avoid double counting of deliveries already included in other columns, the deliveries shown only include deliveries to a contractor's service area. Carryover deliveries to out-of-service area storage are included in column 6, and carryover deliveries to replace flexible storage are included in column 5. Also, since the focus of this analysis is on effects to SWP San Luis storage and Banks diversions, carryover deliveries to North Bay contractors, which are not made directly from SWP San Luis, are excluded.

4.1.2 Deliveries Without Monterey Amendment

The following describe specific assumptions made with regard to determinations about these historical deliveries and whether they would or would not have been made without the Monterey Amendment in place. In some cases, such as SWP deliveries to the KWB or to storage outside the service area, at least some of these deliveries would have been made regardless, but would have been delivered instead to other existing storage programs. In other cases, the deliveries would not likely have occurred.

1. **KWB (column 10):** KCWA was asked to review the deliveries of SWP water to the KWB and determine how much of that water it could have stored in other storage programs to which KCWA had access that were existing at the time of delivery. The other existing storage programs KCWA considered were limited to projects in the Kern Fan area, including: the Berrenda Mesa Project; City of Bakersfield 2800 acres; and the Pioneer Project, including the Kern River Channel. KCWA conducted a detailed monthly analysis of these storage programs, looking at the historical deliveries that were made to those programs, estimating the remaining recharge capacity that would have been available for additional deliveries, and comparing the SWP deliveries to the KWB to this remaining available recharge capacity. The results of KCWA's analysis show that from 1995 through 2004 all SWP water deliveries to the KWB by KWB participants located within Kern County could have been recharged in available capacity in these other Kern Fan projects (see Section VII of Appendix E of the DEIR). Therefore, it was assumed that all SWP water delivered to the KWB by KWB participants located within Kern County would have still been delivered to KCWA without the Monterey Amendment's transfer of the Kern Fan Element property. These deliveries are shown in column 10.

2. **Contractor storage outside service areas (column 11):** Similar to what was done for the KWB, each contractor that stored water outside its service area was asked to review its deliveries to out-of-service area storage and determine how much of that water it could have stored in other existing storage programs within its service area or elsewhere. Santa Clara Valley WD determined that it would have been able to use or store within its service area all of the SWP water it stored outside its service area.

   MWDSC determined that it would have been able to store nearly all of the water it stored outside its service area (excluding its deliveries to the Semitropic banking program since that program was approved prior to the Monterey Amendment). To reach this determination, MWDSC considered these deliveries and its ability to store this water in its other storage programs that existed at the time of the deliveries, including: Desert Water/Coachella Valley Water District

Advance Delivery Account, Diamond Valley Lake, Semitropic Water Storage Program, Hayfield Storage Program, and conjunctive use programs and cyclic storage programs within MWDSC's service area. MWDSC conducted a detailed monthly analysis of these storage programs, looking at the historical storage in and deliveries to those programs, estimating the remaining storage and monthly recharge capacity that would have been available for additional deliveries, and comparing its SWP deliveries to outside-of-service area storage to this remaining available recharge capacity.

It was determined that the other four of the six storing contractors had no additional demand for or place to store this water. Therefore, it was assumed that all the SWP water delivered to out-of-service area storage for these four contractors would not have been delivered without this Monterey Amendment provision. These deliveries are not included in column 11.

3. **Table A deliveries from retired Table A amounts (column 12):** Without the Monterey Amendment, KCWA and Dudley Ridge WD would not have permanently retired 45,000 acre-feet of Table A amount. Since they both typically take delivery of all the Table A supply allocated to them, it was assumed that they would have taken delivery of the additional Table A water that would have been allocated to them without the retirement. The amount of additional annual delivery was determined based on the amount of Table A retired and the actual Table A allocation in each year. The monthly delivery distribution of these annual amounts was assumed to be in proportion to actual Table A deliveries to KCWA and Dudley Ridge WD in each year.

4. **Contractor use of Castaic and Perris lakes, Turnback Pool, and Carryover water:** Without the Monterey Amendment provisions, it was assumed that there would be: a) no deliveries to replace flexible storage withdrawals at Castaic and Perris lakes, b) no deliveries of Turnback Pool water, and c) no deliveries of Article 56(c) carryover water. Therefore, it was assumed that all the SWP water delivered under these provisions would not have been delivered.

5. **Change in SWP water deliveries related to Monterey Amendment provisions (column 13):** The total change in SWP water deliveries related to Monterey Amendment provisions represents the net change in deliveries, compared to what was delivered historically, that would have occurred without the Monterey Amendment provisions in place. This net change is calculated as a reduction from historical deliveries, based on the total of the historical deliveries made under these provisions (column 9), less those deliveries that would have been made without those provisions in place (columns 10 - 12).

4.1.3 Changes in SWP Operations and Supply Decisions Without Monterey Amendment

The assumptions that follow are specific to the estimated changes in SWP operations and supply decisions that would likely have been made if deliveries under the Monterey Amendment had not been made. In general, water not delivered under the water management provisions would have been partly offset by increased deliveries related to the Table A amount not retired. The net reduction in deliveries would either have been re-allocated and delivered to other contractors or would have remained in storage in San Luis Reservoir. Any increase in San Luis Reservoir storage that would have led to an earlier fill of the reservoir would in turn have increased the availability of unscheduled surplus water under Article 21. Only after these demands had been met would diversions at Banks Pumping Plant have been reduced.

1. **General SWP operations:** It was assumed that general SWP operations would not have changed. In other words, the Department would have continued to maximize diversions at Banks Pumping Plant, within the constraints of existing hydrologic conditions and regulatory and operational requirements, to meet contractor SWP water demands.

2. **Change in water deliveries:** The net change in water deliveries without the Monterey Amendment provisions in place (column 13) was assumed to directly change storage in the SWP share of San Luis Reservoir (i.e., any water that would not have been delivered was assumed instead to remain in SWP San Luis storage). This water was then assumed to either be reallocated and delivered to

other contractors with unmet SWP demands, or if demands were met, remain in SWP San Luis storage.

3. **Table A water deliveries (column 14):** In years when historical Table A allocations were less than 100 percent, the water not delivered under the Monterey Amendment provisions was assumed to be used to increase the allocation percentage, resulting in an increase in allocation and delivery to contractors with unmet Table A demands. The amount of any additional Table A deliveries that would have resulted from a Table A allocation increase was estimated based on the following. In years when historical Table A allocations were less than 90 percent, it was assumed that there would have been enough unmet contractor demand to take an additional Table A delivery of the entire amount of those deliveries not made under the water management provisions. In years when historical Table A allocations were 90 percent or more, unmet contractor Table A demands might have limited any additional Table A deliveries to something less than the deliveries not made. To be conservative, it was assumed in these years that additional Table A deliveries would have been limited to the demands of those contractors with known, but what would have been unmet, demands (i.e., based on actual deliveries to those contractors that purchased water from the Turnback Pool or the Department's dry-year purchase programs, or that used all of their 90 percent allocation).

   In addition, it was assumed that deliveries of carryover water to contractor service areas were used to meet direct contractor demands, and that in the absence of this carryover water, these deliveries would instead have been made with Table A water.

4. **Article 21 surplus water (column 15):** Under the terms of Article 21 of the SWP contract as it existed prior to the Monterey Amendment, when SWP supplies were available in excess of contractors' demands for Table A water, the Department could make surplus water available to contractors. Like Table A water, this surplus water was available for scheduled delivery throughout the year. In two years (1996 and 1999), SWP supplies were abundant enough that all requests for Table A water were met (i.e., historical Table A allocations were

100 percent) and, without the deliveries made under the Monterey Amendment provisions, additional water would have been available for delivery on a scheduled basis. In these two years, it was assumed that the Department would have made scheduled surplus water available to contractors. The amount of any additional deliveries that would have resulted from the availability of surplus water was estimated based on the demands of those contractors with known, but what would have been unmet, demands (i.e., based on actual deliveries to those contractors that purchased water from the Turnback Pool).

5. **Article 21 unscheduled surplus water (column 16):** It was assumed that any of the water not delivered under the Monterey Amendment provisions (column 13) that wasn't delivered as additional Table A water (column 14) or scheduled surplus water (column 15) would have remained in storage in San Luis Reservoir. Any increase in San Luis Reservoir storage that would have led to an earlier fill of the reservoir would have resulted in the Department making Article 21 unscheduled water available to the contractors sooner than happened historically. The amount of any additional deliveries of Article 21 unscheduled water was limited by estimated contractor demand for that water.

6. **Total change in SWP deliveries (column 17):** The total change in SWP water deliveries represents the net change in total SWP deliveries, compared to what was delivered historically, that would likely have occurred without the Monterey Amendment provisions in place. This net change from historical deliveries is calculated as the sum of the change in water delivered related to Monterey Amendment provisions (column 13) and the increase in deliveries of Table A water, scheduled surplus water, and unscheduled surplus water (columns 14 - 16).

7. **Change in diversions at Banks Pumping Plant (column 18):** The historical diversions at Banks Pumping Plant (as well as historical SWP deliveries) are reflected in the historical change in SWP San Luis Reservoir storage (column 3). A change in the historical diversions at Banks was assumed to occur when all contractor demands for SWP water that would have been made available were

already being met, and SWP San Luis storage was already full (with "full" here including any historical amount of surcharge into CVP San Luis Reservoir storage, as is discussed further below). In this situation, it was determined that diversions at Banks would have been reduced by the amount that SWP San Luis storage would have exceeded full capacity (defined below).

8. **SWP San Luis Reservoir storage (column 19):** The SWP storage in San Luis Reservoir represents the storage as it would have been without the Monterey Amendment provisions in place, considering changes both in SWP deliveries and in diversions at Banks Pumping Plant. This storage was calculated each month, as the previous month storage (starting with historical storage at the beginning of the first month of the analysis), plus the historical change in SWP San Luis storage (column 3, which reflects historical Banks Pumping Plant diversions and SWP deliveries), minus any change in total SWP deliveries (column 17), plus any change in diversions at Banks (column 18). Because storage capacity can limit diversions at Banks Pumping Plant, an initial storage calculation, without any change in diversions, was made to determine if storage would exceed full. If it did, then it was assumed that Banks diversions (column 18) would be reduced by the amount of that excess.

   In determining what would be considered "full" in this analysis, historical storage amounts were used as a guide. For example, when historical SWP San Luis storage was close to or in excess of SWP storage capacity of 1,062,000 AF, the historical storage values were used as a limit (e.g., December 1996 through March 1997). This reflects the assumption that any change in SWP deliveries without the Monterey Amendment water management provisions in place would have had no effect on the amount of surcharge into available CVP storage space the Department would have found to be acceptable.[1] Similarly, after implementation of the EWA, the Department historically, at times, limited the amount of water it physically stored, in anticipation of the replacement by EWA of

[1] When SWP storage in San Luis is full but CVP storage is not, the Department sometimes continues adding to SWP storage, in excess of SWP capacity (1,062,000 AF). This excess storage, called surcharge, is only available on a temporary basis until the CVP can fill its share of San Luis Reservoir. The Department determines the amount and timing of any SWP surcharge it deems appropriate on a real-time basis, considering a number of operational factors.

water debt EWA had incurred. In this situation, SWP San Luis storage in this analysis was limited to the historical storage value even though it was less than SWP capacity (e.g., March 2003).

9. **Annual assumptions (column 21):** Descriptions of specific assumptions made in each year of the analysis are included in column 21.

4.2 Water Management Provision Analysis

The water management provision impact analysis is shown in Table 3. This analysis is similar to the historical impact analysis described in Section 4.1, but excludes the effects of the Monterey Amendment's permanent retirement of Table A amounts and makes a different assumption regarding outside-of-service area storage. Except as identified below, the assumptions for both analyses are the same. References to specific columns in the assumptions described below refer to the column numbers shown in Table 3. (Note that because this analysis excludes the effects of Table A retirement, column numbers between the two analyses shown in Tables 1 and 3 differ slightly past column 11.)

4.2.1. Historical Water Delivery Data

The historical delivery data used in the water management provision analysis is the same as used in the historical impact analysis. See Section 4.1.1 for specific assumptions regarding the data shown in columns 4 through 8.

4.2.2 Deliveries Without Monterey Amendment Water Management Provisions

The specific assumptions made with regard to whether these historical deliveries would or would not have been made without the Monterey Amendment in place are the same as used in the historical impact analysis, with two notable exceptions. Those exceptions are the exclusion of the effects of the retirement of Table A amounts, and a different assumption regarding outside-of-service area storage, as discussed further below. See Section 4.1.2 for specific assumptions regarding: KWB (column 10); and contractor use of Castaic and Perris lakes, Turnback Pool, and carryover water.

1. **Contractor storage outside service areas (column 11):** For the purpose of estimating future effects of the water management provisions, it was assumed that none of the SWP water delivered to out-of-service area storage for the storing contractors would have been delivered without this Monterey Amendment provision. In the historical impact analysis, it was assumed that that portion of the water delivered to out-of-service area storage that could have been delivered to other existing storage programs available to the storing contractors, would have been delivered even without this Monterey Amendment provision. At some point, however, those other existing storage programs would fill, and additional deliveries would be made to the added out-of-service area storage available through this provision. In other words, total available storage has increased, along with the potential for increased deliveries to storage. Therefore, for the purpose of estimating the future effects of this provision, the deliveries to this additional out-of-service area storage are assumed to be additional deliveries that would not otherwise have been made.

2. **Table A deliveries from retired Table A amounts:** Because the purpose of this analysis is to estimate the future effects of the water management provisions, and because the future effects of this provision are already included in the CALSIM II model studies mentioned in Section 2.1, it is excluded from this analysis.

3. **Change in SWP water deliveries under water management programs (column 12):** The change in SWP water deliveries under water management programs represents the net change in deliveries, compared to what was delivered historically, that would have occurred without the Monterey Amendment water management provisions in place. This net change is calculated as a reduction from historical deliveries, based on the total of the historical deliveries made under these provisions (column 9), less those deliveries that would have been made even without those provisions in place (columns 10 - 11).

4.2.3 Changes in SWP Operations and Supply Decisions Without Monterey Amendment Water Management Provisions

The assumptions specific to the estimated changes in SWP operations and supply decisions that would likely have been made if deliveries under the Monterey Amendment water management provisions had not been made, are the same as used in the historical impact analysis. See Section 4.1.3 for specific assumptions regarding the data shown in columns 13 through 20. Note that while the assumptions are the same, the specific decisions made on the basis of those assumptions (i.e., the data shown), differs somewhat because of differing deliveries and storage levels.

(Also note that because the water management provision analysis excludes the effects of the Table A retirement included in the historical impact analysis, and therefore excludes that data column, the column numbers for the two analyses beyond column 11 differ by one (e.g., column 14 in Table 1 is comparable to column 13 in Table 3)).

5.0 RESULTS

5.1 Historical SWP Operations Impact Analysis 1996 - 2004

The historical impact analysis in Table 1 shows that the Monterey Amendment resulted in an estimated increase in diversions at Banks Pumping Plant of a total of 44,000 acre-feet during the period from 1996 through 2004. This increase in diversions occurred during six months out of this nine-year period, as is summarized in Table 2. As is shown in both Table 2 and Figure 1, these increases in diversions are small relative to total diversions at Banks Pumping Plant, and occurred in months when Delta outflow was high.

The estimated changes in storage in the SWP share of San Luis Reservoir that resulted from the Monterey Amendment's historical operations are shown in Figure 2. These storage changes were small, typically ranging from zero to about 30,000 acre-feet during this period, out of a total SWP San Luis Reservoir capacity of 1,062,000 acre-feet. The largest storage difference occurred between August 2000 and February 2001, when

storage would have been nearly 200,000 acre-feet higher without the Monterey Amendment in effect.

As was discussed in more detail in Section 2.1.2 above, the permanent transfer of Table A amounts was not included in this analysis. If it had been, it would likely show lower deliveries during this period due to temporarily lower demands between the selling and buying contractors. This would be reflected in higher storage at SWP San Luis Reservoir and potential reductions in diversions at Banks Pumping Plant, which would have offset some or all of the potential diversion increases resulting from the water management provisions. Because the inclusion of this provision would likely show a reduction in impacts (or even a benefit), the exclusion of this provision in the historical analysis in this study results in an over-estimate of historical impacts from 1996 through 2004.

5.2 Water Management Provision Analysis

The water management provision analysis in Table 3 shows that the Monterey Amendment water management provisions resulted in an estimated increase in diversions at Banks Pumping Plant of a total of 449,000 acre-feet over the nine-year period from 1996 through 2004, or an average of 50,000 acre-feet per year. This increase in diversions occurred during 11 months out of this nine-year period, as is summarized in Table 4. As is shown in both Table 4 and Figure 3, these increases in diversions are small relative to total diversions at Banks Pumping Plant, and occurred in months when Delta outflow was high.

The estimated changes in storage in the SWP share of San Luis Reservoir that resulted from the Monterey Amendment water management provisions are shown in Figure 4. These storage changes were small, typically ranging from zero to up to about 100,000 acre-feet, out of a total SWP San Luis Reservoir capacity of 1,062,000 acre-feet. The largest storage difference occurred between August 2000 and February 2001, when storage would have been 200,000 to more than 300,000 acre-feet higher without the Monterey Amendment in effect.

This analysis is intended to provide a basis for estimating the future effects of the water management provisions of the Monterey Amendment on SWP operations. While this analysis is based on historical data from 1996 through 2004, because this period includes both a series of wet years and a series of drier years, it provides a reasonable estimate of the effects that might be anticipated in the future.

Monterey Historical Operations Analysis With Storage Assumption

TABLE 1

HISTORICAL IMPACT ANALYIS: 1996 – 2004

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF)											Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Monterey Programs and Retirement				Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56															
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Table A Deliveries from Retired Table A Amounts	Total Change in SWP Water Deliveries Related to Monterey	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	- cal 2:(rau.x) - cal 2:(rau.x-1)	Actual	Actual	Actual	Actual	Actual	-sum(calr 4 thru 8)	Calculated	Calculated	Calculated	- - (calr 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	-sum(calr 13 thru 16)	Estimated	-cal 19:(x-1) + cal 3 - cal 17 + cal 18	- cal 19 - cal 2	
Jan-96	1,061,411	0	11,565	0	22	0	0	11,587	11,565	0	230	208	0	0	0	208	0	1,061,203	-208	- SWP allocation in 1996 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to 45,000 AF of Table A amount that would not have been retired.
Feb-96	1,076,912	15,501	9,678	0	1,062	0	0	10,740	9,678	0	987	-75	0	0	0	-75	0	1,076,779	-133	
Mar-96	1,058,720	-18,192	5,829	0	668	0	0	6,497	5,829	0	1,672	1,004	0	0	0	1,004	0	1,057,583	-1,137	
Apr-96	972,070	-86,650	1,409	0	0	27,290	0	28,699	1,409	0	2,221	-25,069	0	27,000	0	1,931	0	969,002	-3,068	- Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Desert, Coachella), in about the same amount and schedule.
May-96	843,235	-128,835	2,103	0	0	19,632	0	21,735	2,103	0	4,264	-15,368	0	20,000	0	4,632	0	835,534	-7,701	
Jun-96	787,228	-56,007	255	0	25,000	31,774	0	57,029	255	25,000	7,307	-24,467	0	32,000	0	7,533	0	771,994	-15,234	
Jul-96	750,346	-36,882	2,015	0	20,000	34,774	0	56,789	2,015	20,000	9,189	-25,585	0	35,000	0	9,415	0	725,698	-24,648	
Aug-96	628,876	-121,470	11,456	0	6,200	44,165	0	61,821	11,456	0	8,172	-42,193	0	44,000	0	1,807	0	602,420	-26,456	- Without Monterey, SWP San Luis would have been slightly surcharged into CVP San Luis storage by year end, although at a lower level than historically. With this lower storage, diversions at Banks would not have been reduced.
Sep-96	740,379	111,503	10,695	0	0	17,274	0	27,969	10,695	0	2,391	-14,883	0	17,000	0	2,117	0	711,806	-28,573	
Oct-96	843,170	102,791	9,079	0	0	0	0	9,079	9,079	0	1,484	1,484	0	0	0	1,484	0	813,112	-30,058	
Nov-96	1,048,478	205,308	5,601	0	0	0	0	5,601	5,601	0	938	938	0	0	0	938	0	1,017,482	-30,996	
Dec-96	1,109,158	60,680	13,676	0	2,379	0	0	16,055	13,676	0	1,813	-566	0	0	0	-566	0	1,078,728	-30,430	
Jan-97	1,101,867	-7,291	873	0	114	0	0	987	873	0	20	-94	0	0	0	-94	0	1,071,531	-30,336	- SWP allocation in 1997 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired.
Feb-97	1,105,151	3,284	0	0	0	0	0	0	0	0	249	249	0	0	0	249	0	1,074,566	-30,585	
Mar-97	1,085,462	-19,689	1,299	0	4,328	0	0	5,627	1,299	0	2,173	-2,155	0	0	0	-2,155	0	1,057,032	-28,430	
Apr-97	944,918	-140,544	2,772	0	0	0	0	2,772	2,772	0	3,243	3,243	0	0	0	3,243	0	913,246	-31,672	- Since SWP San Luis did not quite fill by the end of December, there would have been no additional deliveries of Article 21 water and no need to reduce diversions at Banks.
May-97	721,579	-223,339	0	0	0	9,505	0	9,505	0	0	5,444	-4,061	0	0	0	-4,061	0	693,968	-27,611	
Jun-97	593,083	-128,496	0	0	35,000	11,505	0	46,505	0	35,000	7,917	-3,588	0	0	0	-3,588	0	569,060	-24,023	
Jul-97	445,203	-147,880	0	0	10,000	12,504	0	22,504	0	0	10,626	-11,878	0	0	0	-11,878	0	433,059	-12,144	
Aug-97	334,549	-110,654	0	0	0	7,294	0	7,294	0	0	9,651	2,357	0	0	0	2,357	0	320,047	-14,502	
Sep-97	461,649	127,100	2,769	0	0	6,842	0	9,611	2,769	0	1,379	-5,463	0	0	0	-5,463	0	452,610	-9,039	
Oct-97	547,915	86,266	2,563	0	0	6,298	0	8,861	2,563	0	1,191	-5,107	0	0	0	-5,107	0	543,983	-3,932	
Nov-97	713,723	165,808	11,165	645	0	4,298	0	16,108	11,165	0	1,267	-3,676	0	0	0	-3,676	0	713,467	-256	
Dec-97	953,588	239,865	13,266	611	2,386	4,298	0	20,561	13,266	1,486	1,841	-3,968	0	0	0	-3,968	0	957,300	3,712	

TABLE 1 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: Turnback Pool Water	Historical: Carryover Water (delivered to service area)	Historical: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	- cal 2:(rau.x) - cal 2:(rau.x-1)	Actual	Actual	Actual	Actual	Actual	-sum(calr 4 thru 8)	Calculated	Calculated	Calculated	- - (calr 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	-sum(calr 13 thru 16)	Estimated	-cal 19:(x-1) + cal 3 - cal 17 + cal 18	- cal 19 - cal 2	
Jan-98	1,068,183	114,595	13,541	0	11,384	0	25,759	50,684	13,541	10,973	2,579	-23,591	26,000	0	0	2,409	-1,000	1,068,486	303	- SWP allocation in 1998 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Carryover water deliveries in January would have been met by Table A water instead. - Deliveries to Turnback Pool buyers (Desert, Coachella) in May and June would have been met by Art. 21 unscheduled water. - Without Monterey, SWP San Luis would have filled earler in November, and additional Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water. Their demand would be limited by the amount of water made available. - SWP would have surcharged into CVP San Luis storage space in November. Increased Art. 21 deliveries would have limited surcharge amount to historic level by the end of December.
Feb-98	1,062,277	-5,906	2,545	0	909	0	0	3,454	2,545	336	275	-298	0	0	0	-298	0	1,062,878	601	
Mar-98	1,063,334	1,057	0	0	0	0	0	0	0	0	427	427	0	0	0	427	0	1,063,508	174	
Apr-98	1,062,227	-1,107	0	0	0	0	0	0	0	0	912	912	0	0	0	912	0	1,061,489	-738	
May-98	1,061,880	-347	0	0	0	15,000	0	15,000	0	0	1,618	-13,382	0	0	15,000	1,618	0	1,059,524	-2,356	
Jun-98	1,060,880	-1,000	0	0	23,800	15,000	0	38,800	0	23,800	3,886	-11,114	0	0	15,000	3,886	0	1,054,639	-6,241	
Jul-98	1,004,087	-56,793	0	0	5,750	15,000	0	20,750	0	0	9,512	-11,238	0	0	0	-11,238	0	1,009,084	4,997	
Aug-98	873,994	-130,093	0	0	1,759	15,000	0	16,759	0	1,759	11,369	-3,631	0	0	0	-3,631	0	882,622	8,628	
Sep-98	900,000	26,006	6,391	0	12,575	15,000	0	33,966	6,391	12,519	6,007	-9,049	0	0	0	-9,049	0	917,677	17,677	
Oct-98	1,014,790	114,790	10,685	0	8,732	0	0	19,417	10,685	4,147	3,452	-1,133	0	0	0	-1,133	0	1,033,600	18,810	
Nov-98	1,063,595	48,805	3,804	0	0	0	0	3,804	3,804	0	1,625	1,625	0	0	7,000	8,625	0	1,073,780	10,185	
Dec-98	1,074,246	10,651	8,264	0	300	0	0	8,564	8,264	0	3,339	3,039	0	0	7,000	10,039	0	1,074,392	146	
Jan-99	1,103,949	29,703	204	0	2,011	0	0	2,215	204	600	578	-833	0	0	0	-833	0	1,104,928	979	- SWP allocation in 1999 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Without Monterey, SWP diversion reductions at Banks would have been needed in February and March to limit surcharge into CVP San Luis space to historic levels. - Deliveries of Art. 21 unscheduled water, already available in January through April, would not have increased because there were no additional unmet demands during those months. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Kern, Dudley, Desert, Coachella), in about the same amount and schedule. - While SWP San Luis storage was slightly higher by the end of December, it did not fill. Therefore, at the end of 1999 there would have been no additional Art. 21 unscheduled water made available and no need to reduce diversions at Banks.
Feb-99	1,097,321	-6,628	1,149	0	6,220	0	0	7,369	1,149	5,390	672	-158	0	0	0	-158	-1,000	1,097,458	137	
Mar-99	1,061,800	-35,521	1,022	0	18,841	0	0	19,863	1,022	15,661	970	-2,210	0	0	0	-2,210	-2,000	1,062,148	348	
Apr-99	1,011,650	-50,150	2,274	0	18,976	0	0	21,250	2,274	11,688	1,841	-5,447	0	0	0	-5,447	0	1,017,445	5,795	
May-99	863,254	-148,396	347	0	16,024	347	0	16,718	347	6,185	4,479	-5,707	0	500	0	-5,207	0	874,256	11,002	
Jun-99	555,473	-307,781	0	0	54,865	15,217	0	70,082	0	24,945	7,230	-37,907	0	15,000	0	-22,907	0	589,382	33,909	
Jul-99	476,215	-79,258	0	0	3,800	26,600	0	30,400	0	0	10,666	-19,734	0	27,000	0	7,266	0	502,858	26,643	
Aug-99	451,049	-25,166	0	0	0	19,534	0	19,534	0	0	8,798	-10,736	0	20,000	0	9,264	0	468,428	17,379	
Sep-99	591,796	140,747	0	0	2,958	34,503	0	37,461	0	2,958	3,779	-30,724	0	34,000	0	3,276	0	605,899	14,103	
Oct-99	573,547	-18,249	5,758	0	137	45,573	0	51,468	5,758	137	3,301	-42,272	0	44,000	0	1,728	0	585,921	12,374	
Nov-99	683,127	109,580	10,780	0	4,292	44,173	0	59,245	10,780	4,292	1,760	-42,413	0	44,000	0	1,587	0	693,914	10,787	
Dec-99	716,955	33,828	3,156	0	4,369	31,490	0	39,015	3,156	4,369	926	-30,564	0	31,500		936	0	726,806	9,851	

TABLE 1 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	- col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	-sum(colr 4 thru 8)	Calculated	Calculated	Calculated	- (colr 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	-sum(colr 13 thru 16)	Estimated	-col 19:(n-1) + col 3 - col 17 + col 18	- col 19 - col 2	
Jan-00	914,717	197,762	224	0	12,049	0	79,981	92,254	224	12,049	424	-79,557	80,000	0	0	443	0	924,125	9,408	- SWP allocation in 2000 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Table A deliveries would have been made related to the Table A amount that would not have been retired. - Carryover water deliveries in January and February would have been Table A deliveries instead. - Any Table A delivery increases from April on would have been limited to those contractors that were Turnback Pool buyers (Dudley, KCWA, Tulare, Desert, Coachella) or that used all of their 90% allocation (Co. of Kings). - Without Monterey, SWP diversions at Banks would have been reduced in February and March to avoid SWP surcharge into CVP San Luis storage space. - SWP San Luis storage would have been higher by the end of 2000 but would not have filled.
Feb-00	1,057,575	142,858	4,733	0	12,068	0	73,114	89,915	4,733	9,685	1,408	-74,089	73,000	0	0	-1,089	-10,000	1,058,072	497	
Mar-00	1,061,880	4,305	13,212	0	13,210	0	0	26,422	13,212	8,520	1,232	-3,458	0	0	0	-3,458	-4,000	1,061,835	-45	
Apr-00	969,343	-92,537	0	0	10,801	10,000	0	20,801	0	10,801	4,182	-5,818	9,300	0	0	3,482	0	965,817	-3,526	
May-00	762,064	-207,279	0	0	0	12,100	0	12,100	0	0	6,287	-5,813	17,300	0	0	11,487	0	747,051	-15,013	
Jun-00	580,449	-181,615	0	0	27,880	12,290	0	40,170	0	21,130	11,416	-7,624	17,300	0	0	9,676	0	555,760	-24,689	
Jul-00	401,285	-179,164	0	0	38,553	122,832	0	161,385	0	24,803	6,559	-130,023	17,300	0	0	-112,723	0	489,319	88,034	
Aug-00	307,591	-93,694	0	0	24,675	106,860	0	131,535	0	16,675	3,900	-110,960	17,300	0	0	-93,660	0	489,285	181,694	
Sep-00	387,635	80,044	0	0	29,866	2,041	0	31,907	0	27,166	2,493	-2,248	17,300	0	0	15,052	0	554,277	166,642	
Oct-00	421,304	33,669	0	0	21,119	16,182	0	37,301	0	21,119	1,572	-14,610	17,300	0	0	2,690	0	585,256	163,952	
Nov-00	460,177	38,873	333	0	15,752	0	0	16,085	333	15,752	540	540	12,000	0	0	12,540	0	611,589	151,412	
Dec-00	481,677	21,500	0	0	5,761	0	0	5,761	0	5,761	488	488	8,000	0	0	8,488	0	624,601	142,924	
Jan-01	556,930	75,253	0	0	0	0	131,245	131,245	0	0	0	-131,245	80,000	0	0	-51,245	0	751,099	194,169	- SWP allocation in 2001 was 39%. Since all Table A demand was not met and with higher initial SWP storage, allocations would have been slightly higher early in the year, allowing additional Table A deliveries early in the year. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, since SWP San Luis filled (after consideration for EWA debt to SWP) in February, that January delivery reduction would instead have been made in February as Art. 21 water. - Unmet demands by Turnback Pool buyers in 2000 (Dudley, KCWA, Tulare, Desert, Coachella) would have resulted in added demand for Art. 21 unscheduled water in March 2001, with demand limited by ability to take delivery those months. - Water otherwise delivered through the Turnback Pool would have essentially offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-01	747,404	190,474	0	0	0	0	78,523	78,523	0	0	0	-78,523	78,000	0	45,000	44,477	0	897,096	149,692	
Mar-01	996,764	249,360	8,297	4,710	6,733	0	71,425	91,165	8,297	0	128	-82,740	72,000	0	160,000	149,260	0	997,196	432	
Apr-01	984,617	-12,147	0	0	0	8,191	0	8,191	0	0	150	-8,041		0	0	-8,041	0	993,090	8,473	
May-01	815,834	-168,783	0	0	0	921	0	921	0	0	2,019	1,098		0	0	1,098	0	823,209	7,375	
Jun-01	642,248	-173,586	0	0	0	82	0	82	0	0	5,032	4,950		0	0	4,950	0	644,673	2,425	
Jul-01	549,059	-93,189	0	0	0	4,948	0	4,948	0	0	4,024	-924		0	0	-924	0	552,409	3,350	
Aug-01	515,197	-33,862	0	0	0	2,016	0	2,016	0	0	2,225	209		0	0	209	0	518,338	3,141	
Sep-01	516,007	810	0	0	0	947	0	947	0	0	2,170	1,223		0	0	1,223	0	517,925	1,918	
Oct-01	357,700	-158,307	0	0	0	395	0	395	0	0	1,364	969		0	0	969	0	358,649	949	
Nov-01	412,836	55,136	0	0	0	0	0	0	0	0	378	378		0	0	378	0	413,406	570	
Dec-01	675,995	263,159	0	2,589	0	740	0	3,329	0	0	60	-3,269		0	0	-3,269	0	679,834	3,839	

TABLE 1 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	- col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	-sum(colr 4 thru 8)	Calculated	Calculated	Calculated	- - (colr 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	-sum(colr 13 thru 16)	Estimated	-col 19:(n-1) + col 3 - col 17 + col 18	- col 19 - col 2	
Jan-02	912,332	236,337	0	0	4,532	0	109,171	113,703	0	3,311	453	-109,939	80,000	0	0	-29,939	0	946,110	33,778	- SWP allocation in 2002 was 70%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January and February would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, that January delivery reduction would instead have been made in February as additional Table A water. - Without Monterey, SWP San Luis would have filled slightly sooner, resulting in an added demand for Article 21 water in March. - Water otherwise delivered from April through December to replace flexible storage, to out-of-service area storage, or through the Turnback Pool, less Table A deliveries that would have been made related to the Table A amount that would not have been retired, would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-02	1,030,871	118,539	0	0	6,919	0	4,549	11,468	0	0	1,450	-10,018	34,000	0	0	23,982	0	1,040,666	9,795	
Mar-02	1,078,173	47,302	2,793	1,190	643	0	13	4,639	2,793	0	2,202	356	0	0	9,000	9,356	0	1,078,612	439	
Apr-02	973,457	-104,716	2,991	4,760	1,520	0	0	9,271	2,991	0	1,131	-5,149	8,800	0	0	3,651	0	970,245	-3,212	
May-02	744,784	-228,673	0	8,630	0	1,501	0	10,131	0	0	2,291	-7,840	16,300	0	0	8,460	0	733,112	-11,672	
Jun-02	488,121	-256,663	0	8,630	0	4,694	0	13,324	0	0	7,532	-5,792	16,300	0	0	10,508	0	465,941	-22,180	
Jul-02	398,657	-89,464	0	8,630	0	23,061	0	31,691	0	0	7,223	-24,468	16,300	0	0	-8,168	0	384,645	-14,012	
Aug-02	467,946	69,289	0	0	1,000	15,996	0	16,996	0	0	4,937	-12,059	16,300	0	0	4,241	0	449,693	-18,253	
Sep-02	393,795	-74,151	0	0	8,332	0	0	8,332	0	0	2,148	-6,184	16,300	0	0	10,116	0	365,425	-28,370	
Oct-02	237,482	-156,313	0	16,468	12,819	0	0	29,287	0	0	1,673	-27,614	16,300	0	0	-11,314	0	220,426	-17,056	
Nov-02	219,224	-18,258	0	13,342	3,408	0	0	16,750	0	0	191	-16,559	11,300	0	0	-5,259	0	207,427	-11,797	
Dec-02	319,803	100,579	0	13,342	4,441	0	0	17,783	0	-2,785	267	-20,301	7,500	0	0	-12,801	0	320,807	1,004	
Jan-03	569,838	250,035	0	0	5,800	0	9,486	15,286	0	0	86	-15,200	9,000	0	0	-6,200	0	577,042	7,204	- SWP allocation in 2003 was 90%. While not all Table A demand was met, allocations would not have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. - The increase in SWP San Luis storage compared to historic at the end of February would have been an added Art. 21 unscheduled water delivery in March. Note that SWP San Luis was "full" in March, after consideration of EWA debt to SWP. - Water otherwise delivered to out-of-service area storage from April-December or through the Turnback Pool would have offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-03	837,137	267,299	0	0	3,400	0	25,521	28,921	0	0	411	-28,510	26,000	0	0	-2,510	0	846,852	9,715	
Mar-03	984,556	147,419	4,632	0	0	0	40,577	45,209	4,632	0	1,328	-39,249	41,000	0	8,000	9,751	0	984,520	-36	
Apr-03	920,243	-64,313	0	0	0	16,006	0	16,006	0	0	877	-15,129		0	0	-15,129	0	935,335	15,092	
May-03	684,343	-235,900	0	0	15,477	0	0	15,477	0	5,477	3,150	-6,850		0	0	-6,850	0	706,285	21,942	
Jun-03	557,749	-126,594	0	0	40,927	4,373	0	45,300	0	34,827	6,826	-3,647		0	0	-3,647	0	583,338	25,589	
Jul-03	521,880	-35,869	0	0	13,290	9,339	0	22,629	0	13,290	10,977	1,638		0	0	1,638	0	545,831	23,951	
Aug-03	529,944	8,064	0	0	19,706	52	0	19,758	0	19,706	6,449	6,397		0	0	6,397	0	547,498	17,554	
Sep-03	652,744	122,800	0	0	10,900	0	0	10,900	0	10,900	2,908	2,908		0	0	2,908	0	667,390	14,646	
Oct-03	607,364	-45,380	2,413	0	5,020	0	0	7,433	2,413	5,020	2,648	2,648		0	0	2,648	0	619,362	11,998	
Nov-03	613,477	6,113	16,789	0	675	0	0	17,464	16,789	675	2,417	2,417		0	0	2,417	0	623,059	9,582	
Dec-03	615,769	2,292	16,190	0	4,220	0	0	20,410	16,190	3,870	2,424	2,074		0	0	2,074	0	623,277	7,508	

TABLE 1 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	- col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	-sum(colr 4 thru 8)	Calculated	Calculated	Calculated	- - (colr 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	-sum(colr 13 thru 16)	Estimated	-col 19:(n-1) + col 3 - col 17 + col 18	- col 19 - col 2	
Jan-04	809,033	193,264	0	0	6,543	0	120,099	126,642	0	0	0	-126,642	100,000	0	0	-26,642	0	843,183	34,150	- SWP allocation in 2004 was 65%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January and February's delivery would have been made as Table A water. However, since SWP San Luis storage was nearing full in February, any January and February deliveries not made as Table A water would instead have been made in February as Art. 21 unscheduled water and in March as added Table A water. - Without Monterey, SWP San Luis would have nearly filled in February, and Art. 21 unscheduled water would have been made available that month, resulting in an added demand for Art. 21 unscheduled water in February. - Water otherwise delivered to out-of-service area storage from April-December or through Turnback Pool would not quite have offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-04	971,719	162,686	1,914	0	31,004	0	148,915	181,833	1,914	0	6	-179,913	100,000	0	50,000	-29,913	0	1,035,782	64,063	
Mar-04	1,069,446	97,727	14,494	0	6,372	0	6,883	27,749	14,494	0	907	-12,348	50,000	0	0	37,652	-26,000	1,069,857	411	
Apr-04	938,544	-130,902	0	0	0	4,815	0	4,815	0	0	3,406	-1,409		0	0	-1,409	0	940,365	1,821	
May-04	674,017	-264,527	0	0	0	5,075	0	5,075	0	0	4,485	-590		0	0	-590	0	676,427	2,410	
Jun-04	434,812	-239,205	0	0	0	6,402	0	6,402	0	0	7,086	684		0	0	684	0	436,539	1,727	
Jul-04	369,739	-65,073	0	0	2,000	291	0	2,291	0	0	8,006	5,715		0	0	5,715	0	365,751	-3,988	
Aug-04	408,702	38,963	0	0	2,000	657	0	2,657	0	0	3,707	1,050		0	0	1,050	0	403,664	-5,038	
Sep-04	513,536	104,834	0	0	0	0	0	0	0	0	1,096	1,096		0	0	1,096	0	507,402	-6,134	
Oct-04	522,176	8,640	0	0	0	0	0	0	0	0	318	318		0	0	318	0	515,724	-6,452	
Nov-04	603,410	81,234	0	0	0	0	0	0	0	0	11	11		0	0	11	0	596,947	-6,463	
Dec-04	672,181	68,771	0	0	0	0	0	0	0	0	223	223		0	0	223	0	665,495	-6,686	
1996-2004																				
Total			**277,003**	**83,547**	**734,276**	**922,697**	**925,261**	**2,942,784**	**277,003**	**478,997**	**334,970**	**-1,851,814**	**1,107,500**	**391,000**	**316,000**	**-37,314**	**-44,000**			

TABLE 2

HISTORICAL IMPACT ANALYIS: 1996 – 2004

Effects of Monterey Amendment on Banks Diversions

Year	Month	Actual Net Delta Ouflow Index[1] (AF)	Actual Banks Diversions[2] (AF)	Change in Banks Diversions without Monterey (AF)
1998	January	4,399,140	196,584	-1,000
1999	February	5,487,282	52,203	-1,000
1999	March	4,249,136	182,800	-2,000
2000	February	5,412,226	421,683	-10,000
2000	March	5,400,323	343,011	-4,000
2004	March	3,459,039	423,147	-26,000
96-04 Total				-44,000

1. Source: IEP's Dayflow calculations (http://iep.water.ca.gov/dayflow/output/index.html).
2. Source: DWR Division of Operations and Maintenance Operations Control Office annual and monthly reports of operations (http://wwwoco.water.ca.gov/indexo.html).

TABLE 3
WATER MANAGEMENT PROVISION ANLYSIS

Month	Historical SWP Operations and SWP Water Deliveries (AF)								Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF)										Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
	SWP San Luis Storage		SWP Water Deliveries Under Monterey Water Management Programs						Change in SWP Water Del's Related to Water Mgmt Progs			Resulting Change in Other SWP Water Deliveries					SWP San Luis Storage		
					SWP Water Deliveries Under Article 56														
	End-of-Month Storage	Change in Storage from Previous Month	SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Storage Outside Service Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	End-of-Month Storage	Change in Storage Compared to Historic	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	Actual	- cal 2:(row n) - cal 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	-sum(cols 4 thru 8)	Calculated	Calculated	- - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	-sum(cols 12 thru 15)	Estimated	- cal 18:(n-1) + cal 3 - cal 16 + cal 17	- cal 18 - cal 2	
Jan-96	1,061,411	0	11,565	0	22	0	0	11,587	11,565	0	-22	0	0	0	-22	0	1,061,433	22	- SWP allocation in 1996 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries.
Feb-96	1,076,912	15,501	9,678	0	1,062	0	0	10,740	9,678	0	-1,062	0	0	0	-1,062	0	1,077,996	1,084	
Mar-96	1,058,720	-18,192	5,829	0	668	0	0	6,497	5,829	0	-668	0	0	0	-668	0	1,060,472	1,752	- Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Desert, Coachella), in about the same amount and schedule.
Apr-96	972,070	-86,650	1,409	0	0	27,290	0	28,699	1,409	0	-27,290	0	27,000	0	-290	0	974,112	2,042	
May-96	843,235	-128,835	2,103	0	0	19,632	0	21,735	2,103	0	-19,632	0	20,000	0	368	0	844,909	1,674	
Jun-96	787,228	-56,007	255	0	25,000	31,774	0	57,029	255	0	-56,774	0	32,000	0	-24,774	0	813,676	26,448	
Jul-96	750,346	-36,882	2,015	0	20,000	34,774	0	56,789	2,015	0	-54,774	0	35,000	0	-19,774	0	796,568	46,222	- Without Monterey water management program deliveries, SWP San Luis would have been more full by year end. Storage would have been maintained at levels similar to historic storage in November and December, necessitating a reduction in SWP diversions at Banks in November and December.
Aug-96	628,876	-121,470	11,456	0	6,200	44,165	0	61,821	11,456	0	-50,365	0	44,000	0	-6,365	0	681,463	52,587	
Sep-96	740,379	111,503	10,695	0	0	17,274	0	27,969	10,695	0	-17,274	0	17,000	0	-274	0	793,240	52,861	
Oct-96	843,170	102,791	9,079	0	0	0	0	9,079	9,079	0	0	0	0	0	0	0	896,031	52,861	
Nov-96	1,048,478	205,308	5,601	0	0	0	0	5,601	5,601	0	0	0	0	0	0	0	1,101,339	52,861	
Dec-96	1,109,158	60,680	13,676	0	2,379	0	0	16,055	13,676	0	-2,379	0	0	0	-2,379	-55,000	1,109,398	240	
Jan-97	1,101,867	-7,291	873	0	114	0	0	987	873	0	-114	0	0	0	-114	0	1,102,221	354	- SWP allocation in 1997 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries.
Feb-97	1,105,151	3,284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,105,505	354	
Mar-97	1,085,462	-19,689	1,299	0	4,328	0	0	5,627	1,299	0	-4,328	0	0	0	-4,328	0	1,090,144	4,682	- Without Monterey water management program deliveries, SWP San Luis would have nearly filled in December, and Art. 21 unscheduled water would have been made available that month.
Apr-97	944,918	-140,544	2,772	0	0	0	0	2,772	2,772	0	0	0	0	0	0	0	949,600	4,682	
May-97	721,579	-223,339	0	0	0	9,505	0	9,505	0	0	-9,505	0	0	0	-9,505	0	735,766	14,187	
Jun-97	593,083	-128,496	0	0	35,000	11,505	0	46,505	0	0	-46,505	0	0	0	-46,505	0	653,775	60,692	- Unmet demands by Turnback Pool buyers (Dudley, Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water in December. Their demand would be limited only by their ability to take delivery during December.
Jul-97	445,203	-147,880	0	0	10,000	12,504	0	22,504	0	0	-22,504	0	0	0	-22,504	0	528,399	83,196	
Aug-97	334,549	-110,654	0	0	0	7,294	0	7,294	0	0	-7,294	0	0	0	-7,294	0	425,039	90,490	
Sep-97	461,649	127,100	2,769	0	0	6,842	0	9,611	2,769	0	-6,842	0	0	0	-6,842	0	558,981	97,332	
Oct-97	547,915	86,266	2,563	0	0	6,298	0	8,861	2,563	0	-6,298	0	0	0	-6,298	0	651,545	103,630	- Since SWP San Luis did not quite fill by the end of December, there would have been no need to reduce diversions at Banks.
Nov-97	713,723	165,808	11,165	645	0	4,298	0	16,108	11,165	0	-4,943	0	0	0	-4,943	0	822,296	108,573	
Dec-97	953,588	239,865	13,266	611	2,386	4,298	0	20,561	13,266	0	-7,295	0	0	16,000	8,705	0	1,053,456	99,868	

TABLE 3 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	SWP San Luis Storage: Change in Storage from Previous Month	SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	SWP Water Deliveries Under Article 56: Storage Outside Service Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	SWP San Luis Storage: End-of-Month Storage	Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	Actual	- col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	-sum(colr 4 thru 8)	Calculated	Calculated	- - (colr 9 - 10 - 11)	Estimated	Estimated	Estimated	-sum(colr 12 thru 15)	Estimated	- col 18:(n-1) + col 3 - col 16 + col 17	- col 18 - col 2	
Jan-98	1,068,183	114,595	13,541	0	11,384	0	25,759	50,684	13,541	0	-37,143	26,000	0	0	-11,143	-111,000	1,068,194	11	- SWP allocation in 1998 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Carryover water deliveries in January would have been met by Table A water instead. - Deliveries to Turnback Pool buyers (Desert, Coachella) in May and June would have been met by Art. 21 unscheduled water. Greater efforts would have been made to meet as much Turnback Pool demand as possible in these two months. - Without Monterey water management program deliveries, SWP San Luis would have filled in October, and additional Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water. Their demand would be limited by their total take of Turnback Pool water in 1998. - SWP would have surcharged into CVP San Luis storage space in October. SWP diversions at Banks would have been reduced in November and December to limit
Feb-98	1,062,277	-5,906	2,545	0	909	0	0	3,454	2,545	0	-909	0	0	0	-909	0	1,063,197	920	
Mar-98	1,063,334	1,057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,064,254	920	
Apr-98	1,062,227	-1,107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,063,147	920	
May-98	1,061,880	-347	0	0	0	15,000	0	15,000	0	0	-15,000	0	0	20,000	5,000	0	1,057,800	-4,080	
Jun-98	1,060,880	-1,000	0	0	23,800	15,000	0	38,800	0	0	-38,800	0	0	30,000	-8,800	0	1,065,600	4,720	
Jul-98	1,004,087	-56,793	0	0	5,750	15,000	0	20,750	0	0	-20,750	0	0	0	-20,750	0	1,029,557	25,470	
Aug-98	873,994	-130,093	0	0	1,759	15,000	0	16,759	0	0	-16,759	0	0	0	-16,759	0	916,223	42,229	
Sep-98	900,000	26,006	6,391	0	12,575	15,000	0	33,966	6,391	0	-27,575	0	0	0	-27,575	0	969,804	69,804	
Oct-98	1,014,790	114,790	10,685	0	8,732	0	0	19,417	10,685	0	-8,732	0	0	15,000	6,268	0	1,078,326	63,536	
Nov-98	1,063,595	48,805	3,804	0	0	0	0	3,804	3,804	0	0	0	0	10,000	10,000	-40,000	1,077,131	13,536	
Dec-98	1,074,246	10,651	8,264	0	300	0	0	8,564	8,264	0	-300	0	0	0	-300	-13,000	1,075,082	836	
Jan-99	1,103,949	29,703	204	0	2,011	0	0	2,215	204	0	-2,011	0	0	0	-2,011	-2,000	1,104,796	847	- SWP allocation in 1999 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Without Monterey water management program deliveries, SWP diversion reductions at Banks would have been needed from January through March to limit surcharge into CVP San Luis storage space to historic levels. - Deliveries of Art. 21 unscheduled water, already available in January through April, would not have increased because there were no additional unmet demands during those months. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Kern, Dudley, Desert, Coachella), in about the same amount and schedule. - While SWP San Luis storage was higher by the end of December, it did not fill. Therefore, at the end of 1999 there would have been no additional Art. 21 unscheduled water made available and no need to reduce diversions at Banks.
Feb-99	1,097,321	-6,628	1,149	0	6,220	0	0	7,369	1,149	0	-6,220	0	0	0	-6,220	-7,000	1,097,388	67	
Mar-99	1,061,800	-35,521	1,022	0	18,841	0	0	19,863	1,022	0	-18,841	0	0	0	-18,841	-18,000	1,062,708	908	
Apr-99	1,011,650	-50,150	2,274	0	18,976	0	0	21,250	2,274	0	-18,976	0	0	0	-18,976	0	1,031,534	19,884	
May-99	863,254	-148,396	347	0	16,024	347	0	16,718	347	0	-16,371	0	500	0	-15,871	0	899,009	35,755	
Jun-99	555,473	-307,781	0	0	54,865	15,217	0	70,082	0	0	-70,082	0	15,000	0	-55,082	0	646,310	90,837	
Jul-99	476,215	-79,258	0	0	3,800	26,600	0	30,400	0	0	-30,400	0	27,000	0	-3,400	0	570,452	94,237	
Aug-99	451,049	-25,166	0	0	0	19,534	0	19,534	0	0	-19,534	0	20,000	0	466	0	544,820	93,771	
Sep-99	591,796	140,747	0	0	2,958	34,503	0	37,461	0	0	-37,461	0	34,000	0	-3,461	0	689,028	97,232	
Oct-99	573,547	-18,249	5,758	0	137	45,573	0	51,468	5,758	0	-45,710	0	44,000	0	-1,710	0	672,489	98,942	
Nov-99	683,127	109,580	10,780	0	4,292	44,173	0	59,245	10,780	0	-48,465	0	44,000	0	-4,465	0	786,534	103,407	
Dec-99	716,955	33,828	3,156	0	4,369	31,490	0	39,015	3,156	0	-35,859	0	31,500	0	-4,359	0	824,721	107,766	

TABLE 3 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Service Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	Actual	- cal 2:(row n) - cal 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	-sum(calc 4 thru 8)	Calculated	Calculated	- - (calc 9 - 10 - 11)	Estimated	Estimated	Estimated	-sum(calc 12 thru 15)	Estimated	- cal 18:(n-1) + cal 3 - cal 16 + cal 17	- cal 18 - cal 2	
Jan-00	914,717	197,762	224	0	12,049	0	79,981	92,254	224	0	-92,030	80,000	0	13,000	970	0	1,021,513	106,796	- SWP allocation in 2000 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Carryover water deliveries in January and February would have been Table A deliveries instead. - Since SWP Lan Luis nearly filled in January, Art. 21 unscheduled water would have been made available late that month, with demand limited only by contractors' ability to take delivery during that limited period. - Any Table A delivery increases from April on would have been limited to those contractors that were Turnback Pool buyers (Dudley, KCWA, Tulare, Desert, Coachella) or that used all of their 90% allocation (Co. of Kings). - Without Monterey water management program deliveries, SWP diversions at Banks would have been reduced in February and March to avoid SWP surcharge into CVP San Luis storage space. - SWP San Luis storage would have been higher by the end of 2000 but would not have filled.
Feb-00	1,057,575	142,858	4,733	0	12,068	0	73,114	89,915	4,733	0	-85,182	73,000	0	0	-12,182	-119,000	1,057,553	-22	
Mar-00	1,061,880	4,305	13,212	0	13,210	0	0	26,422	13,212	0	-13,210	0	0	0	-13,210	-13,000	1,062,068	188	
Apr-00	969,343	-92,537	0	0	10,801	10,000	0	20,801	0	0	-20,801	9,300	0	0	-11,501	0	981,032	11,689	
May-00	762,064	-207,279	0	0	0	12,100	0	12,100	0	0	-12,100	17,300	0	0	5,200	0	768,553	6,489	
Jun-00	580,449	-181,615	0	0	27,880	12,290	0	40,170	0	0	-40,170	17,300	0	0	-22,870	0	609,808	29,359	
Jul-00	401,285	-179,164	0	0	38,553	122,832	0	161,385	0	0	-161,385	17,300	0	0	-144,085	0	574,729	173,444	
Aug-00	307,591	-93,694	0	0	24,675	106,860	0	131,535	0	0	-131,535	17,300	0	0	-114,235	0	595,270	287,679	
Sep-00	387,635	80,044	0	0	29,866	2,041	0	31,907	0	0	-31,907	17,300	0	0	-14,607	0	689,921	302,286	
Oct-00	421,304	33,669	0	0	21,119	16,182	0	37,301	0	0	-37,301	17,300	0	0	-20,001	0	743,591	322,287	
Nov-00	460,177	38,873	333	0	15,752	0	0	16,085	333	0	-15,752	12,000	0	0	-3,752	0	786,216	326,039	
Dec-00	481,677	21,500	0	0	5,761	0	0	5,761	0	0	-5,761	8,000	0	0	2,239	0	805,477	323,800	
Jan-01	556,930	75,253	0	0	0	0	131,245	131,245	0	0	-131,245	80,000	0	0	-51,245	0	931,975	375,045	- SWP allocation in 2001 was 39%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, since SWP San Luis filled (after consideration for EWA debt to SWP) in February, that January delivery reduction would instead have been made in February as Art. 21 water. - Unmet demands by Turnback Pool buyers in 2000 (Dudley, KCWA, Tulare, Desert, Coachella) would have resulted in added demand for Art. 21 unscheduled water in March 2001, with demand limited only by their ability to take delivery in those months. - Without Monterey water management program deliveries, SWP diversions at Banks would have been reduced in March to limit SWP San Luis storage to historic levels. - Water otherwise delivered through Turnback Pool would have been available for
Feb-01	747,404	190,474	0	0	0	0	78,523	78,523	0	0	-78,523	78,000	0	175,000	174,477	0	947,972	200,568	
Mar-01	996,764	249,360	8,297	4,710	6,733	0	71,425	91,165	8,297	0	-82,868	72,000	0	160,000	149,132	-51,000	997,200	436	
Apr-01	984,617	-12,147	0	0	0	8,191	0	8,191	0	0	-8,191	1,300	0	0	-6,891	0	991,944	7,327	
May-01	815,834	-168,783	0	0	0	921	0	921	0	0	-921	2,300	0	0	1,379	0	821,782	5,948	
Jun-01	642,248	-173,586	0	0	0	82	0	82	0	0	-82	2,300	0	0	2,218	0	645,978	3,730	
Jul-01	549,059	-93,189	0	0	0	4,948	0	4,948	0	0	-4,948	2,300	0	0	-2,648	0	555,437	6,378	
Aug-01	515,197	-33,862	0	0	0	2,016	0	2,016	0	0	-2,016	2,300	0	0	284	0	521,291	6,094	
Sep-01	516,007	810	0	0	0	947	0	947	0	0	-947	2,300	0	0	1,353	0	520,748	4,741	
Oct-01	357,700	-158,307	0	0	0	395	0	395	0	0	-395	2,300	0	0	1,905	0	360,536	2,836	
Nov-01	412,836	55,136	0	0	0	0	0	0	0	0	0	1,600	0	0	1,600	0	414,072	1,236	
Dec-01	675,995	263,159	0	2,589	0	740	0	3,329	0	0	-3,329	1,100	0	0	-2,229	0	679,460	3,465	

TABLE 3 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Service Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	Actual	- cal 2:(row n) - cal 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	-sum(cols 4 thru 8)	Calculated	Calculated	- - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	-sum(cols 12 thru 15)	Estimated	- cal 18:(n-1) + cal 3 - cal 16 + cal 17	- cal 18 - cal 2	
Jan-02	912,332	236,337	0	0	4,532	0	109,171	113,703	0	0	-113,703	80,000	0	0	-33,703	0	949,500	37,168	- SWP allocation in 2002 was 70%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January and February would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, that January delivery reduction would instead have been made in February as additional Table A water. - Without Monterey water management program deliveries, SWP San Luis would have filled slightly sooner, resulting in an added demand for Article 21 water in March. - Water otherwise delivered from April through December to replace flexible storage, to out-of-service area storage, or through the Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-02	1,030,871	118,539	0	0	6,919	0	4,549	11,468	0	0	-11,468	34,000	0	0	22,532	0	1,045,507	14,636	
Mar-02	1,078,173	47,302	2,793	1,190	643	0	13	4,639	2,793	0	-1,846	0	0	16,000	14,154	0	1,078,655	482	
Apr-02	973,457	-104,716	2,991	4,760	1,520	0	0	9,271	2,991	0	-6,280	10,500	0	0	4,220	0	969,719	-3,738	
May-02	744,784	-228,673	0	8,630	0	1,501	0	10,131	0	0	-10,131	19,500	0	0	9,369	0	731,677	-13,107	
Jun-02	488,121	-256,663	0	8,630	0	4,694	0	13,324	0	0	-13,324	19,500	0	0	6,176	0	468,838	-19,283	
Jul-02	398,657	-89,464	0	8,630	0	23,061	0	31,691	0	0	-31,691	19,500	0	0	-12,191	0	391,565	-7,092	
Aug-02	467,946	69,289	0	0	1,000	15,996	0	16,996	0	0	-16,996	19,500	0	0	2,504	0	458,350	-9,596	
Sep-02	393,795	-74,151	0	0	8,332	0	0	8,332	0	0	-8,332	19,500	0	0	11,168	0	373,031	-20,764	
Oct-02	237,482	-156,313	0	16,468	12,819	0	0	29,287	0	0	-29,287	19,500	0	0	-9,787	0	226,505	-10,977	
Nov-02	219,224	-18,258	0	13,342	3,408	0	0	16,750	0	0	-16,750	13,500	0	0	-3,250	0	211,497	-7,727	
Dec-02	319,803	100,579	0	13,342	4,441	0	0	17,783	0	0	-17,783	9,000	0	0	-8,783	0	320,859	1,056	
Jan-03	569,838	250,035	0	0	5,800	0	9,486	15,286	0	0	-15,286	9,000	0	0	-6,286	0	577,180	7,342	- SWP allocation in 2003 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Carryover deliveries in January-March would have been Table A deliveries instead. - The increase in SWP San Luis storage compared to historic at the end of February would have been an added Art. 21 unscheduled water delivery in March. Note that SWP San Luis was "full" in March, after consideration of EWA debt to SWP. - Water otherwise delivered to out-of-service area storage from April-December or through the Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December. - Any Table A delivery increase from April on would have been limited to those contractors that purchased from the Turnback Pool (Zone 7, Alameda, Santa Clara, Oak Flat, Co. Kings, Dudley, KCWA, Tulare, AVEK, Castaic, Desert, Coachella, MWD) or dry-year purchase program (Dudley, KCWA), or that used all of their 90% allocation.
Feb-03	837,137	267,299	0	0	3,400	0	25,521	28,921	0	0	-28,921	26,000	0	0	-2,921	0	847,400	10,263	
Mar-03	984,556	147,419	4,632	0	0	0	40,577	45,209	4,632	0	-40,577	41,000	0	10,000	10,423	0	984,396	-160	
Apr-03	920,243	-64,313	0	0	0	16,006	0	16,006	0	0	-16,006	9,800	0	0	-6,206	0	926,289	6,046	
May-03	684,343	-235,900	0	0	15,477	0	0	15,477	0	0	-15,477	18,200	0	0	2,723	0	687,666	3,323	
Jun-03	557,749	-126,594	0	0	40,927	4,373	0	45,300	0	0	-45,300	18,200	0	0	-27,100	0	588,172	30,423	
Jul-03	521,880	-35,869	0	0	13,290	9,339	0	22,629	0	0	-22,629	18,200	0	0	-4,429	0	556,732	34,852	
Aug-03	529,944	8,064	0	0	19,706	52	0	19,758	0	0	-19,758	18,200	0	0	-1,558	0	566,354	36,410	
Sep-03	652,744	122,800	0	0	10,900	0	0	10,900	0	0	-10,900	18,200	0	0	7,300	0	681,854	29,110	
Oct-03	607,364	-45,380	2,413	0	5,020	0	0	7,433	2,413	0	-5,020	18,200	0	0	13,180	0	623,294	15,930	
Nov-03	613,477	6,113	16,789	0	675	0	0	17,464	16,789	0	-675	12,600	0	0	11,925	0	617,482	4,005	
Dec-03	615,769	2,292	16,190	0	4,220	0	0	20,410	16,190	0	-4,220	8,400	0	0	4,180	0	615,594	-175	

TABLE 3 (cont.)

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	SWP San Luis Storage: Change in Storage from Previous Month	SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Turnback Pool Water	Carryover Water (delivered to service area)	Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Total Change in SWP Deliveries Under Water Mgmt Programs	Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Article 21 Surplus Water Deliveries	Additional Article 21 Unscheduled Water Deliveries	Total Change in all SWP Deliveries	Change in Diversions at Banks Pumping Plant	SWP San Luis Storage: End-of-Month Storage	Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
---	Actual	- col 2:(row n) - col 2:(row n-1)	Actual	Actual	Actual	Actual	Actual	-sum(cols 4 thru 8)	Calculated	Calculated	- - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	-sum(cols 12 thru 15)	Estimated	- col 18:(n-1) + col 3 - col 16 + col 17	- col 18 - col 2	
Jan-04	809,033	193,264	0	0	6,543	0	120,099	126,642	0	0	-126,642	100,000	0	0	-26,642	0	835,500	26,467	- SWP allocation in 2004 was 65%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January and February's delivery would have been made as Table A water. However, since SWP San Luis storage was nearing full in February, any January and February deliveries not made as Table A water would instead have been made in February as Art. 21 unscheduled water and in March as added Table A water. - Without Monterey water management program deliveries, SWP San Luis would have nearly filled in February, and Art. 21 unscheduled water would have been made available that month, resulting in an added demand for Art. 21 unscheduled water in February. - Water otherwise delivered to out-of-service area storage from April-December or through Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-04	971,719	162,686	1,914	0	31,004	0	148,915	181,833	1,914	0	-179,919	100,000	0	50,000	-29,919	0	1,028,105	56,386	
Mar-04	1,069,446	97,727	14,494	0	6,372	0	6,883	27,749	14,494	0	-13,255	50,000	0	0	36,745	-20,000	1,069,087	-359	
Apr-04	938,544	-130,902	0	0	0	4,815	0	4,815	0	0	-4,815	1,500	0	0	-3,315	0	941,500	2,956	
May-04	674,017	-264,527	0	0	0	5,075	0	5,075	0	0	-5,075	2,700	0	0	-2,375	0	679,348	5,331	
Jun-04	434,812	-239,205	0	0	0	6,402	0	6,402	0	0	-6,402	2,700	0	0	-3,702	0	443,845	9,033	
Jul-04	369,739	-65,073	0	0	2,000	291	0	2,291	0	0	-2,291	2,700	0	0	409	0	378,363	8,624	
Aug-04	408,702	38,963	0	0	2,000	657	0	2,657	0	0	-2,657	2,700	0	0	43	0	417,283	8,581	
Sep-04	513,536	104,834	0	0	0	0	0	0	0	0	0	2,700	0	0	2,700	0	519,417	5,881	
Oct-04	522,176	8,640	0	0	0	0	0	0	0	0	0	2,700	0	0	2,700	0	525,357	3,181	
Nov-04	603,410	81,234	0	0	0	0	0	0	0	0	0	1,900	0	0	1,900	0	604,691	1,281	
Dec-04	672,181	68,771	0	0	0	0	0	0	0	0	0	1,300	0	0	1,300	0	672,162	-19	
1996-2004																			
Total			**277,003**	**83,547**	**734,276**	**922,697**	**925,261**	**2,942,784**	**277,003**	**0**	**-2,665,781**	**1,310,800**	**391,000**	**515,000**	**-448,981**	**-449,000**			
Annual Average			**30,778**	**9,283**	**81,586**	**102,522**	**102,807**	**326,976**	**30,778**	**0**	**-296,198**	**145,644**	**43,444**	**57,222**	**-49,887**	**-49,889**			

TABLE 4

WATER MANAGEMENT PROVISION ANLYSIS

Effects of Monterey Amendment Water Management Provisions on Banks Diversions

Year	Month	Actual Net Delta Ouflow Index[1] (AF)	Actual Banks Diversions[2] (AF)	Change in Banks Diversions without Monterey (AF)
1996	December	5,198,059	211,225	-55,000
1998	January	4,399,140	196,584	-111,000
1998	November	1,227,905	129,489	-40,000
1998	December	2,904,722	128,026	-13,000
1999	January	2,337,832	85,366	-2,000
1999	February	5,487,282	52,203	-7,000
1999	March	4,249,136	182,800	-18,000
2000	February	5,412,226	421,683	-119,000
2000	March	5,400,323	343,011	-13,000
2001	March	1,439,070	360,751	-51,000
2004	March	3,459,039	423,147	-20,000
96-04 Total				-449,000

1. Source: IEP's Dayflow calculations (http://iep.water.ca.gov/dayflow/output/index.html).
2. Source: DWR Division of Operations and Maintenance Operations Control Office annual and monthly reports of operations (http://wwwoco.water.ca.gov/inde

FIGURE 1

HISTORICAL IMPACT ANLYSIS: 1996 - 2004

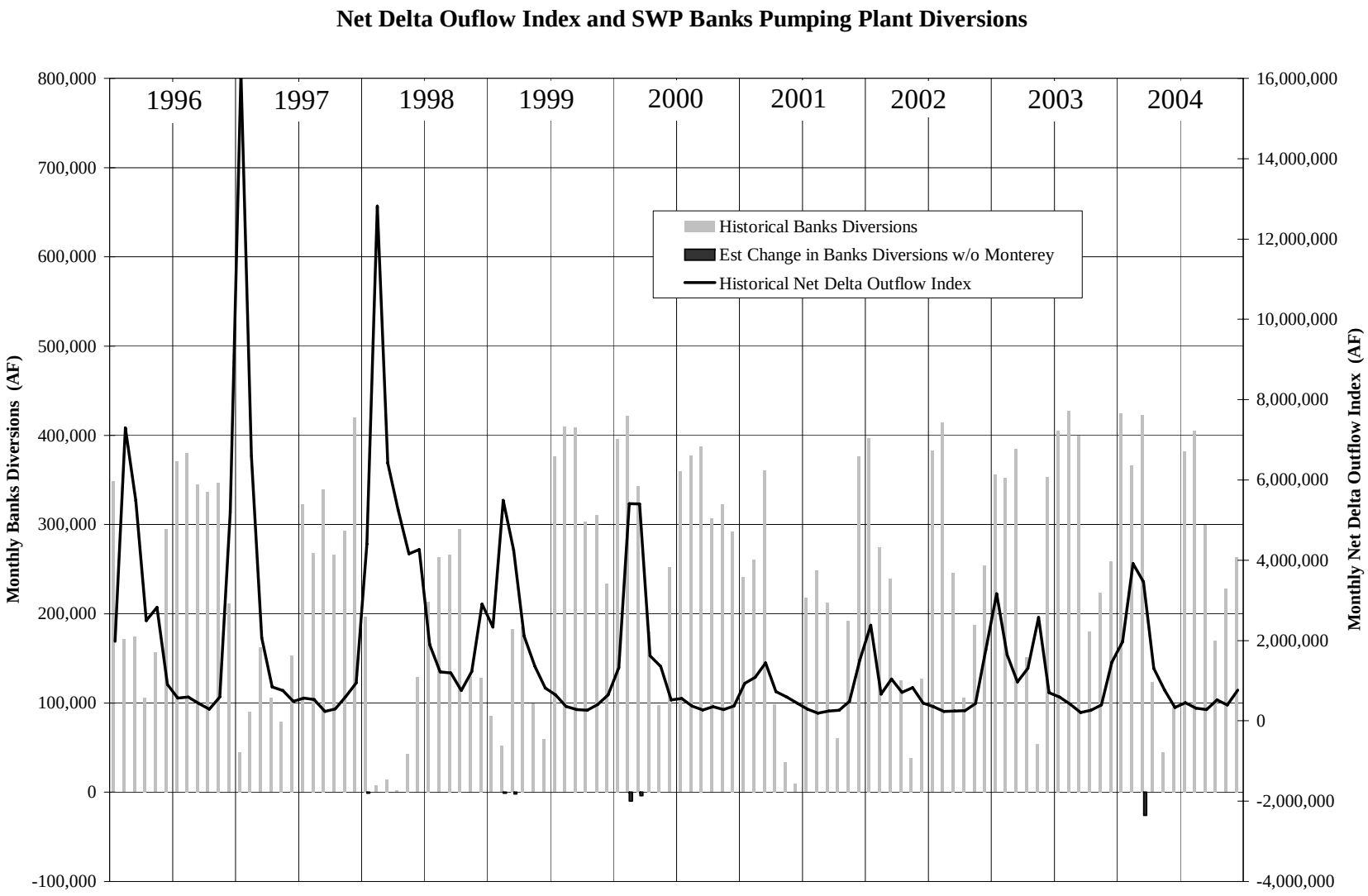


FIGURE 2

HISTORICAL IMPACT ANLYSIS: 1996 - 2004

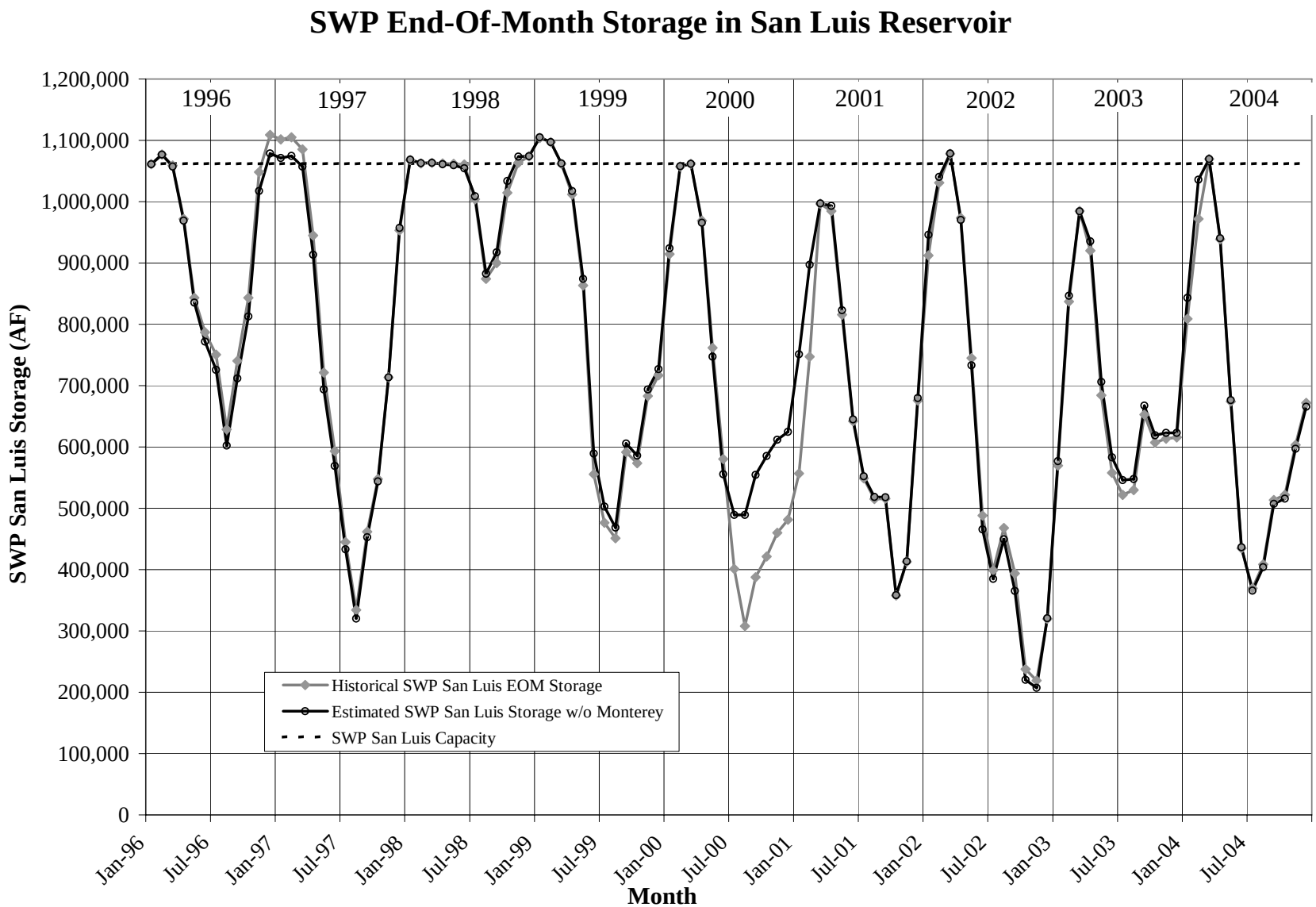


FIGURE 3

WATER MANAGEMENT PROVISION ANLYSIS

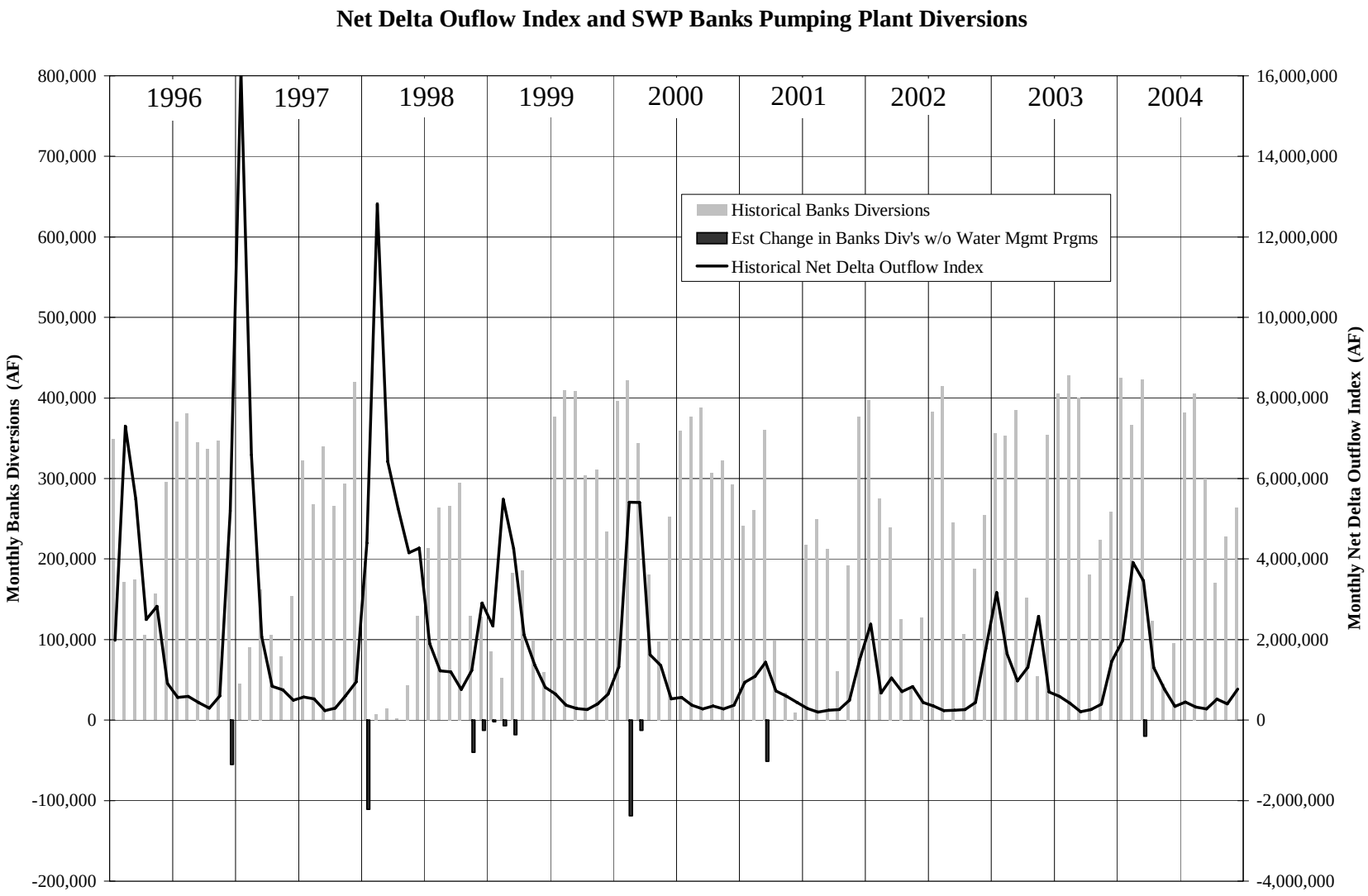
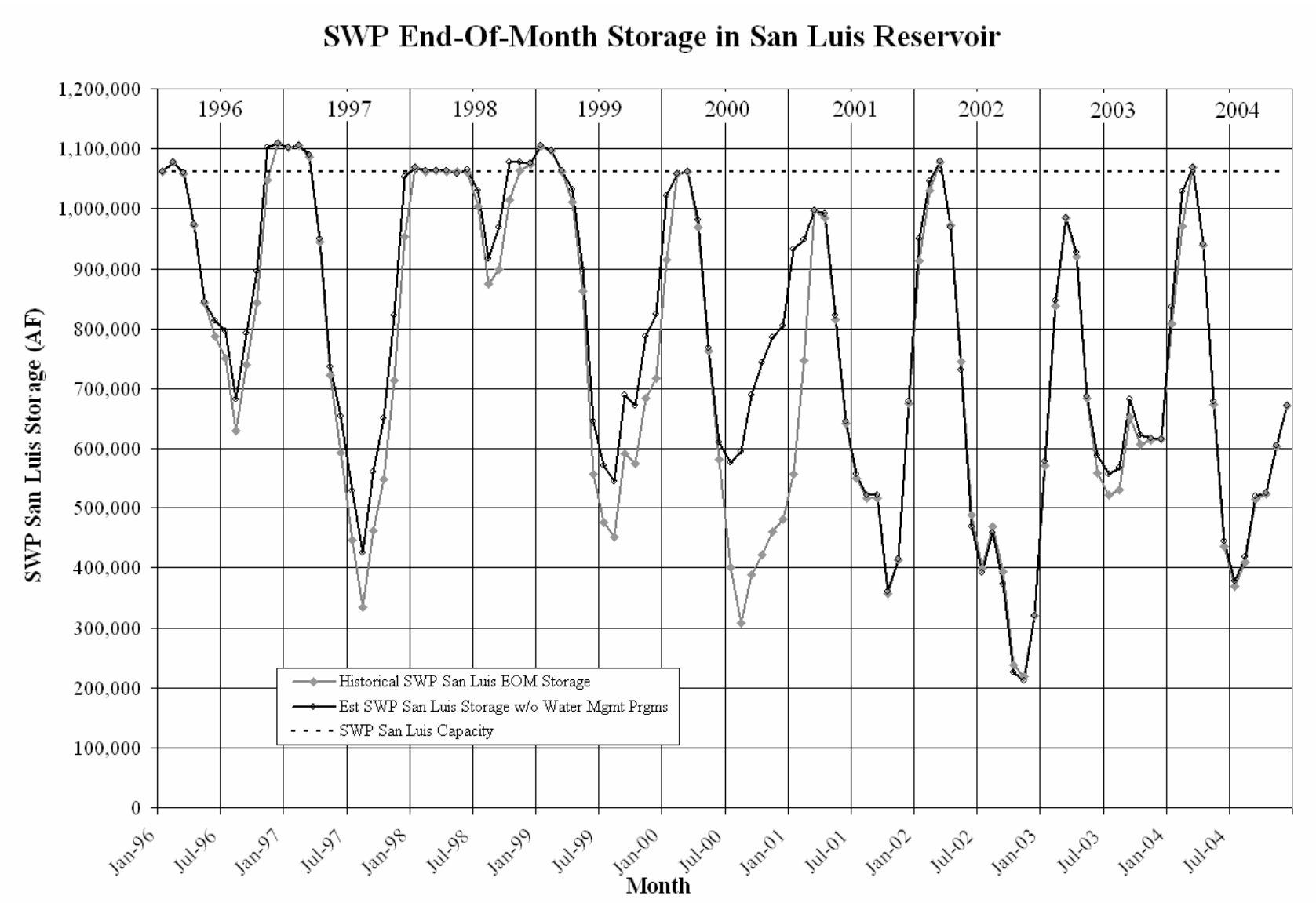


FIGURE 4

WATER MANAGEMENT PROVISION ANLYSIS



Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts On SWP Deliveries and Operations

6/15/2007
N. Clemm

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
---	Actual	= col 2:(row *n)* - col 2:(row *n-1)*	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-96	1,061,411	0	11,565	0	22	0	0	11,587	11,565	0	230	208	0	0	0	208	0	1,061,203	-208	- SWP allocation in 1996 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to 45,000 AF of Table A amount that would not have been retired. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Desert, Coachella), in about the same amount and schedule. - Without Monterey, SWP San Luis would have been slightly surcharged into CVP San Luis storage by year end, although at a lower level than historically. With this lower storage, diversions at Banks would not have been reduced.
Feb-96	1,076,912	15,501	9,678	0	1,062	0	0	10,740	9,678	0	987	-75	0	0	0	-75	0	1,076,779	-133	
Mar-96	1,058,720	-18,192	5,829	0	668	0	0	6,497	5,829	0	1,672	1,004	0	0	0	1,004	0	1,057,583	-1,137	
Apr-96	972,070	-86,650	1,409	0	0	27,290	0	28,699	1,409	0	2,221	-25,069	0	27,000	0	1,931	0	969,002	-3,068	
May-96	843,235	-128,835	2,103	0	0	19,632	0	21,735	2,103	0	4,264	-15,368	0	20,000	0	4,632	0	835,534	-7,701	
Jun-96	787,228	-56,007	255	0	25,000	31,774	0	57,029	255	25,000	7,307	-24,467	0	32,000	0	7,533	0	771,994	-15,234	
Jul-96	750,346	-36,882	2,015	0	20,000	34,774	0	56,789	2,015	20,000	9,189	-25,585	0	35,000	0	9,415	0	725,698	-24,648	
Aug-96	628,876	-121,470	11,456	0	6,200	44,165	0	61,821	11,456	0	8,172	-42,193	0	44,000	0	1,807	0	602,420	-26,456	
Sep-96	740,379	111,503	10,695	0	0	17,274	0	27,969	10,695	0	2,391	-14,883	0	17,000	0	2,117	0	711,806	-28,573	
Oct-96	843,170	102,791	9,079	0	0	0	0	9,079	9,079	0	1,484	1,484	0	0	0	1,484	0	813,112	-30,058	
Nov-96	1,048,478	205,308	5,601	0	0	0	0	5,601	5,601	0	938	938	0	0	0	938	0	1,017,482	-30,996	
Dec-96	1,109,158	60,680	13,676	0	2,379	0	0	16,055	13,676	0	1,813	-566	0	0	0	-566	0	1,078,728	-30,430	
Jan-97	1,101,867	-7,291	873	0	114	0	0	987	873	0	20	-94	0	0	0	-94	0	1,071,531	-30,336	- SWP allocation in 1997 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Since SWP San Luis did not quite fill by the end of December, there would have been no additional deliveries of Article 21 water and no need to reduce diversions at Banks.
Feb-97	1,105,151	3,284	0	0	0	0	0	0	0	0	249	249	0	0	0	249	0	1,074,566	-30,585	
Mar-97	1,085,462	-19,689	1,299	0	4,328	0	0	5,627	1,299	0	2,173	-2,155	0	0	0	-2,155	0	1,057,032	-28,430	
Apr-97	944,918	-140,544	2,772	0	0	0	0	2,772	2,772	0	3,243	3,243	0	0	0	3,243	0	913,246	-31,672	
May-97	721,579	-223,339	0	0	0	9,505	0	9,505	0	0	5,444	-4,061	0	0	0	-4,061	0	693,968	-27,611	
Jun-97	593,083	-128,496	0	0	35,000	11,505	0	46,505	0	35,000	7,917	-3,588	0	0	0	-3,588	0	569,060	-24,023	
Jul-97	445,203	-147,880	0	0	10,000	12,504	0	22,504	0	0	10,626	-11,878	0	0	0	-11,878	0	433,059	-12,144	
Aug-97	334,549	-110,654	0	0	0	7,294	0	7,294	0	0	9,651	2,357	0	0	0	2,357	0	320,047	-14,502	
Sep-97	461,649	127,100	2,769	0	0	6,842	0	9,611	2,769	0	1,379	-5,463	0	0	0	-5,463	0	452,610	-9,039	
Oct-97	547,915	86,266	2,563	0	0	6,298	0	8,861	2,563	0	1,191	-5,107	0	0	0	-5,107	0	543,983	-3,932	
Nov-97	713,723	165,808	11,165	645	0	4,298	0	16,108	11,165	0	1,267	-3,676	0	0	0	-3,676	0	713,467	-256	
Dec-97	953,588	239,865	13,266	611	2,386	4,298	0	20,561	13,266	1,486	1,841	-3,968	0	0	0	-3,968	0	957,300	3,712	

Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-98	1,068,183	114,595	13,541	0	11,384	0	25,759	50,684	13,541	10,973	2,579	-23,591	26,000	0	0	2,409	-1,000	1,068,486	303	- SWP allocation in 1998 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Carryover water deliveries in January would have been met by Table A water instead. - Deliveries to Turnback Pool buyers (Desert, Coachella) in May and June would have been met by Art. 21 unscheduled water. - Without Monterey, SWP San Luis would have filled earler in November, and additional Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water. Their demand would be limited by the amount of water made available. - SWP would have surcharged into CVP San Luis storage space in November. Increased Art. 21 deliveries would have limited surcharge amount to historic level by the end of December.
Feb-98	1,062,277	-5,906	2,545	0	909	0	0	3,454	2,545	336	275	-298	0	0	0	-298	0	1,062,878	601	
Mar-98	1,063,334	1,057	0	0	0	0	0	0	0	0	427	427	0	0	0	427	0	1,063,508	174	
Apr-98	1,062,227	-1,107	0	0	0	0	0	0	0	0	912	912	0	0	0	912	0	1,061,489	-738	
May-98	1,061,880	-347	0	0	0	15,000	0	15,000	0	0	1,618	-13,382	0	0	15,000	1,618	0	1,059,524	-2,356	
Jun-98	1,060,880	-1,000	0	0	23,800	15,000	0	38,800	0	23,800	3,886	-11,114	0	0	15,000	3,886	0	1,054,639	-6,241	
Jul-98	1,004,087	-56,793	0	0	5,750	15,000	0	20,750	0	0	9,512	-11,238	0	0	0	-11,238	0	1,009,084	4,997	
Aug-98	873,994	-130,093	0	0	1,759	15,000	0	16,759	0	1,759	11,369	-3,631	0	0	0	-3,631	0	882,622	8,628	
Sep-98	900,000	26,006	6,391	0	12,575	15,000	0	33,966	6,391	12,519	6,007	-9,049	0	0	0	-9,049	0	917,677	17,677	
Oct-98	1,014,790	114,790	10,685	0	8,732	0	0	19,417	10,685	4,147	3,452	-1,133	0	0	0	-1,133	0	1,033,600	18,810	
Nov-98	1,063,595	48,805	3,804	0	0	0	0	3,804	3,804	0	1,625	1,625	0	0	7,000	8,625	0	1,073,780	10,185	
Dec-98	1,074,246	10,651	8,264	0	300	0	0	8,564	8,264	0	3,339	3,039	0	0	7,000	10,039	0	1,074,392	146	
Jan-99	1,103,949	29,703	204	0	2,011	0	0	2,215	204	600	578	-833	0	0	0	-833	0	1,104,928	979	- SWP allocation in 1999 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries, except for deliveries related to the Table A amount that would not have been retired. - Without Monterey, SWP diversion reductions at Banks would have been needed in February and March to limit surcharge into CVP San Luis space to historic levels. - Deliveries of Art. 21 unscheduled water, already available in January through April, would not have increased because there were no additional unmet demands during those months. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Kern, Dudley, Desert, Coachella), in about the same amount and schedule. - While SWP San Luis storage was slightly higher by the end of December, it did not fill. Therefore, at the end of 1999 there would have been no additional Art. 21 unscheduled water made available and no need to reduce diversions at Banks.
Feb-99	1,097,321	-6,628	1,149	0	6,220	0	0	7,369	1,149	5,390	672	-158	0	0	0	-158	-1,000	1,097,458	137	
Mar-99	1,061,800	-35,521	1,022	0	18,841	0	0	19,863	1,022	15,661	970	-2,210	0	0	0	-2,210	-2,000	1,062,148	348	
Apr-99	1,011,650	-50,150	2,274	0	18,976	0	0	21,250	2,274	11,688	1,841	-5,447	0	0	0	-5,447	0	1,017,445	5,795	
May-99	863,254	-148,396	347	0	16,024	347	0	16,718	347	6,185	4,479	-5,707	0	500	0	-5,207	0	874,256	11,002	
Jun-99	555,473	-307,781	0	0	54,865	15,217	0	70,082	0	24,945	7,230	-37,907	0	15,000	0	-22,907	0	589,382	33,909	
Jul-99	476,215	-79,258	0	0	3,800	26,600	0	30,400	0	0	10,666	-19,734	0	27,000	0	7,266	0	502,858	26,643	
Aug-99	451,049	-25,166	0	0	0	19,534	0	19,534	0	0	8,798	-10,736	0	20,000	0	9,264	0	468,428	17,379	
Sep-99	591,796	140,747	0	0	2,958	34,503	0	37,461	0	2,958	3,779	-30,724	0	34,000	0	3,276	0	605,899	14,103	
Oct-99	573,547	-18,249	5,758	0	137	45,573	0	51,468	5,758	137	3,301	-42,272	0	44,000	0	1,728	0	585,921	12,374	
Nov-99	683,127	109,580	10,780	0	4,292	44,173	0	59,245	10,780	4,292	1,760	-42,413	0	44,000	0	1,587	0	693,914	10,787	
Dec-99	716,955	33,828	3,156	0	4,369	31,490	0	39,015	3,156	4,369	926	-30,564	0	31,500		936	0	726,806	9,851	

Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts On SWP Deliveries and Operations

6/15/2007
N. Clemm

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
---	Actual	= col 2:(row *n)* - col 2:(row *n-1)*	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-00	914,717	197,762	224	0	12,049	0	79,981	92,254	224	12,049	424	-79,557	80,000	0	0	443	0	924,125	9,408	- SWP allocation in 2000 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Table A deliveries would have been made related to the Table A amount that would not have been retired. - Carryover water deliveries in January and February would have been Table A deliveries instead. - Any Table A delivery increases from April on would have been limited to those contractors that were Turnback Pool buyers (Dudley, KCWA, Tulare, Desert, Coachella) or that used all of their 90% allocation (Co. of Kings). - Without Monterey, SWP diversions at Banks would have been reduced in February and March to avoid SWP surcharge into CVP San Luis storage space. - SWP San Luis storage would have been higher by the end of 2000 but would not have filled.
Feb-00	1,057,575	142,858	4,733	0	12,068	0	73,114	89,915	4,733	9,685	1,408	-74,089	73,000	0	0	-1,089	-10,000	1,058,072	497	
Mar-00	1,061,880	4,305	13,212	0	13,210	0	0	26,422	13,212	8,520	1,232	-3,458	0	0	0	-3,458	-4,000	1,061,835	-45	
Apr-00	969,343	-92,537	0	0	10,801	10,000	0	20,801	0	10,801	4,182	-5,818	9,300	0	0	3,482	0	965,817	-3,526	
May-00	762,064	-207,279	0	0	0	12,100	0	12,100	0	0	6,287	-5,813	17,300	0	0	11,487	0	747,051	-15,013	
Jun-00	580,449	-181,615	0	0	27,880	12,290	0	40,170	0	21,130	11,416	-7,624	17,300	0	0	9,676	0	555,760	-24,689	
Jul-00	401,285	-179,164	0	0	38,553	122,832	0	161,385	0	24,803	6,559	-130,023	17,300	0	0	-112,723	0	489,319	88,034	
Aug-00	307,591	-93,694	0	0	24,675	106,860	0	131,535	0	16,675	3,900	-110,960	17,300	0	0	-93,660	0	489,285	181,694	
Sep-00	387,635	80,044	0	0	29,866	2,041	0	31,907	0	27,166	2,493	-2,248	17,300	0	0	15,052	0	554,277	166,642	
Oct-00	421,304	33,669	0	0	21,119	16,182	0	37,301	0	21,119	1,572	-14,610	17,300	0	0	2,690	0	585,256	163,952	
Nov-00	460,177	38,873	333	0	15,752	0	0	16,085	333	15,752	540	540	12,000	0	0	12,540	0	611,589	151,412	
Dec-00	481,677	21,500	0	0	5,761	0	0	5,761	0	5,761	488	488	8,000	0	0	8,488	0	624,601	142,924	
Jan-01	556,930	75,253	0	0	0	0	131,245	131,245	0	0	0	-131,245	80,000	0	0	-51,245	0	751,099	194,169	- SWP allocation in 2001 was 39%. Since all Table A demand was not met and with higher initial SWP storage, allocations would have been slightly higher early in the year, allowing additional Table A deliveries early in the year. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, since SWP San Luis filled (after consideration for EWA debt to SWP) in February, that January delivery reduction would instead have been made in February as Art. 21 water. - Unmet demands by Turnback Pool buyers in 2000 (Dudley, KCWA, Tulare, Desert, Coachella) would have resulted in added demand for Art. 21 unscheduled water in March 2001, with demand limited by ability to take delivery those months. - Water otherwise delivered through the Turnback Pool would have essentially offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-01	747,404	190,474	0	0	0	0	78,523	78,523	0	0	0	-78,523	78,000	0	45,000	44,477	0	897,096	149,692	
Mar-01	996,764	249,360	8,297	4,710	6,733	0	71,425	91,165	8,297	0	128	-82,740	72,000	0	160,000	149,260	0	997,196	432	
Apr-01	984,617	-12,147	0	0	0	8,191	0	8,191	0	0	150	-8,041		0	0	-8,041	0	993,090	8,473	
May-01	815,834	-168,783	0	0	0	921	0	921	0	0	2,019	1,098		0	0	1,098	0	823,209	7,375	
Jun-01	642,248	-173,586	0	0	0	82	0	82	0	0	5,032	4,950		0	0	4,950	0	644,673	2,425	
Jul-01	549,059	-93,189	0	0	0	4,948	0	4,948	0	0	4,024	-924		0	0	-924	0	552,409	3,350	
Aug-01	515,197	-33,862	0	0	0	2,016	0	2,016	0	0	2,225	209		0	0	209	0	518,338	3,141	
Sep-01	516,007	810	0	0	0	947	0	947	0	0	2,170	1,223		0	0	1,223	0	517,925	1,918	
Oct-01	357,700	-158,307	0	0	0	395	0	395	0	0	1,364	969		0	0	969	0	358,649	949	
Nov-01	412,836	55,136	0	0	0	0	0	0	0	0	378	378		0	0	378	0	413,406	570	
Dec-01	675,995	263,159	0	2,589	0	740	0	3,329	0	0	60	-3,269		0	0	-3,269	0	679,834	3,839	

Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*
---	Actual	= col 2:(row *n)* - col 2:(row *n-1)*	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-02	912,332	236,337	0	0	4,532	0	109,171	113,703	0	3,311	453	-109,939	80,000	0	0	-29,939	0	946,110	33,778	- SWP allocation in 2002 was 70%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January and February would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, that January delivery reduction would instead have been made in February as additional Table A water. - Without Monterey, SWP San Luis would have filled slightly sooner, resulting in an added demand for Article 21 water in March. - Water otherwise delivered from April through December to replace flexible storage, to out-of-service area storage, or through the Turnback Pool, less Table A deliveries that would have been made related to the Table A amount that would not have been retired, would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-02	1,030,871	118,539	0	0	6,919	0	4,549	11,468	0	0	1,450	-10,018	34,000	0	0	23,982	0	1,040,666	9,795	
Mar-02	1,078,173	47,302	2,793	1,190	643	0	13	4,639	2,793	0	2,202	356	0	0	9,000	9,356	0	1,078,612	439	
Apr-02	973,457	-104,716	2,991	4,760	1,520	0	0	9,271	2,991	0	1,131	-5,149	8,800	0	0	3,651	0	970,245	-3,212	
May-02	744,784	-228,673	0	8,630	0	1,501	0	10,131	0	0	2,291	-7,840	16,300	0	0	8,460	0	733,112	-11,672	
Jun-02	488,121	-256,663	0	8,630	0	4,694	0	13,324	0	0	7,532	-5,792	16,300	0	0	10,508	0	465,941	-22,180	
Jul-02	398,657	-89,464	0	8,630	0	23,061	0	31,691	0	0	7,223	-24,468	16,300	0	0	-8,168	0	384,645	-14,012	
Aug-02	467,946	69,289	0	0	1,000	15,996	0	16,996	0	0	4,937	-12,059	16,300	0	0	4,241	0	449,693	-18,253	
Sep-02	393,795	-74,151	0	0	8,332	0	0	8,332	0	0	2,148	-6,184	16,300	0	0	10,116	0	365,425	-28,370	
Oct-02	237,482	-156,313	0	16,468	12,819	0	0	29,287	0	0	1,673	-27,614	16,300	0	0	-11,314	0	220,426	-17,056	
Nov-02	219,224	-18,258	0	13,342	3,408	0	0	16,750	0	0	191	-16,559	11,300	0	0	-5,259	0	207,427	-11,797	
Dec-02	319,803	100,579	0	13,342	4,441	0	0	17,783	0	-2,785	267	-20,301	7,500	0	0	-12,801	0	320,807	1,004	
Jan-03	569,838	250,035	0	0	5,800	0	9,486	15,286	0	0	86	-15,200	9,000	0	0	-6,200	0	577,042	7,204	- SWP allocation in 2003 was 90%. While not all Table A demand was met, allocations would not have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. - The increase in SWP San Luis storage compared to historic at the end of February would have been an added Art. 21 unscheduled water delivery in March. Note that SWP San Luis was "full" in March, after consideration of EWA debt to SWP. - Water otherwise delivered to out-of-service area storage from April-December or through the Turnback Pool would have offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December.
Feb-03	837,137	267,299	0	0	3,400	0	25,521	28,921	0	0	411	-28,510	26,000	0	0	-2,510	0	846,852	9,715	
Mar-03	984,556	147,419	4,632	0	0	0	40,577	45,209	4,632	0	1,328	-39,249	41,000	0	8,000	9,751	0	984,520	-36	
Apr-03	920,243	-64,313	0	0	0	16,006	0	16,006	0	0	877	-15,129		0	0	-15,129	0	935,335	15,092	
May-03	684,343	-235,900	0	0	15,477	0	0	15,477	0	5,477	3,150	-6,850		0	0	-6,850	0	706,285	21,942	
Jun-03	557,749	-126,594	0	0	40,927	4,373	0	45,300	0	34,827	6,826	-3,647		0	0	-3,647	0	583,338	25,589	
Jul-03	521,880	-35,869	0	0	13,290	9,339	0	22,629	0	13,290	10,977	1,638		0	0	1,638	0	545,831	23,951	
Aug-03	529,944	8,064	0	0	19,706	52	0	19,758	0	19,706	6,449	6,397		0	0	6,397	0	547,498	17,554	
Sep-03	652,744	122,800	0	0	10,900	0	0	10,900	0	10,900	2,908	2,908		0	0	2,908	0	667,390	14,646	
Oct-03	607,364	-45,380	2,413	0	5,020	0	0	7,433	2,413	5,020	2,648	2,648		0	0	2,648	0	619,362	11,998	
Nov-03	613,477	6,113	16,789	0	675	0	0	17,464	16,789	675	2,417	2,417		0	0	2,417	0	623,059	9,582	
Dec-03	615,769	2,292	16,190	0	4,220	0	0	20,410	16,190	3,870	2,424	2,074		0	0	2,074	0	623,277	7,508	

Effect of Monterey Amendment Water Management Programs and Retirement of Table A Amounts On SWP Deliveries and Operations

6/15/2007
N. Clemm

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements (AF): Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Table A Deliveries from Retired Table A Amounts	Estimated: Change in SWP Water Del's Related to Monterey Programs and Retirement: Total Change in SWP Water Deliveries Related to Monterey	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs and Table A Retirements
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
---	Actual	= col 2:(row *n)* - col 2:(row *n-1)*	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	Calculated	= - (cols 9 - 10 - 11 - 12)	Estimated	Estimated	Estimated	= sum(cols 13 thru 16)	Estimated	=col 19:(n-1) + col 3 - col 17 + col 18	= col 19 - col 2	
Jan-04	809,033	193,264	0	0	6,543	0	120,099	126,642	0	0	0	-126,642	100,000	0	0	-26,642	0	843,183	34,150	- SWP allocation in 2004 was 65%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January and February's delivery would have been made as Table A water. However, since SWP San Luis storage was nearing full in February, any January and February deliveries not made as Table A water would instead have been made in February as Art. 21 unscheduled water and in March as added Table A water. - Without Monterey, SWP San Luis would have nearly filled in February, and Art. 21 unscheduled water would have been made available that month, resulting in an added demand for Art. 21 unscheduled water in February. - Water otherwise delivered to out-of-service area storage from April-December or through Turnback Pool would not quite have offset additional Table A deliveries related to the Table A amount that would not have been retired, so there would have been no additional Table A water available for delivery from April-December
Feb-04	971,719	162,686	1,914	0	31,004	0	148,915	181,833	1,914	0	6	-179,913	100,000	0	50,000	-29,913	0	1,035,782	64,063	
Mar-04	1,069,446	97,727	14,494	0	6,372	0	6,883	27,749	14,494	0	907	-12,348	50,000	0	0	37,652	-26,000	1,069,857	411	
Apr-04	938,544	-130,902	0	0	0	4,815	0	4,815	0	0	3,406	-1,409		0	0	-1,409	0	940,365	1,821	
May-04	674,017	-264,527	0	0	0	5,075	0	5,075	0	0	4,485	-590		0	0	-590	0	676,427	2,410	
Jun-04	434,812	-239,205	0	0	0	6,402	0	6,402	0	0	7,086	684		0	0	684	0	436,539	1,727	
Jul-04	369,739	-65,073	0	0	2,000	291	0	2,291	0	0	8,006	5,715		0	0	5,715	0	365,751	-3,988	
Aug-04	408,702	38,963	0	0	2,000	657	0	2,657	0	0	3,707	1,050		0	0	1,050	0	403,664	-5,038	
Sep-04	513,536	104,834	0	0	0	0	0	0	0	0	1,096	1,096		0	0	1,096	0	507,402	-6,134	
Oct-04	522,176	8,640	0	0	0	0	0	0	0	0	318	318		0	0	318	0	515,724	-6,452	
Nov-04	603,410	81,234	0	0	0	0	0	0	0	0	11	11		0	0	11	0	596,947	-6,463	
Dec-04	672,181	68,771	0	0	0	0	0	0	0	0	223	223		0	0	223	0	665,495	-6,686	
TOTALS																				
1996-2003			**260,595**	**83,547**	**686,357**	**905,457**	**649,364**	**2,585,320**	**260,595**	**478,997**	**305,720**	**-1,540,008**	**857,500**	**391,000**	**266,000**	**-25,508**	**-18,000**			
1996-2004			**277,003**	**83,547**	**734,276**	**922,697**	**925,261**	**2,942,784**	**277,003**	**478,997**	**334,970**	**-1,851,814**	**1,107,500**	**391,000**	**316,000**	**-37,314**	**-44,000**			

EFFECTS OF MONTEREY AMENDMENT ON BANKS DIVERSIONS

Year	Month	Actual Net Delta Ouflow Index[1] (AF)	Actual Banks Diversions[2] (AF)	Change in Banks Diversions without Monterey (AF)
1998	January	4,399,140	196,584	-1,000
1999	February	5,487,282	52,203	-1,000
1999	March	4,249,136	182,800	-2,000
2000	February	5,412,226	421,683	-10,000
2000	March	5,400,323	343,011	-4,000
2004	March	3,459,039	423,147	-26,000
96-04 Total				-44,000

1. Source: IEP's Dayflow calculations (http://iep.water.ca.gov/dayflow/output/index.html).
2. Source: DWR Division of Operations and Maintenance Operations Control Office annual and monthly reports of operations (http://wwwoco.water.ca.gov/indexo.html).

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

HISTORICAL SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMEN PROGRAMS (TO KWB AND UNDER ARTICLES 54, 55, AND 56)

Month	KWB DELIVERIES				FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55									
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water					
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR
Jan-96	11,587	11,565	0	11,565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0
Feb-96	10,740	9,678	0	9,678	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,062	0	0	0
Mar-96	6,497	5,829	0	5,829	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	668	0	0	0
Apr-96	1,409	1,409	0	1,409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-96	2,103	2,103	0	2,103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-96	255	255	0	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-96	2,015	2,015	0	2,015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-96	11,456	11,456	0	11,456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-96	10,695	10,695	0	10,695	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-96	9,079	9,079	0	9,079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-96	5,601	5,601	0	5,601	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-96	16,055	13,676	0	13,676	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**87,492**	**83,361**	**0**	**83,361**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,752**	**0**	**0**	**0**
Jan-97	987	873	0	873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0
Feb-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-97	5,627	1,299	0	1,299	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,328	0	0	0
Apr-97	2,772	2,772	0	2,772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-97	2,769	2,769	0	2,769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-97	2,563	2,563	0	2,563	0	0	0	0	0	0	0	0	0	0	0	0	0	1,600	0	0	1,600	0	0	0	0	0	0
Nov-97	11,165	11,165	0	11,165	0	0	0	0	0	0	645	0	645	0	645	0	645	0	0	0	0	0	0	0	0	0	0
Dec-97	14,166	13,266	0	13,266	0	0	0	0	0	0	611	0	611	0	611	0	611	0	0	0	0	0	0	0	0	0	0
Total	**40,049**	**34,707**	**0**	**34,707**	**0**	**0**	**0**	**0**	**0**	**0**	**1,256**	**0**	**1,256**	**0**	**1,256**	**0**	**1,256**	**1,600**	**0**	**0**	**1,600**	**0**	**0**	**4,442**	**0**	**0**	**0**
Jan-98	13,952	13,541	0	13,541	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	411	0	0	0
Feb-98	3,118	2,545	0	2,545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	573	0	0	0
Mar-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-98	6,447	6,391	0	6,391	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-98	15,270	10,685	0	10,685	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-98	3,804	3,804	0	3,804	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-98	8,564	8,264	0	8,264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**51,155**	**45,230**	**0**	**45,230**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**984**	**0**	**0**	**0**
Jan-99	1,525	204	0	204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	0	1,321	0	600	0
Feb-99	1,149	1,149	0	1,149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	830	0	0	0	5,390	0
Mar-99	1,022	1,022	0	1,022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,140	0	0	0	7,620	2,040
Apr-99	2,274	2,274	0	2,274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	1,870	870
May-99	347	347	0	347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-99	5,758	5,758	0	5,758	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-99	10,780	10,780	0	10,780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-99	3,156	3,156	0	3,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**26,011**	**24,690**	**0**	**24,690**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2,380**	**0**	**1,321**	**0**	**15,480**	**2,910**
Jan-00	224	224	0	224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-00	4,896	4,733	0	4,733	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	880	0	163	0	5,210	1,340
Mar-00	14,002	13,212	0	13,212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,500	0	790	0	8,520	2,400
Apr-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	0	0	0	0	3,471	3,471	0	3,471	3,471	0	0	0	0	0	0	0	0	0	0	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	KWB DELIVERIES				FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55									
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water					
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR
Jul-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	900	0	900	0	0	0	0	0	0
Nov-00	333	333	0	333	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**19,455**	**18,502**	**0**	**18,502**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,471**	**3,471**	**0**	**3,471**	**3,471**	**0**	**0**	**900**	**0**	**900**	**2,380**	**0**	**953**	**0**	**13,730**	**3,740**
Jan-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-01	10,030	8,297	0	8,297	0	4,710	4,710	0	0	0	0	0	0	0	4,710	0	4,710	0	0	0	0	0	0	933	0	0	0
Apr-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0	0	0	2,589	2,589	0	2,589	0	0	0	0	0	0	0	0	0	0
Total	**10,030**	**8,297**	**0**	**8,297**	**0**	**4,710**	**4,710**	**0**	**0**	**0**	**0**	**0**	**0**	**2,589**	**7,299**	**0**	**7,299**	**0**	**0**	**0**	**0**	**0**	**0**	**933**	**0**	**0**	**0**
Jan-02	0	-140	0	-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-02	3,039	2,793	0	2,793	0	1,190	1,190	0	0	0	0	0	0	0	1,190	0	1,190	0	0	0	0	0	0	246	0	0	397
Apr-02	3,341	2,991	0	2,991	0	4,760	4,760	0	0	0	0	0	0	0	4,760	0	4,760	0	0	0	0	83	0	350	0	0	1,087
May-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0
Jun-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0
Jul-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0
Aug-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-02	0	0	0	0	0	0	0	0	0	0	0	16,468	16,468	0	16,468	0	16,468	0	0	0	0	0	0	0	0	0	0
Nov-02	0	0	0	0	0	0	0	0	0	0	0	13,342	13,342	0	13,342	0	13,342	0	0	0	0	0	0	0	0	0	0
Dec-02	0	0	0	0	0	0	0	0	0	0	0	13,342	13,342	0	13,342	0	13,342	0	0	0	0	0	0	0	0	0	0
Total	**6,380**	**5,644**	**0**	**5,644**	**0**	**5,950**	**5,950**	**0**	**0**	**0**	**0**	**69,042**	**69,042**	**0**	**74,992**	**0**	**74,992**	**0**	**0**	**0**	**0**	**83**	**0**	**596**	**0**	**0**	**1,484**
Jan-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-03	0	0	0	0	0	0	0	0	7,100	7,100	0	0	0	0	7,100	7,100	0	0	0	0	0	0	0	0	0	0	0
Mar-03	4,632	4,632	0	4,632	0	13,139	13,139	0	38,500	38,500	0	0	0	0	51,639	51,639	0	0	0	0	0	0	0	0	0	0	0
Apr-03	0	0	0	0	0	4,483	4,483	0	0	0	0	32,575	32,575	0	37,058	37,058	0	0	0	0	0	0	0	0	0	0	0
May-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-03	2,413	2,413	0	2,413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,100	3,100	0	0	0	0	0	0
Nov-03	16,789	16,789	0	16,789	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-03	16,540	16,190	0	16,190	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**40,374**	**40,024**	**0**	**40,024**	**0**	**17,622**	**17,622**	**0**	**45,600**	**45,600**	**0**	**32,575**	**32,575**	**0**	**95,797**	**95,797**	**0**	**0**	**0**	**3,100**	**3,100**	**0**	**0**	**0**	**0**	**0**	**0**
Jan-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-04	1,914	1,914	0	1,914	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-04	16,151	14,494	0	14,494	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,657	0	0	0
Apr-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-04	0	0	0	0	0	0	0	0	0	0	0	50,061	50,061	0	50,061	50,061	0	0	0	0	0	0	0	0	0	0	0
Jun-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,100	3,100	0	0	0	0	0	0
Nov-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**18,065**	**16,408**	**0**	**16,408**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**50,061**	**50,061**	**0**	**50,061**	**50,061**	**0**	**0**	**0**	**3,100**	**3,100**	**0**	**0**	**1,657**	**0**	**0**	**0**
Jan-05	29,486	28,593	0	28,593	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	845	0	0	0
Feb-05	39,919	37,596	0	37,596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,323	0	0	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	KWB DELIVERIES				FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55									
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water					
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR
Mar-05	50,106	46,729	0	46,729	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	0	0	0
Apr-05	49,900	46,946	0	46,946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,954	0	0	0
May-05	14,278	13,629	0	13,629	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649	0	764	0
Jun-05	30,897	29,833	0	29,833	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,064	0	2,351	0
Jul-05	234	234	0	234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-05	11,025	11,025	0	11,025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-05	25,520	25,520	0	25,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-05	32,256	30,756	0	30,756	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-05	21,818	20,818	0	20,818	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-05	21,979	20,045	0	20,045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,934	0	0	0
Total	**327,418**	**311,724**	**0**	**311,724**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,146**	**0**	**3,115**	**0**
Totals																											
96-03	**280,946**	**260,455**	**0**	**260,455**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**105,088**	**106,344**	**2,589**	**182,815**	**99,268**	**83,547**	**1,600**	**900**	**3,100**	**5,600**	**4,843**	**0**	**10,981**	**0**	**29,210**	**8,134**
96-04	**299,011**	**276,863**	**0**	**276,863**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**155,149**	**156,405**	**2,589**	**232,876**	**149,329**	**83,547**	**1,600**	**900**	**6,200**	**8,700**	**4,843**	**0**	**12,638**	**0**	**29,210**	**8,134**
96-05	**626,429**	**588,587**	**0**	**588,587**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**155,149**	**156,405**	**2,589**	**232,876**	**149,329**	**83,547**	**1,600**	**900**	**6,200**	**8,700**	**4,843**	**0**	**25,784**	**0**	**32,325**	**8,134**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

HISTOI

Month	SWP DELIVERIES UNDER ARTICLE 56																									
	Storage Outside Service Area (all water types)																					Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)																				Turnbk Pool					
		Article 56 Carryover							Table A and other SWP Water							Total	Could Not Have Stored	Could Have Been Stored in Other Existing Programs				Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total					
	28	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*
Source / Formula	= sum(cols 22 thru 27)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jan-96	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0
Feb-96	1,062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,062	0	0	0	0	0	0	0	0	0	0
Mar-96	668	0	0	0	0	0	0	0	0	0	0	0	0	0	0	668	0	0	0	0	0	0	0	0	0	0
Apr-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27,290	0	0	0	0	0
May-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,632	0	0	0	0	0
Jun-96	0	0	0	0	0	0	0	0	0	0	0	0	25,000	0	25,000	25,000	0	0	25,000	25,000	31,774	0	0	0	0	0
Jul-96	0	0	0	0	0	0	0	0	0	0	0	0	20,000	0	20,000	20,000	0	0	20,000	20,000	34,774	0	0	0	0	0
Aug-96	0	0	0	0	0	0	0	0	6,200	0	0	0	0	0	6,200	6,200	0	0	0	0	44,165	0	0	0	0	0
Sep-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,274	0	0	0	0	0
Oct-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-96	0	0	0	0	0	0	0	0	0	0	2,379	0	0	0	2,379	2,379	0	0	0	0	0	0	0	0	0	0
Total	**1,752**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,200**	**0**	**2,379**	**0**	**45,000**	**0**	**53,579**	**55,331**	**0**	**0**	**45,000**	**45,000**	**174,909**	**0**	**0**	**0**	**0**	**0**
Jan-97	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0	0	0	0	0	0	0	0
Feb-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-97	4,328	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,328	0	0	0	0	0	0	0	0	0	0
Apr-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,505	0	0	0	0	0
Jun-97	0	0	0	0	0	0	0	0	0	0	0	0	35,000	0	35,000	35,000	0	0	35,000	35,000	11,505	0	0	0	0	0
Jul-97	0	0	0	0	0	0	0	0	10,000	0	0	0	0	0	10,000	10,000	0	0	0	0	12,504	0	0	0	0	0
Aug-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,294	0	0	0	0	0
Sep-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,842	0	0	0	0	0
Oct-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,298	0	0	0	0	0
Nov-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,298	0	0	0	0	0
Dec-97	0	0	0	0	0	0	0	0	0	0	900	1,486	0	0	2,386	2,386	0	1,486	0	1,486	4,298	0	0	0	0	0
Total	**4,442**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10,000**	**0**	**900**	**1,486**	**35,000**	**0**	**47,386**	**51,828**	**0**	**1,486**	**35,000**	**36,486**	**62,544**	**0**	**0**	**0**	**0**	**0**
Jan-98	411	0	0	0	8,797	0	0	8,797	0	0	0	2,176	0	0	2,176	11,384	0	10,973	0	10,973	0	34,963	407	8,797	0	25,759
Feb-98	573	0	0	0	0	0	0	0	0	0	0	336	0	0	336	909	0	336	0	336	0	0	0	0	0	0
Mar-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,000	0	0	0	0	0
Jun-98	0	0	0	0	0	0	0	0	0	0	0	0	23,800	0	23,800	23,800	0	0	23,800	23,800	15,000	0	0	0	0	0
Jul-98	0	0	0	0	0	0	0	0	3,780	0	0	0	0	1,970	5,750	5,750	0	0	0	0	15,000	0	0	0	0	0
Aug-98	0	0	0	0	0	0	0	0	0	0	0	1,759	0	0	1,759	1,759	0	1,759	0	1,759	15,000	0	0	0	0	0
Sep-98	0	0	0	0	0	0	0	0	0	0	56	12,519	0	0	12,575	12,575	0	12,519	0	12,519	15,000	0	0	0	0	0
Oct-98	0	0	0	0	0	0	0	0	0	0	4,585	4,147	0	0	8,732	8,732	0	4,147	0	4,147	0	0	0	0	0	0
Nov-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-98	0	0	0	0	0	0	0	0	0	0	300	0	0	0	300	300	0	0	0	0	0	0	0	0	0	0
Total	**984**	**0**	**0**	**0**	**8,797**	**0**	**0**	**8,797**	**3,780**	**0**	**4,941**	**20,937**	**23,800**	**1,970**	**55,428**	**65,209**	**0**	**29,734**	**23,800**	**53,534**	**75,000**	**34,963**	**407**	**8,797**	**0**	**25,759**
Jan-99	2,011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,011	0	0	600	600	0	0	0	0	0	0
Feb-99	6,220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,220	0	0	5,390	5,390	0	0	0	0	0	0
Mar-99	10,800	0	0	0	0	0	0	0	0	0	0	8,041	0	0	8,041	18,841	0	8,041	7,620	15,661	0	0	0	0	0	0
Apr-99	3,060	0	0	0	0	0	0	0	0	0	0	15,916	0	0	15,916	18,976	6,098	9,818	1,870	11,688	0	0	0	0	0	0
May-99	0	0	0	0	0	0	0	0	0	0	0	16,024	0	0	16,024	16,024	9,839	6,185	0	6,185	347	0	0	0	0	0
Jun-99	0	0	0	0	0	0	0	0	12,620	0	0	10,425	14,520	17,300	54,865	54,865	0	10,425	14,520	24,945	15,217	0	0	0	0	0
Jul-99	0	0	0	0	0	0	0	0	1,100	0	0	0	0	2,700	3,800	3,800	0	0	0	0	26,600	0	0	0	0	0
Aug-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,534	0	0	0	0	0
Sep-99	0	0	0	0	0	0	0	0	0	0	0	2,958	0	0	2,958	2,958	0	2,958	0	2,958	34,503	0	0	0	0	0
Oct-99	0	0	0	0	0	0	0	0	0	0	0	137	0	0	137	137	0	137	0	137	45,573	0	0	0	0	0
Nov-99	0	0	0	0	0	0	0	0	0	0	0	4,292	0	0	4,292	4,292	0	4,292	0	4,292	44,173	0	0	0	0	0
Dec-99	0	0	0	0	0	0	0	0	0	0	0	4,369	0	0	4,369	4,369	0	4,369	0	4,369	31,490	0	0	0	0	0
Total	**22,091**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,720**	**0**	**0**	**62,162**	**14,520**	**20,000**	**110,402**	**132,493**	**15,937**	**46,225**	**30,000**	**76,225**	**217,437**	**0**	**0**	**0**	**0**	**0**
Jan-00	0	0	0	0	12,049	0	0	12,049	0	0	0	0	0		0	12,049	0	12,049	0	12,049	0	93,447	1,417	12,049	0	79,981
Feb-00	7,593	0	0	0	4,475	0	0	4,475	0	0	0	0	0	0	0	12,068	0	4,475	5,210	9,685	0	77,589	0	4,475	0	73,114
Mar-00	13,210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,210	0	0	8,520	8,520	0	0	0	0	0	0
Apr-00	0	0	0	0	0	0	0	0	0	0	0	10,801	0	0	10,801	10,801	0	10,801	0	10,801	10,000	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,100	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	0	3,750	0	0	21,130	0	3,000	27,880	27,880	0	21,130	0	21,130	12,290	0	0	0	0	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																									
	Storage Outside Service Area (all water types)																				Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)																Could Not Have Stored	Could Have Been Stored in Other Existing Programs								
		Article 56 Carryover							Table A and other SWP Water							Total						Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total					
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
Source / Formula	= sum(cols 22 thru 27)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jul-00	0	0	0	0	0	0	0	0	5,750	0	0	24,803	0	8,000	38,553	38,553	0	24,803	0	24,803	122,832	0	0	0	0	0
Aug-00	0	0	0	0	0	0	0	0	0	0	0	16,675	0	8,000	24,675	24,675	0	16,675	0	16,675	106,860	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	0	1,500	0	0	17,166	10,000	1,200	29,866	29,866	0	17,166	10,000	27,166	2,041	0	0	0	0	0
Oct-00	0	0	0	0	0	0	0	0	0	0	0	21,119	0	0	21,119	21,119	0	21,119	0	21,119	16,182	0	0	0	0	0
Nov-00	0	0	0	0	0	0	0	0	0	0	0	15,752	0	0	15,752	15,752	0	15,752	0	15,752	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	0	5,761	0	0	5,761	5,761	0	5,761	0	5,761	0	0	0	0	0	0
Total	**20,803**	**0**	**0**	**0**	**16,524**	**0**	**0**	**16,524**	**11,000**	**0**	**0**	**133,207**	**10,000**	**20,200**	**174,407**	**211,734**	**0**	**149,731**	**23,730**	**173,461**	**282,305**	**171,036**	**1,417**	**16,524**	**0**	**153,095**
Jan-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133,186	1,941	0	0	131,245
Feb-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79,326	803	0	0	78,523
Mar-01	933	0	0	800	0	0	5,000	5,800	0	0	0	0	0	0	0	6,733	0	0	0	0	0	77,225	0	5,800	0	71,425
Apr-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,191	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	921	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,948	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,016	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	947	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	395	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	740	0	0	0	0	0
Total	**933**	**0**	**0**	**800**	**0**	**0**	**5,000**	**5,800**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,733**	**0**	**0**	**0**	**0**	**18,240**	**289,737**	**2,744**	**5,800**	**0**	**281,193**
Jan-02	0	0	0	0	0	0	1,081	1,081	0	0	140	0	3,311	0	3,451	4,532	0	0	3,311	3,311	0	110,529	277	1,081	0	109,171
Feb-02	0	0	0	0	0	0	6,919	6,919	0	0	0	0	0	0	0	6,919	0	0	0	0	0	11,587	119	6,919	0	4,549
Mar-02	643	0	0	0	0	0	0	0	0	0	0	0	0	0	0	643	0	0	0	0	0	545	532	0	0	13
Apr-02	1,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,520	0	0	0	0	0	776	776	0	0	0
May-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,501	290	290	0	0	0
Jun-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,694	660	660	0	0	0
Jul-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23,061	714	714	0	0	0
Aug-02	0	0	0	0	0	0	0	0	0	0	0	0	0	1,000	1,000	1,000	0	0	0	0	15,996	316	316	0	0	0
Sep-02	0	0	0	0	0	0	0	0	2,000	3,332	0	0	0	3,000	8,332	8,332	0	0	0	0	0	59	59	0	0	0
Oct-02	0	0	0	0	0	0	0	0	0	12,819	0	0	0	0	12,819	12,819	0	0	0	0	0	0	0	0	0	0
Nov-02	0	0	0	0	0	0	0	0	0	3,408	0	0	0	0	3,408	3,408	0	0	0	0	0	0	0	0	0	0
Dec-02	0	0	0	0	0	0	0	0	0	4,441	0	0	0	0	4,441	4,441	2,785	-2,785	0	-2,785	0	0	0	0	0	0
Total	**2,163**	**0**	**0**	**0**	**0**	**0**	**8,000**	**8,000**	**2,000**	**24,000**	**140**	**0**	**3,311**	**4,000**	**33,451**	**43,614**	**2,785**	**-2,785**	**3,311**	**526**	**45,252**	**125,476**	**3,743**	**8,000**	**0**	**113,733**
Jan-03	0	2,000	0	0	0	0	3,800	5,800	0	0	0	0	0	0	0	5,800	0	0	0	0	0	15,286	0	5,800	0	9,486
Feb-03	0	700	0	0	0	0	2,700	3,400	0	0	0	0	0	0	0	3,400	0	0	0	0	0	36,021	0	3,400	7,100	25,521
Mar-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79,077	0	0	38,500	40,577
Apr-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16,006	0	0	0	0	0
May-03	0	0	0	0	0	0	0	0	10,000	0	0	5,477	0	0	15,477	15,477	0	5,477	0	5,477	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	0	6,100	0	0	14,827	20,000	0	40,927	40,927	0	14,827	20,000	34,827	4,373	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	0	13,290	0	0	13,290	13,290	0	13,290	0	13,290	9,339	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	0	19,706	0	0	19,706	19,706	0	19,706	0	19,706	52	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	0	1,400	9,500	0	10,900	10,900	0	1,400	9,500	10,900	0	0	0	0	0	0
Oct-03	0	0	0	0	0	0	0	0	0	0	0	1,520	3,500	0	5,020	5,020	0	1,520	3,500	5,020	0	0	0	0	0	0
Nov-03	0	0	0	0	0	0	0	0	0	0	0	675	0	0	675	675	0	675	0	675	0	0	0	0	0	0
Dec-03	0	0	0	0	0	0	0	0	0	0	350	3,870	0	0	4,220	4,220	0	3,870	0	3,870	0	0	0	0	0	0
Total	**0**	**2,700**	**0**	**0**	**0**	**0**	**6,500**	**9,200**	**16,100**	**0**	**350**	**60,765**	**33,000**	**0**	**110,215**	**119,415**	**0**	**60,765**	**33,000**	**93,765**	**29,770**	**130,384**	**0**	**9,200**	**45,600**	**75,584**
Jan-04	0	0	803	0	0	0	5,740	6,543	0	0	0	0	0	0	0	6,543	0	0	0	0	0	127,492	850	6,543	0	120,099
Feb-04	0	4,000	27,004	0	0	0	0	31,004	0	0	0	0	0	0	0	31,004	0	0	0	0	0	180,703	784	31,004	0	148,915
Mar-04	1,657	0	4,715	0	0	0	0	4,715	0	0	0	0	0	0	0	6,372	0	0	0	0	0	11,613	15	4,715	0	6,883
Apr-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,815	0	0	0	0	0
May-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,075	0	0	0	0	0
Jun-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,402	0	0	0	0	0
Jul-04	0	0	0	0	0	0	0	0	2,000	0	0	0	0	0	2,000	2,000	0	0	0	0	291	0	0	0	0	0
Aug-04	0	0	0	0	0	0	0	0	2,000	0	0	0	0	0	2,000	2,000	0	0	0	0	657	0	0	0	0	0
Sep-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,657**	**4,000**	**32,522**	**0**	**0**	**0**	**5,740**	**42,262**	**4,000**	**0**	**0**	**0**	**0**	**0**	**4,000**	**47,919**	**0**	**0**	**0**	**0**	**17,240**	**319,808**	**1,649**	**42,262**	**0**	**275,897**
Jan-05	845	1,952	0	48	0	4,554	845	7,399	0	0	0	0	0	0	0	8,244	0	0	4,554	4,554	0	113,543	947	7,399	0	105,197
Feb-05	2,323	2,648	0	0	0	7,079	4,895	14,622	0	0	0	0	0	0	0	16,945	0	0	7,079	7,079	0	55,665	877	14,622	0	40,166

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																									
	Storage Outside Service Area (all water types)																				Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)																Could Not Have Stored	Could Have Been Stored in Other Existing Programs								
		Article 56 Carryover							Table A and other SWP Water							Total						Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total						
	28	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*
Source / Formula	= sum(cols 22 thru 27)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Mar-05	3,377	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	0	0	0	0	0	0	0	0	0	0
Apr-05	2,954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,954	0	0	0	0	0	0	0	0	0	0
May-05	1,413	0	0	0	0	0	0	0	0	0	0	1,138	0	0	1,138	2,551	0	1,138	764	1,902	0	0	0	0	0	0
Jun-05	3,415	0	0	0	0	0	0	0	0	0	0	1,324	0	0	1,324	4,739	0	1,324	2,351	3,675	0	0	0	0	0	0
Jul-05	0	0	0	0	0	0	0	0	10,100	0	0	10,000	23,041	0	43,141	43,141	0	10,000	23,041	33,041	32,844	0	0	0	0	0
Aug-05	0	0	0	0	0	0	0	0	15,600	0	0	2,538	7,792	0	25,930	25,930	0	2,538	7,792	10,330	5,089	0	0	0	0	0
Sep-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	342	0	0	0	0	0
Oct-05	0	0	0	0	0	0	0	0	0	0	1,500	576	0	0	2,076	2,076	0	576	0	576	0	0	0	0	0	0
Nov-05	0	0	0	0	0	0	0	0	0	12,869	1,000	0	0	0	13,869	13,869	0	0	0	0	0	0	0	0	0	0
Dec-05	1,934	0	0	0	0	0	0	0	0	7,131	0	0	1,500	0	8,631	10,565	0	0	1,500	1,500	0	0	0	0	0	0
Total	**16,261**	**4,600**	**0**	**48**	**0**	**11,633**	**5,740**	**22,021**	**25,700**	**20,000**	**2,500**	**15,576**	**32,333**	**0**	**96,109**	**134,391**	**0**	**15,576**	**47,081**	**62,657**	**38,275**	**169,208**	**1,824**	**22,021**	**0**	**145,363**
Totals																										
96-03	**53,168**	**2,700**	**0**	**800**	**25,321**	**0**	**19,500**	**48,321**	**62,800**	**24,000**	**8,710**	**278,557**	**164,631**	**46,170**	**584,868**	**686,357**	**18,722**	**285,156**	**193,841**	**478,997**	**905,457**	**751,596**	**8,311**	**48,321**	**45,600**	**649,364**
96-04	**54,825**	**6,700**	**32,522**	**800**	**25,321**	**0**	**25,240**	**90,583**	**66,800**	**24,000**	**8,710**	**278,557**	**164,631**	**46,170**	**588,868**	**734,276**	**18,722**	**285,156**	**193,841**	**478,997**	**922,697**	**1,071,404**	**9,960**	**90,583**	**45,600**	**925,261**
96-05	**71,086**	**11,300**	**32,522**	**848**	**25,321**	**11,633**	**30,980**	**112,604**	**92,500**	**44,000**	**11,210**	**294,133**	**196,964**	**46,170**	**684,977**	**868,667**	**18,722**	**300,732**	**240,922**	**541,654**	**960,972**	**1,240,612**	**11,784**	**112,604**	**45,600**	**1,070,624**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

SAN LUIS RESERVOIR STORAGE

Elevation: 543' · SAN LUIS CR basin · Operator: CA Dept of Water Resources
Provisional data, subject to change.
Data obtained from CDEC 5/15/2006

STORAGE (from CDEC) (AF)

Date	Total (1)	SWP (2)	CVP (3)	Total Check (4) (2+3)	Diff (5) (4-1)
Jan-95	1,789,637	1,091,587	698,050	1,789,637	0
Feb-95	2,024,025	1,171,880	852,145	2,024,025	0
Mar-95	2,034,447	1,169,817	864,630	2,034,447	0
Apr-95	2,026,819	1,086,588	940,231	2,026,819	0
May-95	2,009,440	1,061,812	947,628	2,009,440	0
Jun-95	1,876,744	1,048,887	827,857	1,876,744	0
Jul-95	1,763,906	1,073,430	690,476	1,763,906	0
Aug-95	1,499,314	1,077,656	421,658	1,499,314	0
Sep-95	1,524,232	1,081,845	442,387	1,524,232	0
Oct-95	1,637,786	1,133,031	504,755	1,637,786	0
Nov-95	1,664,769	1,048,190	616,579	1,664,769	0
Dec-95	1,646,822	911,417	735,465	1,646,882	60
Jan-96	1,934,442	1,061,411	873,031	1,934,442	0
Feb-96	2,024,533	1,076,912	947,621	2,024,533	0
Mar-96	2,023,644	1,058,720	964,924	2,023,644	0
Apr-96	1,885,781	972,070	913,711	1,885,781	0
May-96	1,643,454	843,235	800,219	1,643,454	0
Jun-96	1,350,109	787,228	562,881	1,350,109	0
Jul-96	979,318	750,346	228,972	979,318	0
Aug-96	753,481	628,876	124,605	753,481	0
Sep-96	914,750	740,379	174,371	914,750	0
Oct-96	1,175,411	843,170	332,241	1,175,411	0
Nov-96	1,596,193	1,048,478	547,719	1,596,197	4
Dec-96	1,903,404	1,109,158 r	794,246	1,903,404	0
Jan-97	1,999,062	1,101,867	897,195	1,999,062	0
Feb-97	1,978,868	1,105,151	873,717	1,978,868	0
Mar-97	2,009,693	1,085,462	924,231	2,009,693	0
Apr-97	1,778,698	944,918	833,780	1,778,698	0
May-97	1,266,881	721,579	545,302	1,266,881	0
Jun-97	871,579	593,083	278,496	871,579	0
Jul-97	553,683	445,203	108,480	553,683	0
Aug-97	396,307	334,549	61,758	396,307	0
Sep-97	593,428	461,649	131,779	593,428	0
Oct-97	827,147	547,915	279,232	827,147	0
Nov-97	1,165,611	713,723	451,888	1,165,611	0
Dec-97	1,642,982	953,588	649,394	1,602,982	-40,000
Jan-98	1,858,715	1,068,183	790,532	1,858,715	0
Feb-98	2,025,549	1,062,277	963,272	2,025,549	0
Mar-98	2,028,090	1,063,334	964,756	2,028,090	0
Apr-98	1,999,821	1,062,227	937,594	1,999,821	0
May-98	2,028,725	1,061,880	966,845	2,028,725	0
Jun-98	2,024,025	1,060,880	963,145	2,024,025	0
Jul-98	1,824,308	1,004,087	820,221	1,824,308	0
Aug-98	1,566,459	873,994	692,465	1,566,459	0
Sep-98	1,613,068	900,000	713,008	1,613,008	-60

STORAGE (from CDEC) (AF)

Date	Total (1)	SWP (2)	CVP (3)	Total Check (4) (2+3)	Diff (5) (4-1)
Oct-98	1,861,058	1,014,790	846,268	1,861,058	0
Nov-98	1,970,810	1,063,595	904,215	1,967,810	-3,000
Dec-98	1,898,186	1,074,246	823,940	1,898,186	0
Jan-99	1,929,319	1,103,949	825,370	1,929,319	0
Feb-99	1,985,676	1,097,321	888,355	1,985,676	0
Mar-99	2,027,831	1,061,800	966,035	2,027,835	4
Apr-99	1,913,855	1,011,650	902,205	1,913,855	0
May-99	1,496,796	863,254	633,542	1,496,796	0
Jun-99	936,402	555,473	380,929	936,402	0
Jul-99	611,617	476,215	135,402	611,617	0
Aug-99	520,283	451,049	69,234	520,283	0
Sep-99	702,409	591,796	110,613	702,409	0
Oct-99	801,279	573,547	227,732	801,279	0
Nov-99	1,073,901	683,127	390,774	1,073,901	0
Dec-99	1,187,142	716,955	470,187	1,187,142	0
Jan-00	1,505,272	914,717	590,555	1,505,272	0
Feb-00	1,825,778	1,057,575	768,203	1,825,778	0
Mar-00	2,026,438	1,061,880	964,558	2,026,438	0
Apr-00	1,876,126	969,343	906,783	1,876,126	0
May-00	1,462,484	762,064	700,520	1,462,584	100
Jun-00	1,051,334	580,449	470,885	1,051,334	0
Jul-00	771,746	401,285	370,461	771,746	0
Aug-00	666,538	307,591	358,947	666,538	0
Sep-00	850,828	387,635	463,193	850,828	0
Oct-00	1,051,945	421,304	630,641	1,051,945	0
Nov-00	1,299,262	460,177	839,085	1,299,262	0
Dec-00	1,470,439	481,677	988,762	1,470,439	0

STORAGE (from CDEC) (AF)

Date	Total (1)	SWP (2)	CVP (3)	Total Check (4) (2+3)	Diff (5) (4-1)
Jan-01	1,595,959	556,930	1,039,029	1,595,959	0
Feb-01	1,797,186	747,404	1,049,782	1,797,186	0
Mar-01	1,977,986	996,764	981,222	1,977,986	0
Apr-01	1,910,991	984,617	926,374	1,910,991	0
May-01	1,493,135	815,834	677,301	1,493,135	0
Jun-01	1,033,071	642,248	390,823	1,033,071	0
Jul-01	829,778	549,059	280,719	829,778	0
Aug-01	760,039	515,197	244,842	760,039	0
Sep-01	829,590	516,007	313,583	829,590	0
Oct-01	764,056	357,700	406,356	764,056	0
Nov-01	964,447	412,836	551,611	964,447	0
Dec-01	1,385,632	675,995	709,637	1,385,632	0
Jan-02	1,807,066	912,332	894,734	1,807,066	0
Feb-02	1,925,324	1,030,871	894,453	1,925,324	0
Mar-02	2,027,963	1,078,173	949,790	2,027,963	0
Apr-02	1,844,188	973,457	870,731	1,844,188	0
May-02	1,402,950	744,784	658,166	1,402,950	0
Jun-02	873,969	488,121	385,848	873,969	0
Jul-02	646,887	398,657	248,230	646,887	0
Aug-02	643,876	467,946	175,930	643,876	0
Sep-02	688,435	393,795	294,640	688,435	0
Oct-02	649,730	237,482	412,248	649,730	0
Nov-02	787,573	219,224	568,349	787,573	0
Dec-02	1,010,089	319,803	690,286	1,010,089	0
Jan-03	1,437,576	569,838	867,738	1,437,576	0
Feb-03	1,739,389	837,137	902,252	1,739,389	0
Mar-03	1,953,851	984,556	969,295	1,953,851	0
Apr-03	1,818,676	920,243	898,433	1,818,676	0
May-03	1,428,330	684,343	743,987	1,428,330	0
Jun-03	1,217,645	557,749	659,896	1,217,645	0
Jul-03	918,347	521,880	396,467	918,347	0
Aug-03	787,480	529,944	257,536	787,480	0
Sep-03	939,243	652,744	286,499	939,243	0
Oct-03	961,975	607,364	354,611	961,975	0
Nov-03	1,122,517	613,477	509,040	1,122,517	0
Dec-03	1,316,540	615,769	700,771	1,316,540	0
Jan-04	1,664,413	809,033	855,380	1,664,413	0
Feb-04	1,878,476	971,719	906,757	1,878,476	0
Mar-04	2,020,089	1,069,446	950,643	2,020,089	0
Apr-04	1,768,145	938,544	829,601	1,768,145	0
May-04	1,213,592	674,017	539,575	1,213,592	0
Jun-04	719,890	434,812	285,078	719,890	0
Jul-04	492,864	369,739	123,125	492,864	0
Aug-04	498,397	408,702	89,695	498,397	0
Sep-04	670,373	513,536	156,837	670,373	0
Oct-04	787,850	522,176	265,674	787,850	0
Nov-04	1,057,649	603,410	454,239	1,057,649	0
Dec-04	1,283,146	672,181	610,965	1,283,146	0
Jan-05	1,810,485	1,013,425	797,060	1,810,485	0
Feb-05	1,968,294	1,099,874	868,420	1,968,294	0
Mar-05	2,029,615	1,063,312	966,303	2,029,615	0

STORAGE (from CDEC) (AF)

Date	Total	SWP	CVP	Total Check	Diff
	(1)	(2)	(3)	(4)	(5)
				(2+3)	(4-1)
Apr-05	1,898,434	933,372	965,062	1,898,434	0
May-05	1,696,202	801,190	895,012	1,696,202	0
Jun-05	1,566,575	764,709	801,866	1,566,575	0
Jul-05	1,343,373	773,382	569,991	1,343,373	0
Aug-05	1,197,211	819,673	377,538	1,197,211	0
Sep-05	1,328,065	925,423	402,642	1,328,065	0
Oct-05	1,462,938	990,340	472,598	1,462,938	0
Nov-05	1,627,412	1,022,206	605,206	1,627,412	0
Dec-05	1,893,469	1,167,668	725,801	1,893,469	0
Jan-06	2,030,250	1,153,152	877,098	2,030,250	0
Feb-06	2,019,836	1,144,384	875,452	2,019,836	0
Mar-06	2,031,649	1,063,143	968,506	2,031,649	0
Apr-06	2,024,025	1,059,354	964,671	2,024,025	0

HISTORIC AND ESTIMATED
ADDITIONAL
ARTICLE 21 DELIVERIES

Month	Historic Art. 21 Water Deliveries			
	Total	N of Delta	S of Delta	Estimated
Jan-96	2,117	0	2,117	0
Feb-96	22,519	0	22,519	0
Mar-96	4,011	0	4,011	0
Apr-96	0	0	0	0
May-96	0	0	0	0
Jun-96	0	0	0	0
Jul-96	0	0	0	0
Aug-96	0	0	0	0
Sep-96	0	0	0	0
Oct-96	0	0	0	0
Nov-96	0	0	0	0
Dec-96	0	0	0	0
Jan-97	3,044	0	3,044	0
Feb-97	1,572	0	1,572	0
Mar-97	16,420	0	16,420	0
Apr-97	396	0	396	0
May-97	0	0	0	0
Jun-97	0	0	0	0
Jul-97	0	0	0	0
Aug-97	0	0	0	0
Sep-97	0	0	0	0
Oct-97	0	0	0	0
Nov-97	0	0	0	0
Dec-97	0	0	0	0
Jan-98	9,576	58	9,518	0
Feb-98	1,208	482	726	0
Mar-98	62	0	62	0
Apr-98	0	0	0	0
May-98	614	614	0	15,000
Jun-98	1,497	1,497	0	15,000
Jul-98	3,549	3,549	0	0
Aug-98	3,782	3,782	0	0
Sep-98	0		0	0
Oct-98	0		0	0
Nov-98	0		0	7,000
Dec-98	0		0	7,000
Jan-99	28,555	161	28,394	0
Feb-99	27,220	425	26,795	0
Mar-99	73,062	168	72,894	0
Apr-99	29,233	0	29,233	0
May-99	0	0	0	0
Jun-99	0	0	0	0
Jul-99	0	0	0	0
Aug-99	0	0	0	0
Sep-99	0	0	0	0
Oct-99	0	0	0	0
Nov-99	0	0	0	0
Dec-99	0	0	0	0

Month	Historic Art. 21 Water Deliveries			
	Total	N of Delta	S of Delta	Estimated
Jan-00	0	0	0	0
Feb-00	94,467	0	94,467	0
Mar-00	214,318	1,337	212,981	0
Apr-00	0	0	0	0
May-00	0	0	0	0
Jun-00	0	0	0	0
Jul-00	0	0	0	0
Aug-00	0	0	0	0
Sep-00	0	0	0	0
Oct-00	0	0	0	0
Nov-00	0	0	0	0
Dec-00	0	0	0	0
Jan-01	0	0	0	0
Feb-01	1,324	1,324	0	45,000
Mar-01	45,833	988	44,845	160,000
Apr-01	0	0	0	0
May-01	0	0	0	0
Jun-01	0	0	0	0
Jul-01	0	0	0	0
Aug-01	0	0	0	0
Sep-01	0	0	0	0
Oct-01	0	0	0	0
Nov-01	0	0	0	0
Dec-01	988	988	0	0
Jan-02	532	532	0	0
Feb-02	46	46	0	0
Mar-02	9,709	355	9,354	9,000
Apr-02	29,842	340	29,502	0
May-02	1,796	1,769	27	0
Jun-02	0	0	0	0
Jul-02	0	0	0	0
Aug-02	0	0	0	0
Sep-02	0	0	0	0
Oct-02	0	0	0	0
Nov-02	0	0	0	0
Dec-02	0	0	0	0
Jan-03	0	0	0	0
Feb-03	0	0	0	0
Mar-03	49,616	376	49,240	8,000
Apr-03	7,928	0	7,928	0
May-03	1,210	1,210	0	0
Jun-03	1,070	1,070	0	0
Jul-03	0	0	0	0
Aug-03	0	0	0	0
Sep-03	0	0	0	0
Oct-03	0	0	0	0
Nov-03	0	0	0	0
Dec-03	0	0	0	0
Jan-04	1,145	1,145	0	0
Feb-04	658	658	0	50,000
Mar-04	209,741	482	209,259	0
Apr-04	1,126	1,126	0	0
May-04	5,786	5,786	0	0
Jun-04	0	0	0	0
Jul-04	0	0	0	0
Aug-04	0	0	0	0
Sep-04	0	0	0	0
Oct-04	0	0	0	0
Nov-04	0	0	0	0
Dec-04	40	40	0	0
Total	905,612	30,308	875,304	316,000

Deliveries from Retired Table A Amounts

Month	Annual SWP Allocation	KCWA			DRWD			Total Calculated Deliveries from Retired Table A Amounts
		Retired Table A	1996 = 1997 on =	**36,340** **40,670**	Retired Table A	1996 on =	**4,330**	
		Actual Table A Deliveries to Service Area	Percent Distribution of Actual Table A Deliveries	Calculated Deliveries for Retired Table A Amount	Actual Table A Deliveries to Service Area	Percent Distribution of Actual Table A Deliveries	Calculated Deliveries for Retired Table A Amount	
	(%)	(AF)	(%)	(AF)	(AF)	(%)	(AF)	(AF)
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Source / Formula	Actual	DWR del'y files	=col 2 / ann'l total col 2	=ret'd Tbl A * col 1 * col 3	Bulletin 132	=col 2 / ann'l total col 2	=ret'd Tbl A * col 1 * col 3	= col 4 + 7
Jan-96	100%	5,710	0.6%	217	148	0.3%	13	230
Feb-96		23,468	2.5%	893	1,053	2.2%	93	987
Mar-96		41,482	4.3%	1,579	1,046	2.1%	93	1,672
Apr-96		50,591	5.3%	1,926	3,334	6.8%	295	2,221
May-96		102,320	10.7%	3,896	4,166	8.5%	369	4,264
Jun-96		169,473	17.8%	6,452	9,651	19.7%	855	7,307
Jul-96		212,593	22.3%	8,094	12,365	25.3%	1,095	9,189
Aug-96		189,487	19.9%	7,214	10,820	22.1%	958	8,172
Sep-96		58,419	6.1%	2,224	1,890	3.9%	167	2,391
Oct-96		34,968	3.7%	1,331	1,729	3.5%	153	1,484
Nov-96		24,246	2.5%	923	170	0.3%	15	938
Dec-96		41,756	4.4%	1,590	2,524	5.2%	224	1,813
Total		954,513	100.0%	36,340	48,896	100.0%	4,330	40,670
Jan-97	100%	402	0.0%	19	4	0.0%	0	20
Feb-97		4,087	0.5%	197	513	1.2%	51	249
Mar-97		42,557	5.1%	2,055	1,182	2.7%	119	2,173
Apr-97		59,887	7.1%	2,891	3,501	8.1%	351	3,243
May-97		100,221	11.9%	4,839	6,033	14.0%	605	5,444
Jun-97		144,890	17.2%	6,995	9,183	21.3%	921	7,917
Jul-97		197,688	23.5%	9,544	10,777	25.0%	1,081	10,626
Aug-97		182,440	21.7%	8,808	8,403	19.5%	843	9,651
Sep-97		26,734	3.2%	1,291	885	2.1%	89	1,379
Oct-97		22,643	2.7%	1,093	975	2.3%	98	1,191
Nov-97		24,970	3.0%	1,206	616	1.4%	62	1,267
Dec-97		35,877	4.3%	1,732	1,081	2.5%	108	1,841
Total		842,396	100.0%	40,670	43,153	100.0%	4,330	45,000
Jan-98	100%	45,386	6.3%	2,575	43	0.1%	4	2,579
Feb-98		4,835	0.7%	274	4	0.0%	0	275
Mar-98		6,347	0.9%	360	733	1.5%	67	427
Apr-98		14,569	2.0%	827	944	2.0%	86	912
May-98		27,266	3.8%	1,547	777	1.6%	71	1,618
Jun-98		58,541	8.2%	3,322	6,210	13.0%	564	3,886
Jul-98		149,012	20.8%	8,455	11,642	24.4%	1,057	9,512
Aug-98		180,157	25.1%	10,222	12,628	26.5%	1,147	11,369
Sep-98		95,526	13.3%	5,420	6,465	13.6%	587	6,007
Oct-98		55,513	7.7%	3,150	3,331	7.0%	302	3,452
Nov-98		24,244	3.4%	1,376	2,742	5.7%	249	1,625
Dec-98		55,375	7.7%	3,142	2,169	4.5%	197	3,339
Total		716,771	100.0%	40,670	47,688	100.0%	4,330	45,000
Jan-99	100%	10,763	1.1%	435	1,599	3.3%	143	578
Feb-99		14,362	1.4%	580	1,021	2.1%	92	672
Mar-99		21,463	2.1%	867	1,151	2.4%	103	970
Apr-99		38,454	3.8%	1,553	3,210	6.6%	288	1,841
May-99		94,937	9.4%	3,834	7,192	14.9%	645	4,479
Jun-99		157,802	15.7%	6,372	9,568	19.8%	858	7,230
Jul-99		242,820	24.1%	9,805	9,600	19.9%	861	10,666
Aug-99		196,552	19.5%	7,937	9,600	19.9%	861	8,798
Sep-99		83,937	8.3%	3,389	4,346	9.0%	390	3,779
Oct-99		79,541	7.9%	3,212	997	2.1%	89	3,301
Nov-99		43,591	4.3%	1,760	0	0.0%	0	1,760
Dec-99		22,934	2.3%	926	0	0.0%	0	926
Total		1,007,156	100.0%	40,670	48,284	100.0%	4,330	45,000
Jan-00	90%	6,151	1.0%	374	494	1.3%	50	424
Feb-00		21,716	3.6%	1,319	877	2.3%	89	1,408
Mar-00		20,283	3.4%	1,232	0	0.0%	0	1,232
Apr-00		61,658	10.2%	3,745	4,309	11.2%	436	4,182
May-00		94,243	15.6%	5,725	5,557	14.4%	562	6,287
Jun-00		172,025	28.5%	10,450	9,546	24.8%	966	11,416
Jul-00		91,963	15.3%	5,586	9,607	24.9%	972	6,559
Aug-00		61,370	10.2%	3,728	1,704	4.4%	172	3,900
Sep-00		35,156	5.8%	2,136	3,532	9.2%	357	2,493
Oct-00		22,644	3.8%	1,376	1,940	5.0%	196	1,572
Nov-00		8,206	1.4%	498	409	1.1%	41	540
Dec-00		7,148	1.2%	434	532	1.4%	54	488
Total		602,563	100.0%	36,603	38,507	100.0%	3,897	40,500

Month	Annual SWP Allocation	KCWA			DRWD			Total Calculated Deliveries from Retired Table A Amounts
		Retired Table A	1996 = 1997 on =	**36,340** **40,670**	Retired Table A	1996 on =	**4,330**	
		Actual Table A Deliveries to Service Area	Percent Distribution of Actual Table A Deliveries	Calculated Deliveries for Retired Table A Amount	Actual Table A Deliveries to Service Area	Percent Distribution of Actual Table A Deliveries	Calculated Deliveries for Retired Table A Amount	
	(%)	(AF)	(%)	(AF)	(AF)	(%)	(AF)	(AF)
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Source / Formula	Actual	DWR del'y files	=col 2 / ann'l total col 2	=ret'd Tbl A * col 1 * col 3	Bulletin 132	=col 2 / ann'l total col 2	=ret'd Tbl A * col 1 * col 3	= col 4 + 7
Jan-01	39%	0	0.0%	0	0	0.0%	0	0
Feb-01		0	0.0%	0	0	0.0%	0	0
Mar-01		1,702	0.8%	128	0	0.0%	0	128
Apr-01		0	0.0%	0	1,642	8.9%	150	150
May-01		23,541	11.2%	1,773	2,682	14.5%	245	2,019
Jun-01		62,788	29.8%	4,729	3,307	17.9%	303	5,032
Jul-01		48,131	22.9%	3,625	4,352	23.6%	398	4,024
Aug-01		28,985	13.8%	2,183	453	2.5%	41	2,225
Sep-01		24,186	11.5%	1,822	3,804	20.6%	348	2,170
Oct-01		15,905	7.6%	1,198	1,819	9.9%	166	1,364
Nov-01		4,920	2.3%	371	86	0.5%	8	378
Dec-01		427	0.2%	32	308	1.7%	28	60
Total		210,585	100.0%	15,861	18,453	100.0%	1,689	17,550
Jan-02	70%	9,532	1.6%	453	0	0.0%	0	453
Feb-02		28,910	4.8%	1,375	892	2.5%	75	1,450
Mar-02		39,103	6.5%	1,860	4,050	11.3%	343	2,202
Apr-02		21,543	3.6%	1,025	1,257	3.5%	106	1,131
May-02		45,678	7.6%	2,172	1,400	3.9%	118	2,291
Jun-02		144,343	24.1%	6,865	7,881	22.0%	667	7,532
Jul-02		134,801	22.5%	6,411	9,600	26.8%	812	7,223
Aug-02		98,664	16.5%	4,692	2,888	8.1%	244	4,937
Sep-02		38,071	6.4%	1,811	3,991	11.1%	338	2,148
Oct-02		31,073	5.2%	1,478	2,309	6.4%	195	1,673
Nov-02		2,650	0.4%	126	769	2.1%	65	191
Dec-02		4,225	0.7%	201	781	2.2%	66	267
Total		598,593	100.0%	28,469	35,818	100.0%	3,031	31,500
Jan-03	90%	1,630	0.2%	86	0	0.0%	0	86
Feb-03		3,446	0.5%	181	2,312	5.9%	229	411
Mar-03		20,468	2.9%	1,076	2,540	6.5%	252	1,328
Apr-03		12,373	1.8%	650	2,288	5.8%	227	877
May-03		50,130	7.2%	2,635	5,189	13.2%	515	3,150
Jun-03		114,180	16.4%	6,003	8,296	21.1%	823	6,826
Jul-03		190,415	27.3%	10,010	9,745	24.8%	967	10,977
Aug-03		107,059	15.4%	5,628	8,267	21.0%	820	6,449
Sep-03		55,209	7.9%	2,902	61	0.2%	6	2,908
Oct-03		49,607	7.1%	2,608	399	1.0%	40	2,648
Nov-03		45,967	6.6%	2,417	0	0.0%	0	2,417
Dec-03		45,768	6.6%	2,406	177	0.5%	18	2,424
Total		696,252	100.0%	36,603	39,274	100.0%	3,897	40,500
Jan-04	65%	0	0.0%	0	0	0.0%	0	0
Feb-04		108	0.0%	6	0	0.0%	0	6
Mar-04		16,102	3.1%	825	980	2.9%	82	907
Apr-04		62,260	12.1%	3,189	2,586	7.7%	217	3,406
May-04		79,726	15.4%	4,083	4,784	14.3%	402	4,485
Jun-04		125,126	24.2%	6,408	8,060	24.1%	677	7,086
Jul-04		147,845	28.6%	7,572	5,169	15.4%	434	8,006
Aug-04		60,301	11.7%	3,088	7,359	22.0%	618	3,707
Sep-04		19,190	3.7%	983	1,345	4.0%	113	1,096
Oct-04		1,217	0.2%	62	3,047	9.1%	256	318
Nov-04		0	0.0%	0	125	0.4%	11	11
Dec-04		4,295	0.8%	220	38	0.1%	3	223
Total		516,170	100.0%	26,436	33,493	100.0%	2,815	29,250
Jan-05	90%	0	0.0%	0	0	0.0%	0	0
Feb-05		5,931	0.8%	290	0	0.0%	0	290
Mar-05		15,961	2.1%	781	100	0.2%	9	790
Apr-05		32,223	4.3%	1,576	2,205	5.3%	207	1,784
May-05		40,474	5.4%	1,980	3,014	7.3%	283	2,264
Jun-05		123,770	16.5%	6,055	6,576	15.9%	618	6,673
Jul-05		113,387	15.2%	5,547	10,109	24.4%	951	6,498
Aug-05		162,910	21.8%	7,970	8,341	20.1%	784	8,754
Sep-05		92,113	12.3%	4,506	5,292	12.8%	498	5,004
Oct-05		80,049	10.7%	3,916	2,791	6.7%	262	4,179
Nov-05		59,177	7.9%	2,895	212	0.5%	20	2,915
Dec-05		22,201	3.0%	1,086	2,797	6.8%	263	1,349
Total		748,196	100.0%	36,603	41,437	100.0%	3,897	40,500
Totals								
96-03		**5,628,829**	**8**	**275,886**	**320,073**	**8**	**29,834**	**305,720**
96-04		**6,144,999**	**9**	**302,322**	**353,566**	**9**	**32,648**	**334,970**
96-05		**6,893,195**	**10**	**338,925**	**395,003**	**10**	**36,545**	**375,470**

Net Delta Outflow Index and Diversions at Banks Pumping Plant

Date	Historic Data		Estimated Data			Annual Totals				
	Net Delta Outflow Index[1] (AF)	Total Diversns at Banks Pumpg Plant[2,3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)	Net Delta Outflow Index (AF)	Total Diversns at Banks Pumping Plant[3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)
Jan-96	1,976,479	348,376	0	1,976,479	348,376					
Feb-96	7,300,090	171,418	0	7,300,090	171,418					
Mar-96	5,481,485	174,082	0	5,481,485	174,082					
Apr-96	2,501,101	105,770	0	2,501,101	105,770					
May-96	2,829,723	156,749	0	2,829,723	156,749					
Jun-96	908,612	295,490	0	908,612	295,490					
Jul-96	562,986	370,341	0	562,986	370,341					
Aug-96	589,805	379,999	0	589,805	379,999					
Sep-96	433,942	344,926	0	433,942	344,926					
Oct-96	291,578	336,186	0	291,578	336,186					
Nov-96	597,120	346,661	0	597,120	346,661					
Dec-96	5,198,059	211,225	0	5,198,059	211,225	28,670,980	3,241,223	0	28,670,980	3,241,223
Jan-97	16,129,761	45,266	0	16,129,761	45,266					
Feb-97	6,591,947	90,350	0	6,591,947	90,350					
Mar-97	2,072,091	162,393	0	2,072,091	162,393					
Apr-97	841,525	105,648	0	841,525	105,648					
May-97	753,673	78,830	0	753,673	78,830					
Jun-97	487,902	153,328	0	487,902	153,328					
Jul-97	570,976	322,379	0	570,976	322,379					
Aug-97	531,217	268,048	0	531,217	268,048					
Sep-97	232,923	339,410	0	232,923	339,410					
Oct-97	296,727	265,902	0	296,727	265,902					
Nov-97	604,147	293,437	0	604,147	293,437					
Dec-97	943,910	419,695	0	943,910	419,695	30,056,800	2,544,686	0	30,056,800	2,544,686
Jan-98	4,399,140	196,584	-1,000	4,400,140	195,584					
Feb-98	12,820,968	7,285	0	12,820,968	7,285					
Mar-98	6,421,827	14,315	0	6,421,827	14,315					
Apr-98	5,259,868	1,871	0	5,259,868	1,871					
May-98	4,157,282	43,225	0	4,157,282	43,225					
Jun-98	4,268,561	128,947	0	4,268,561	128,947					
Jul-98	1,897,277	213,401	0	1,897,277	213,401					
Aug-98	1,223,161	263,272	0	1,223,161	263,272					
Sep-98	1,193,669	266,204	0	1,193,669	266,204					
Oct-98	755,082	294,791	0	755,082	294,791					
Nov-98	1,227,905	129,489	0	1,227,905	129,489					
Dec-98	2,904,722	128,026	0	2,904,722	128,026	46,529,461	1,687,410	-1,000	46,530,461	1,686,410
Jan-99	2,337,832	85,366	0	2,337,832	85,366					
Feb-99	5,487,282	52,203	-1,000	5,488,282	51,203					
Mar-99	4,249,136	182,800	-2,000	4,251,136	180,800					
Apr-99	2,112,934	185,666	0	2,112,934	185,666					
May-99	1,361,205	99,261	0	1,361,205	99,261					
Jun-99	813,084	59,277	0	813,084	59,277					
Jul-99	643,315	376,107	0	643,315	376,107					
Aug-99	364,641	409,354	0	364,641	409,354					
Sep-99	284,666	408,580	0	284,666	408,580					
Oct-99	261,832	303,546	0	261,832	303,546					
Nov-99	404,817	310,792	0	404,817	310,792					
Dec-99	643,569	233,883	0	643,569	233,883	18,964,313	2,706,835	-3,000	18,967,313	2,703,835
Jan-00	1,324,485	395,929	0	1,324,485	395,929					
Feb-00	5,412,226	421,683	-10,000	5,422,226	411,683					
Mar-00	5,400,323	343,011	-4,000	5,404,323	339,011					
Apr-00	1,620,468	180,473	0	1,620,468	180,473					
May-00	1,356,250	97,696	0	1,356,250	97,696					
Jun-00	525,019	251,955	0	525,019	251,955					
Jul-00	560,955	359,191	0	560,955	359,191					
Aug-00	370,417	376,809	0	370,417	376,809					
Sep-00	275,036	387,824	0	275,036	387,824					
Oct-00	351,975	306,668	0	351,975	306,668					
Nov-00	282,180	322,182	0	282,180	322,182					
Dec-00	368,684	292,231	0	368,684	292,231	17,848,018	3,735,652	-14,000	17,862,018	3,721,652

Date	Historic Data: Net Delta Outflow Index[1] (AF)	Historic Data: Total Diversns at Banks Pumpg Plant[2,3] (AF)	Estimated Data: Change in Diversions at Banks PP (AF)	Estimated Data: Net Delta Outflow Index w/ Change in Banks Div's (AF)	Estimated Data: Diversions at Banks w/ Change in Banks Div's (AF)	Annual Totals: Net Delta Outflow Index (AF)	Annual Totals: Total Diversns at Banks Pumping Plant[3] (AF)	Annual Totals: Change in Diversions at Banks PP (AF)	Annual Totals: Net Delta Outflow Index w/ Change in Banks Div's (AF)	Annual Totals: Diversions at Banks w/ Change in Banks Div's (AF)
Jan-01	935,280	240,845	0	935,280	240,845					
Feb-01	1,086,720	260,853	0	1,086,720	260,853					
Mar-01	1,439,070	360,751	0	1,439,070	360,751					
Apr-01	723,447	98,528	0	723,447	98,528					
May-01	590,993	33,823	0	590,993	33,823					
Jun-01	440,594	9,233	0	440,594	9,233					
Jul-01	285,612	217,665	0	285,612	217,665					
Aug-01	193,843	248,539	0	193,843	248,539					
Sep-01	245,322	212,698	0	245,322	212,698					
Oct-01	261,870	60,306	0	261,870	60,306					
Nov-01	488,210	192,176	0	488,210	192,176					
Dec-01	1,520,785	376,553	0	1,520,785	376,553	8,211,744	2,311,970	0	8,211,744	2,311,970
Jan-02	2,381,690	397,017	0	2,381,690	397,017					
Feb-02	668,037	274,484	0	668,037	274,484					
Mar-02	1,043,088	239,304	0	1,043,088	239,304					
Apr-02	707,623	125,217	0	707,623	125,217					
May-02	829,043	38,455	0	829,043	38,455					
Jun-02	438,772	127,719	0	438,772	127,719					
Jul-02	348,127	382,608	0	348,127	382,608					
Aug-02	231,693	413,948	0	231,693	413,948					
Sep-02	244,463	245,835	0	244,463	245,835					
Oct-02	257,288	106,270	0	257,288	106,270					
Nov-02	436,243	187,071	0	436,243	187,071					
Dec-02	1,776,079	254,341	0	1,776,079	254,341	9,362,146	2,792,269	0	9,362,146	2,792,269
Jan-03	3,162,940	355,592	0	3,162,940	355,592					
Feb-03	1,645,127	352,731	0	1,645,127	352,731					
Mar-03	969,098	384,529	0	969,098	384,529					
Apr-03	1,310,801	151,526	0	1,310,801	151,526					
May-03	2,574,908	54,101	0	2,574,908	54,101					
Jun-03	697,299	353,803	0	697,299	353,803					
Jul-03	592,205	405,355	0	592,205	405,355					
Aug-03	422,678	427,610	0	422,678	427,610					
Sep-03	205,091	399,796	0	205,091	399,796					
Oct-03	263,675	180,443	0	263,675	180,443					
Nov-03	394,288	223,840	0	394,288	223,840					
Dec-03	1,464,633	258,531	0	1,464,633	258,531	13,702,742	3,547,857	0	13,702,742	3,547,857
Jan-04	1,973,974	424,781	0	1,973,974	424,781					
Feb-04	3,916,633	366,266	0	3,916,633	366,266					
Mar-04	3,459,039	423,147	-26,000	3,485,039	397,147					
Apr-04	1,305,985	123,026	0	1,305,985	123,026					
May-04	759,616	45,042	0	759,616	45,042					
Jun-04	336,236	95,039	0	336,236	95,039					
Jul-04	449,905	381,724	0	449,905	381,724					
Aug-04	319,958	405,404	0	319,958	405,404					
Sep-04	278,231	299,316	0	278,231	299,316					
Oct-04	523,137	170,003	0	523,137	170,003					
Nov-04	399,136	227,664	0	399,136	227,664					
Dec-04	765,485	263,441	0	765,485	263,441	14,487,334	3,224,853	-26,000	14,513,334	3,198,853

Notes: 1. Historic Net Delta Outflow Index data is from IEP's Dayflow calculations (accessed from http://iep.water.ca.gov/dayflow/output/index.html). Monthly volumes were determined by summing the average daily cfs for all the days in each month and multiplying those sum by 1.983471 to convert from cfs to acre-feet.

2. Historic Total Diversions at Banks Pumping Plant data is from DWR Division of Operations and Maintenance annual and monthly reports of operations. Data for 1996 through 2001 is from the "State Water Project Annual Report of Operations" reports for each of those years, from Table 1. Data from 2002 through 2004 is from the "State Water Project Operations Data" reports for each month, from Table 9.

3. Total Diversions at Banks Pumping Plant are total diversions, including diversions for SWP, CVP, and others.

Month where diversions for CVP and/or others is greater than zero (i.e., diversions for SWP purposes is less than amount shown).

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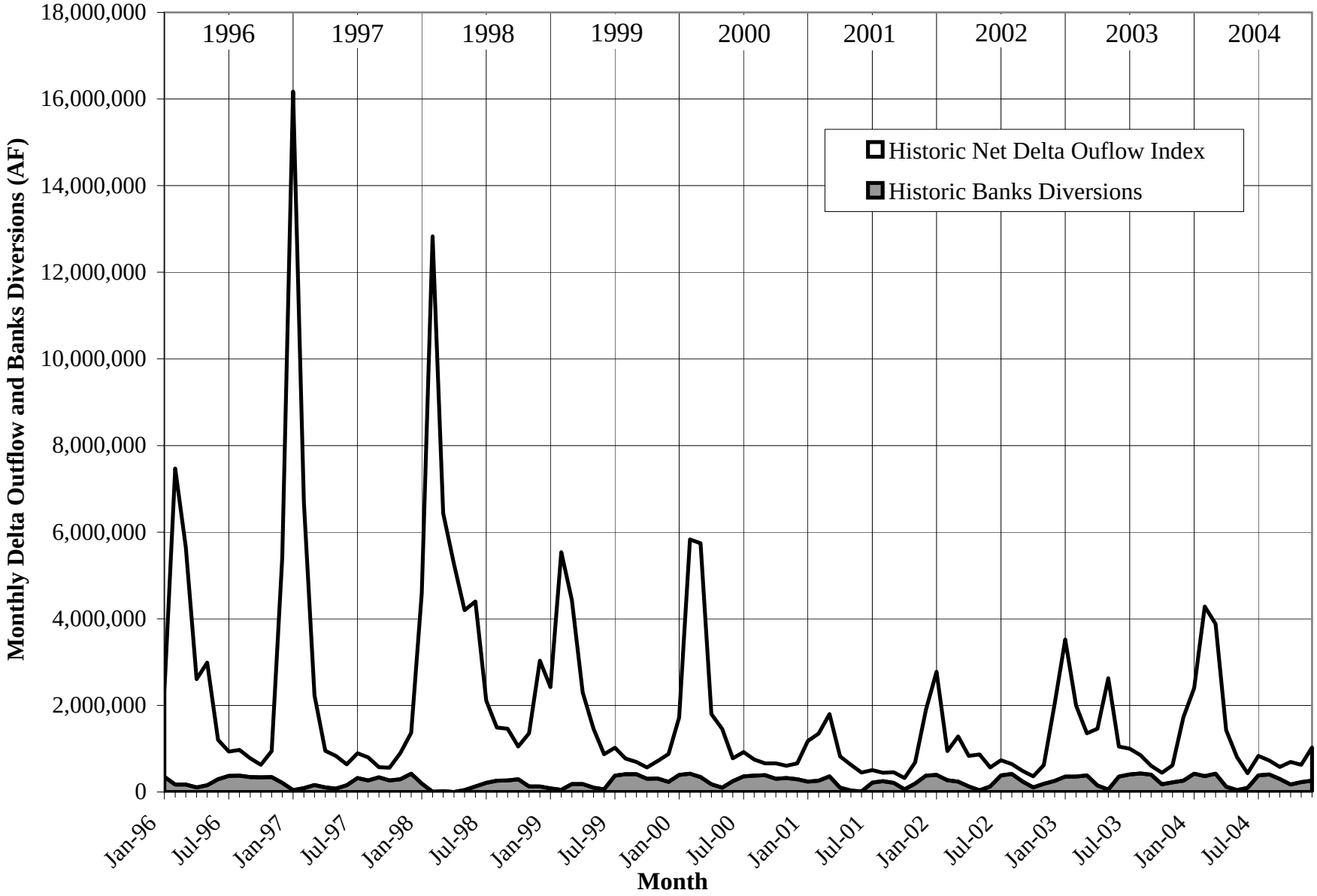
Net Delta Ouflow Index and SWP Banks Pumping Plant Diversions

Monthly Historic Data: 1996-2004



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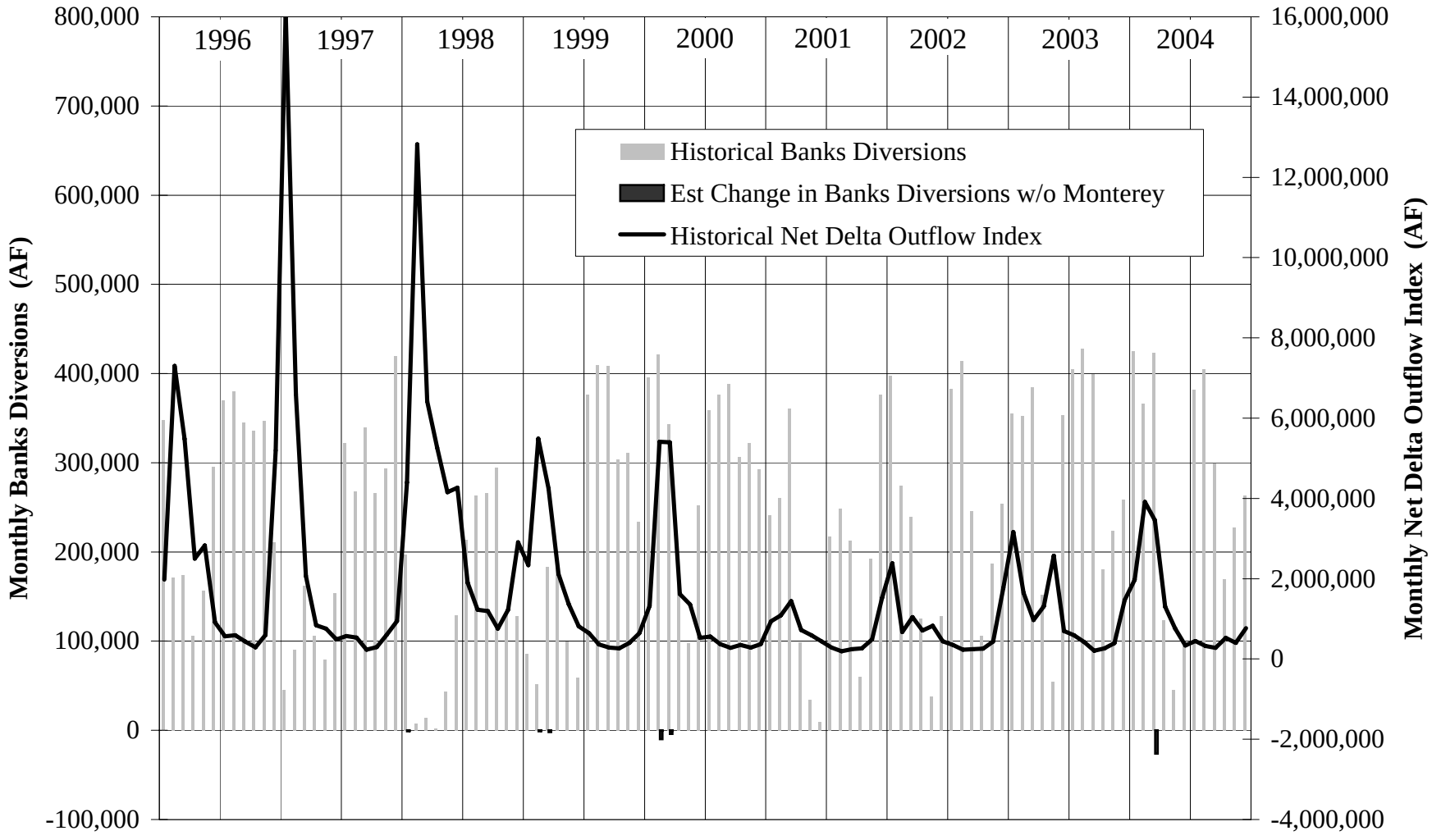
Net Delta Ouflow Index and SWP Banks Pumping Plant Diversions



Monterey Historical Ops Analysis-w stor assump (2007Jun15 Clemm).xls

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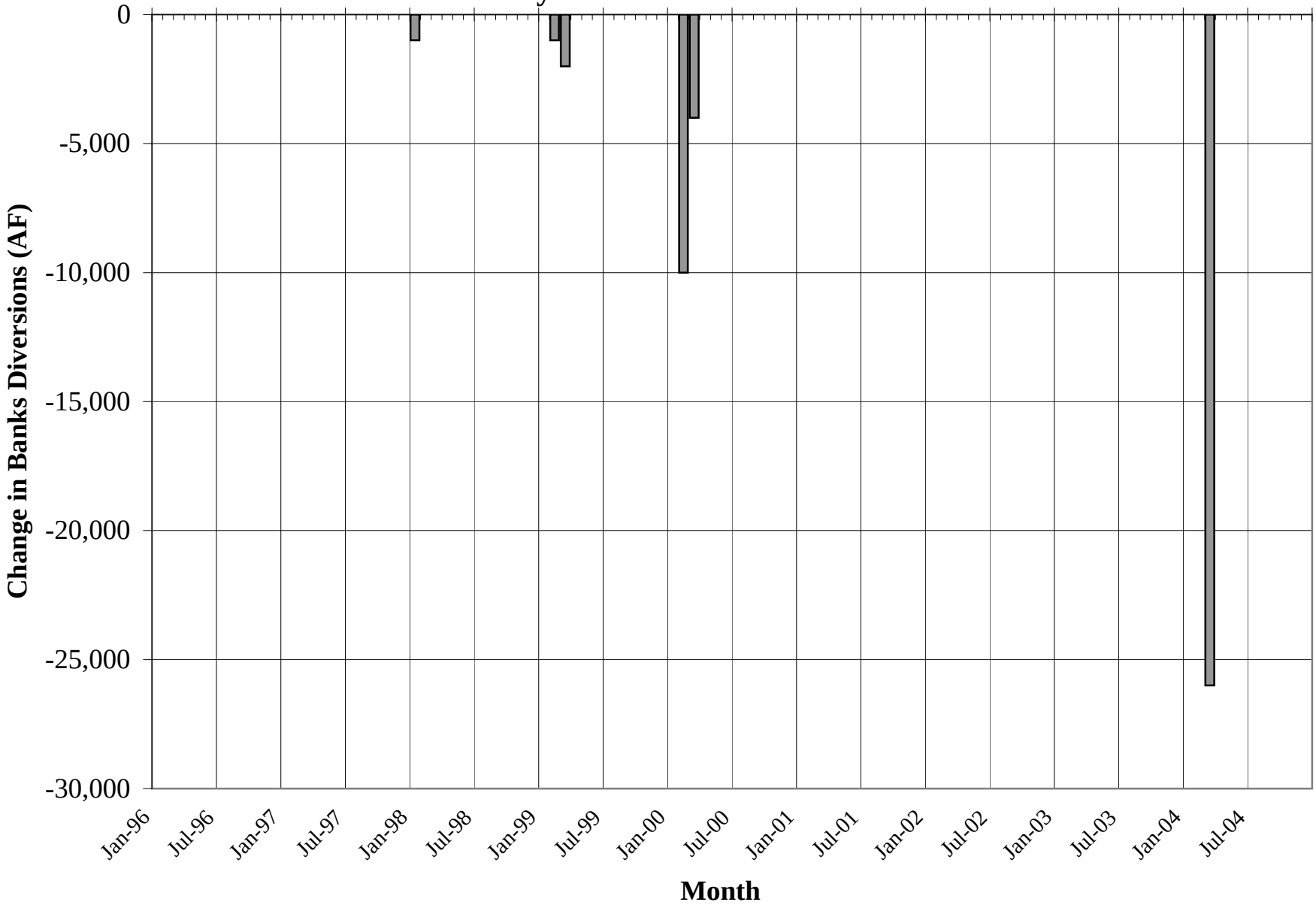
Change in Monthly SWP Banks Pumping Plant Diversions

Monthly Estimated Data: 1996-2004



Monterey Historical Ops Analysis-w stor assump (2007Jun15 Clemm).xls

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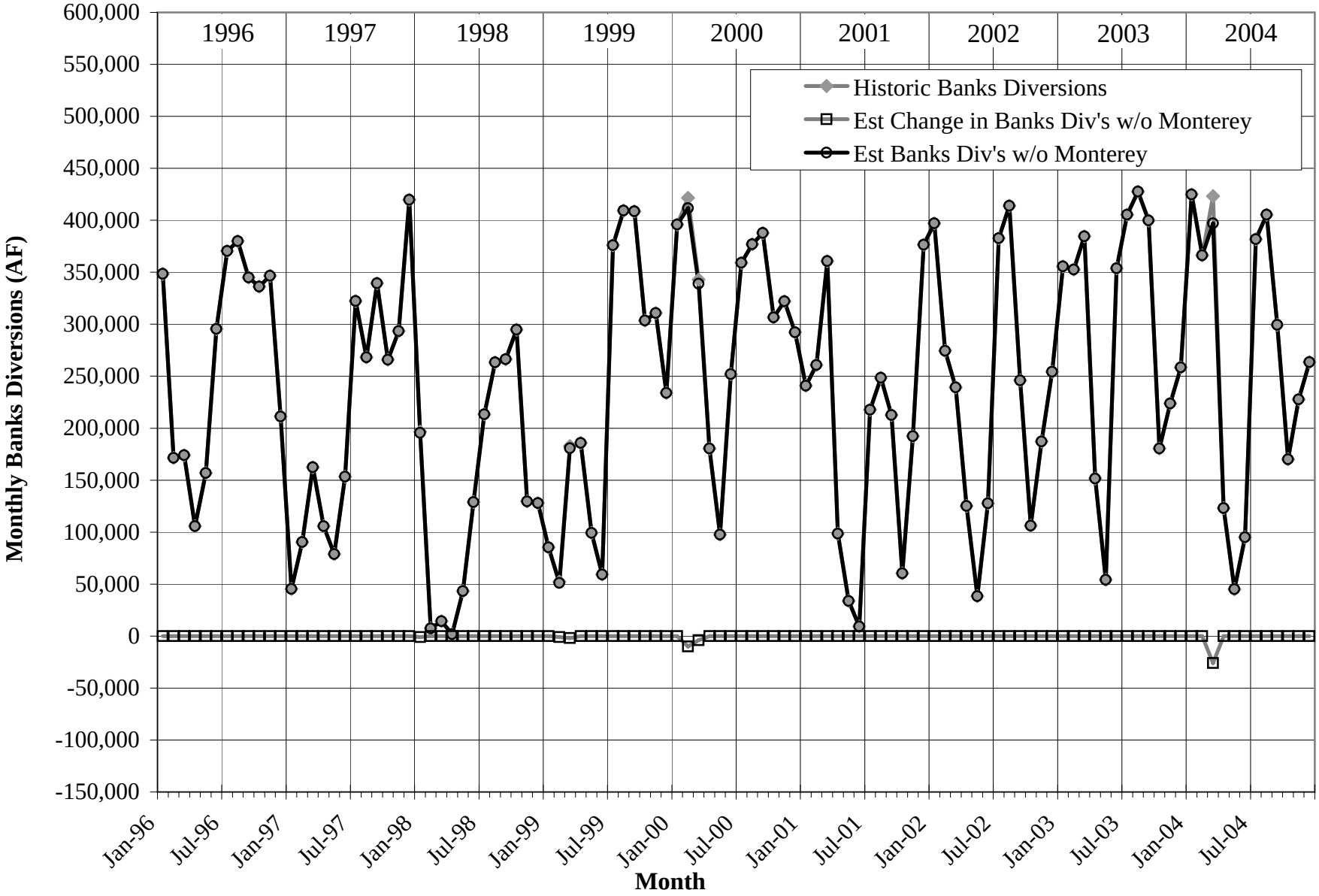
SWP Banks Pumping Plant Diversions
Monthly Historic and Estimated Data: 1996-2004



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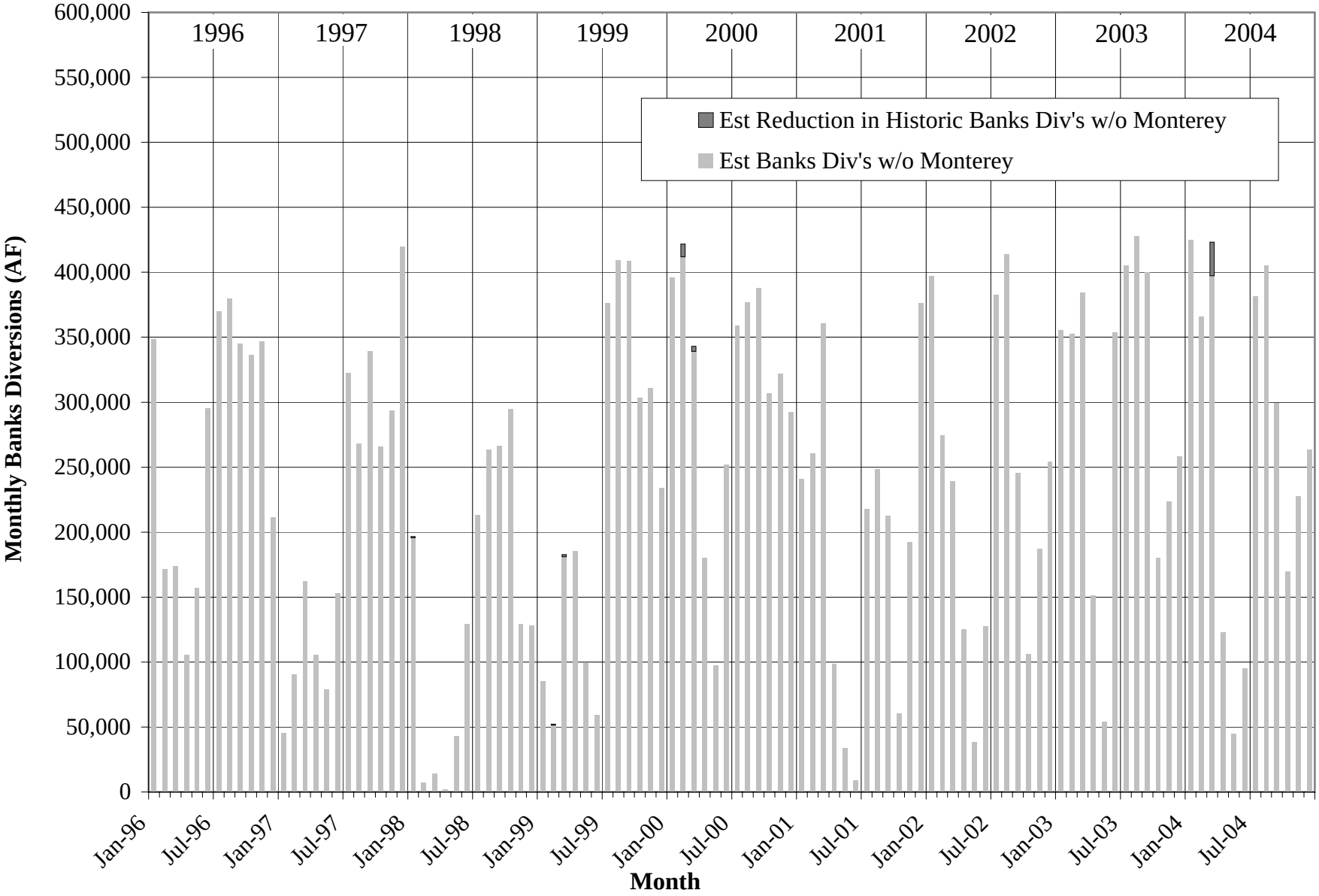
SWP Banks Pumping Plant Diversions
Monthly Historic and Estimated Data: 1996-2004



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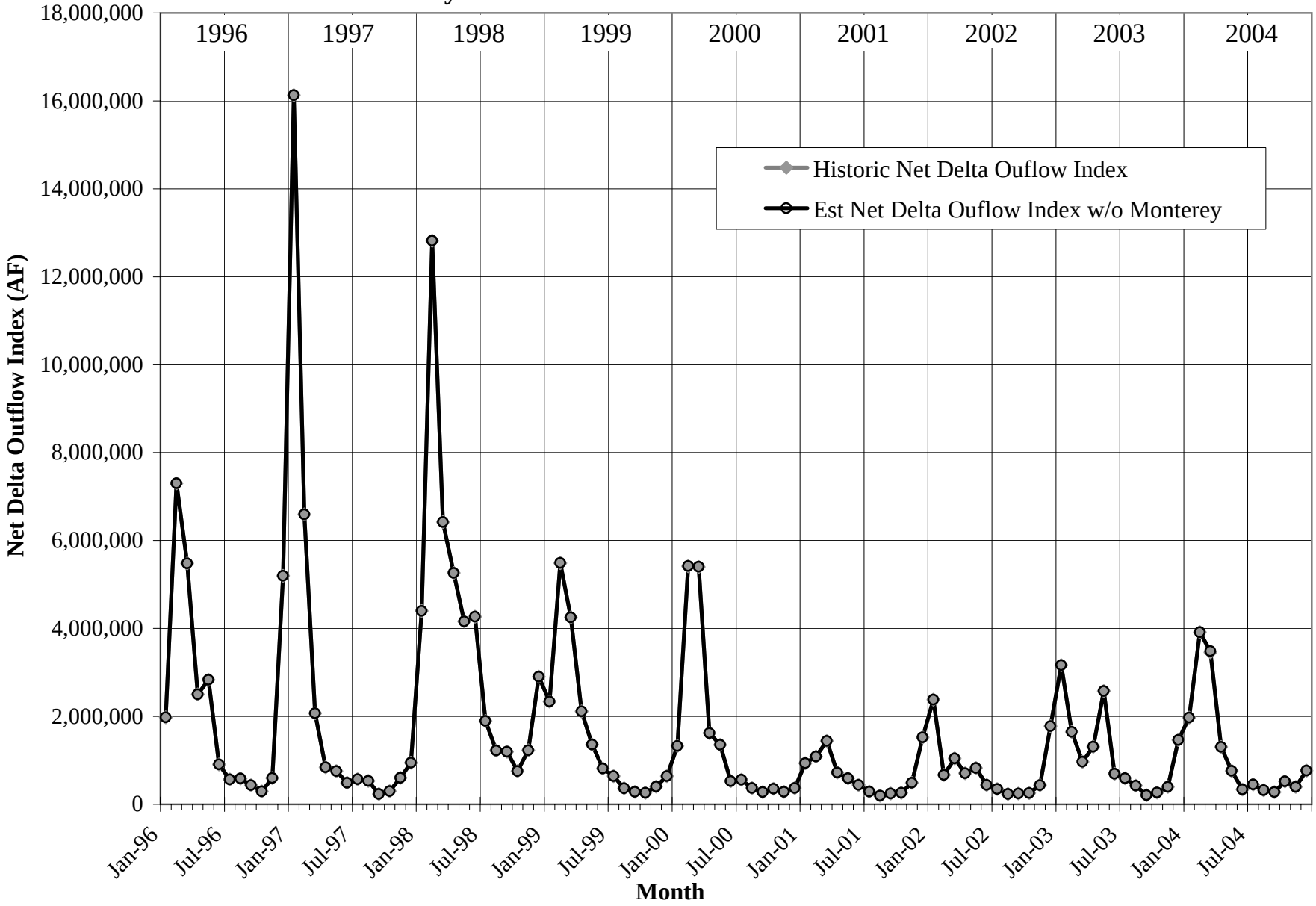
Net Delta Ouflow Index

Monthly Historic and Estimated Data: 1996-2004



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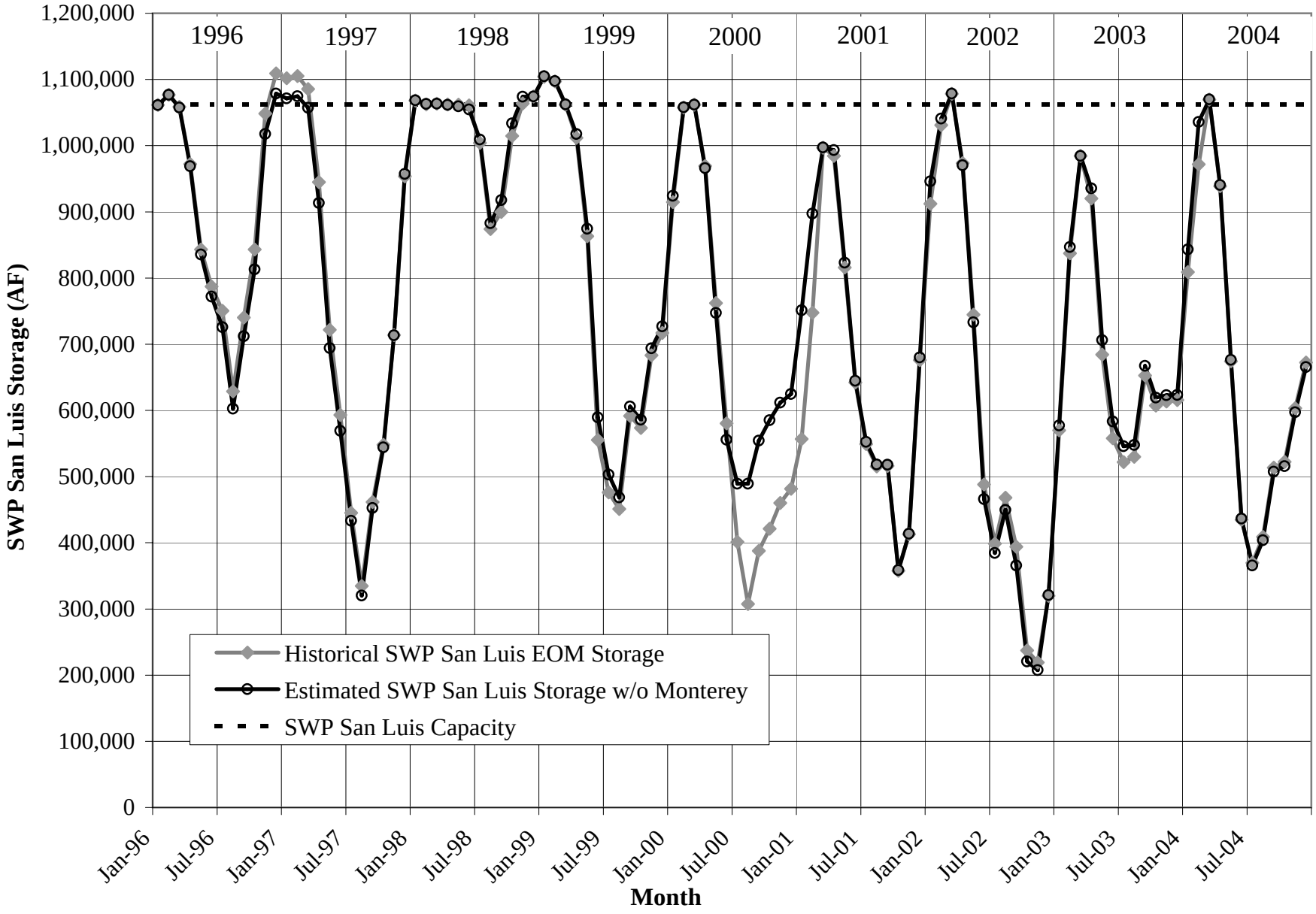
SWP End-Of-Month Storage in San Luis Reservoir



Monterey Historical Ops Analysis-w stor assump (2007Jun15 Clemm).xls

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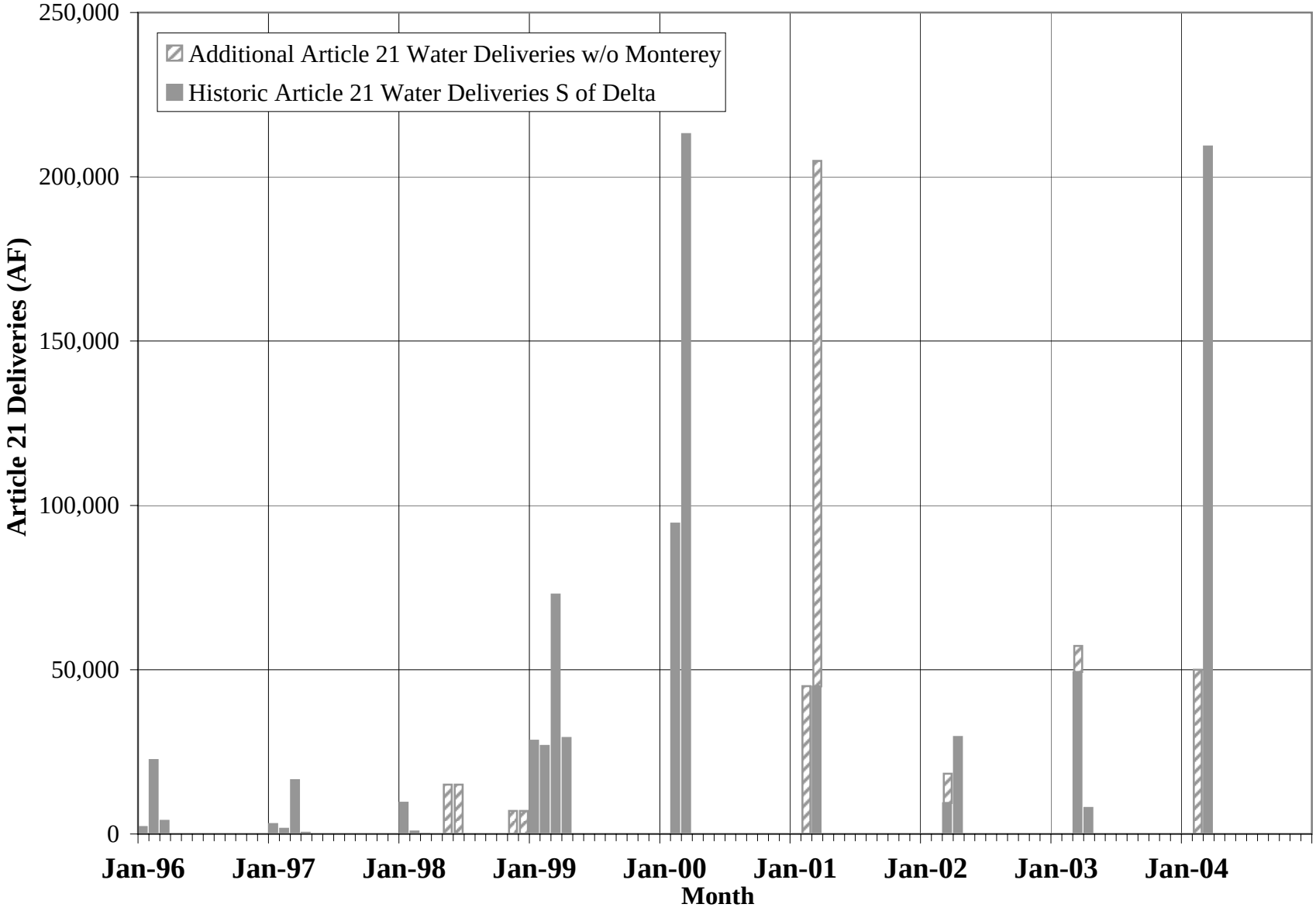
Monthly Article 21 Water Deliveries



Monterey Historical Ops Analysis-w stor assump (2007Jun15 Clemm).xls

Monterey Historical Operations Analysis Without Storage Assumption

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

6/15/2007
N. Clemm

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-96	1,061,411	0	11,565	0	22	0	0	11,587	11,565	0	-22	0	0	0	-22	0	1,061,433	22	- SWP allocation in 1996 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Desert, Coachella), in about the same amount and schedule. - Without Monterey water management program deliveries, SWP San Luis would have been more full by year end. Storage would have been maintained at levels similar to historic storage in November and December, necessitating a reduction in SWP diversions at Banks in November and December.
Feb-96	1,076,912	15,501	9,678	0	1,062	0	0	10,740	9,678	0	-1,062	0	0	0	-1,062	0	1,077,996	1,084	
Mar-96	1,058,720	-18,192	5,829	0	668	0	0	6,497	5,829	0	-668	0	0	0	-668	0	1,060,472	1,752	
Apr-96	972,070	-86,650	1,409	0	0	27,290	0	28,699	1,409	0	-27,290	0	27,000	0	-290	0	974,112	2,042	
May-96	843,235	-128,835	2,103	0	0	19,632	0	21,735	2,103	0	-19,632	0	20,000	0	368	0	844,909	1,674	
Jun-96	787,228	-56,007	255	0	25,000	31,774	0	57,029	255	0	-56,774	0	32,000	0	-24,774	0	813,676	26,448	
Jul-96	750,346	-36,882	2,015	0	20,000	34,774	0	56,789	2,015	0	-54,774	0	35,000	0	-19,774	0	796,568	46,222	
Aug-96	628,876	-121,470	11,456	0	6,200	44,165	0	61,821	11,456	0	-50,365	0	44,000	0	-6,365	0	681,463	52,587	
Sep-96	740,379	111,503	10,695	0	0	17,274	0	27,969	10,695	0	-17,274	0	17,000	0	-274	0	793,240	52,861	
Oct-96	843,170	102,791	9,079	0	0	0	0	9,079	9,079	0	0	0	0	0	0	0	896,031	52,861	
Nov-96	1,048,478	205,308	5,601	0	0	0	0	5,601	5,601	0	0	0	0	0	0	0	1,101,339	52,861	
Dec-96	1,109,158	60,680	13,676	0	2,379	0	0	16,055	13,676	0	-2,379	0	0	0	-2,379	-55,000	1,109,398	240	
Jan-97	1,101,867	-7,291	873	0	114	0	0	987	873	0	-114	0	0	0	-114	0	1,102,221	354	- SWP allocation in 1997 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Without Monterey water management program deliveries, SWP San Luis would have nearly filled in December, and Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Dudley, Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water in December. Their demand would be limited only by their ability to take delivery during December. - Since SWP San Luis did not quite fill by the end of December, there would have been no need to reduce diversions at Banks.
Feb-97	1,105,151	3,284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,105,505	354	
Mar-97	1,085,462	-19,689	1,299	0	4,328	0	0	5,627	1,299	0	-4,328	0	0	0	-4,328	0	1,090,144	4,682	
Apr-97	944,918	-140,544	2,772	0	0	0	0	2,772	2,772	0	0	0	0	0	0	0	949,600	4,682	
May-97	721,579	-223,339	0	0	0	9,505	0	9,505	0	0	-9,505	0	0	0	-9,505	0	735,766	14,187	
Jun-97	593,083	-128,496	0	0	35,000	11,505	0	46,505	0	0	-46,505	0	0	0	-46,505	0	653,775	60,692	
Jul-97	445,203	-147,880	0	0	10,000	12,504	0	22,504	0	0	-22,504	0	0	0	-22,504	0	528,399	83,196	
Aug-97	334,549	-110,654	0	0	0	7,294	0	7,294	0	0	-7,294	0	0	0	-7,294	0	425,039	90,490	
Sep-97	461,649	127,100	2,769	0	0	6,842	0	9,611	2,769	0	-6,842	0	0	0	-6,842	0	558,981	97,332	
Oct-97	547,915	86,266	2,563	0	0	6,298	0	8,861	2,563	0	-6,298	0	0	0	-6,298	0	651,545	103,630	
Nov-97	713,723	165,808	11,165	645	0	4,298	0	16,108	11,165	0	-4,943	0	0	0	-4,943	0	822,296	108,573	
Dec-97	953,588	239,865	13,266	611	2,386	4,298	0	20,561	13,266	0	-7,295	0	0	16,000	8,705	0	1,053,456	99,868	

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

6/15/2007
N. Clemm

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-98	1,068,183	114,595	13,541	0	11,384	0	25,759	50,684	13,541	0	-37,143	26,000	0	0	-11,143	-111,000	1,068,194	11	- SWP allocation in 1998 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Carryover water deliveries in January would have been met by Table A water instead. - Deliveries to Turnback Pool buyers (Desert, Coachella) in May and June would have been met by Art. 21 unscheduled water. Greater efforts would have been made to meet as much Turnback Pool demand as possible in these two months. - Without Monterey water management program deliveries, SWP San Luis would have filled in October, and additional Art. 21 unscheduled water would have been made available that month. - Unmet demands by Turnback Pool buyers (Desert, Coachella) would have resulted in increased demand for Art. 21 unscheduled water. Their demand would be limited by their total take of Turnback Pool water in 1998. - SWP would have surcharged into CVP San Luis storage space in October. SWP diversions at Banks would have been reduced in November and December to limit surcharge amount to historic level by end of December.
Feb-98	1,062,277	-5,906	2,545	0	909	0	0	3,454	2,545	0	-909	0	0	0	-909	0	1,063,197	920	
Mar-98	1,063,334	1,057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,064,254	920	
Apr-98	1,062,227	-1,107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,063,147	920	
May-98	1,061,880	-347	0	0	0	15,000	0	15,000	0	0	-15,000	0	0	20,000	5,000	0	1,057,800	-4,080	
Jun-98	1,060,880	-1,000	0	0	23,800	15,000	0	38,800	0	0	-38,800	0	0	30,000	-8,800	0	1,065,600	4,720	
Jul-98	1,004,087	-56,793	0	0	5,750	15,000	0	20,750	0	0	-20,750	0	0	0	-20,750	0	1,029,557	25,470	
Aug-98	873,994	-130,093	0	0	1,759	15,000	0	16,759	0	0	-16,759	0	0	0	-16,759	0	916,223	42,229	
Sep-98	900,000	26,006	6,391	0	12,575	15,000	0	33,966	6,391	0	-27,575	0	0	0	-27,575	0	969,804	69,804	
Oct-98	1,014,790	114,790	10,685	0	8,732	0	0	19,417	10,685	0	-8,732	0	0	15,000	6,268	0	1,078,326	63,536	
Nov-98	1,063,595	48,805	3,804	0	0	0	0	3,804	3,804	0	0	0	0	10,000	10,000	-40,000	1,077,131	13,536	
Dec-98	1,074,246	10,651	8,264	0	300	0	0	8,564	8,264	0	-300	0	0	0	-300	-13,000	1,075,082	836	
Jan-99	1,103,949	29,703	204	0	2,011	0	0	2,215	204	0	-2,011	0	0	0	-2,011	-2,000	1,104,796	847	- SWP allocation in 1999 was 100%. Since all Table A demand was already met, there would have been no increase in Table A deliveries. - Without Monterey water management program deliveries, SWP diversion reductions at Banks would have been needed from January through March to limit surcharge into CVP San Luis storage space to historic levels. - Deliveries of Art. 21 unscheduled water, already available in January through April, would not have increased because there were no additional unmet demands during those months. - Due to abundant SWP water supplies, scheduled surplus water under pre-Monterey's Art. 21 would have been made available and would have been taken by contractors that otherwise were Turnback Pool buyers (Tulare, Kern, Dudley, Desert, Coachella), in about the same amount and schedule. - While SWP San Luis storage was higher by the end of December, it did not fill. Therefore, at the end of 1999 there would have been no additional Art. 21 unscheduled water made available and no need to reduce diversions at Banks.
Feb-99	1,097,321	-6,628	1,149	0	6,220	0	0	7,369	1,149	0	-6,220	0	0	0	-6,220	-7,000	1,097,388	67	
Mar-99	1,061,800	-35,521	1,022	0	18,841	0	0	19,863	1,022	0	-18,841	0	0	0	-18,841	-18,000	1,062,708	908	
Apr-99	1,011,650	-50,150	2,274	0	18,976	0	0	21,250	2,274	0	-18,976	0	0	0	-18,976	0	1,031,534	19,884	
May-99	863,254	-148,396	347	0	16,024	347	0	16,718	347	0	-16,371	0	500	0	-15,871	0	899,009	35,755	
Jun-99	555,473	-307,781	0	0	54,865	15,217	0	70,082	0	0	-70,082	0	15,000	0	-55,082	0	646,310	90,837	
Jul-99	476,215	-79,258	0	0	3,800	26,600	0	30,400	0	0	-30,400	0	27,000	0	-3,400	0	570,452	94,237	
Aug-99	451,049	-25,166	0	0	0	19,534	0	19,534	0	0	-19,534	0	20,000	0	466	0	544,820	93,771	
Sep-99	591,796	140,747	0	0	2,958	34,503	0	37,461	0	0	-37,461	0	34,000	0	-3,461	0	689,028	97,232	
Oct-99	573,547	-18,249	5,758	0	137	45,573	0	51,468	5,758	0	-45,710	0	44,000	0	-1,710	0	672,489	98,942	
Nov-99	683,127	109,580	10,780	0	4,292	44,173	0	59,245	10,780	0	-48,465	0	44,000	0	-4,465	0	786,534	103,407	
Dec-99	716,955	33,828	3,156	0	4,369	31,490	0	39,015	3,156	0	-35,859	0	31,500	0	-4,359	0	824,721	107,766	

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-00	914,717	197,762	224	0	12,049	0	79,981	92,254	224	0	-92,030	80,000	0	13,000	970	0	1,021,513	106,796	- SWP allocation in 2000 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Carryover water deliveries in January and February would have been Table A deliveries instead. - Since SWP Lan Luis nearly filled in January, Art. 21 unscheduled water would have been made available late that month, with demand limited only by contractors' ability to take delivery during that limited period. - Any Table A delivery increases from April on would have been limited to those contractors that were Turnback Pool buyers (Dudley, KCWA, Tulare, Desert, Coachella) or that used all of their 90% allocation (Co. of Kings). - Without Monterey water management program deliveries, SWP diversions at Banks would have been reduced in February and March to avoid SWP surcharge into CVP San Luis storage space. - SWP San Luis storage would have been higher by the end of 2000 but would not have filled.
Feb-00	1,057,575	142,858	4,733	0	12,068	0	73,114	89,915	4,733	0	-85,182	73,000	0	0	-12,182	-119,000	1,057,553	-22	
Mar-00	1,061,880	4,305	13,212	0	13,210	0	0	26,422	13,212	0	-13,210	0	0	0	-13,210	-13,000	1,062,068	188	
Apr-00	969,343	-92,537	0	0	10,801	10,000	0	20,801	0	0	-20,801	9,300	0	0	-11,501	0	981,032	11,689	
May-00	762,064	-207,279	0	0	0	12,100	0	12,100	0	0	-12,100	17,300	0	0	5,200	0	768,553	6,489	
Jun-00	580,449	-181,615	0	0	27,880	12,290	0	40,170	0	0	-40,170	17,300	0	0	-22,870	0	609,808	29,359	
Jul-00	401,285	-179,164	0	0	38,553	122,832	0	161,385	0	0	-161,385	17,300	0	0	-144,085	0	574,729	173,444	
Aug-00	307,591	-93,694	0	0	24,675	106,860	0	131,535	0	0	-131,535	17,300	0	0	-114,235	0	595,270	287,679	
Sep-00	387,635	80,044	0	0	29,866	2,041	0	31,907	0	0	-31,907	17,300	0	0	-14,607	0	689,921	302,286	
Oct-00	421,304	33,669	0	0	21,119	16,182	0	37,301	0	0	-37,301	17,300	0	0	-20,001	0	743,591	322,287	
Nov-00	460,177	38,873	333	0	15,752	0	0	16,085	333	0	-15,752	12,000	0	0	-3,752	0	786,216	326,039	
Dec-00	481,677	21,500	0	0	5,761	0	0	5,761	0	0	-5,761	8,000	0	0	2,239	0	805,477	323,800	
Jan-01	556,930	75,253	0	0	0	0	131,245	131,245	0	0	-131,245	80,000	0	0	-51,245	0	931,975	375,045	- SWP allocation in 2001 was 39%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, since SWP San Luis filled (after consideration for EWA debt to SWP) in February, that January delivery reduction would instead have been made in February as Art. 21 water. - Unmet demands by Turnback Pool buyers in 2000 (Dudley, KCWA, Tulare, Desert, Coachella) would have resulted in added demand for Art. 21 unscheduled water in March 2001, with demand limited only by their ability to take delivery in those months. - Without Monterey water management program deliveries, SWP diversions at Banks would have been reduced in March to limit SWP San Luis storage to historic levels. - Water otherwise delivered through Turnback Pool would have been available for increased allocation and delivery as additional Table A water from April-December.
Feb-01	747,404	190,474	0	0	0	0	78,523	78,523	0	0	-78,523	78,000	0	175,000	174,477	0	947,972	200,568	
Mar-01	996,764	249,360	8,297	4,710	6,733	0	71,425	91,165	8,297	0	-82,868	72,000	0	160,000	149,132	-51,000	997,200	436	
Apr-01	984,617	-12,147	0	0	0	8,191	0	8,191	0	0	-8,191	1,300	0	0	-6,891	0	991,944	7,327	
May-01	815,834	-168,783	0	0	0	921	0	921	0	0	-921	2,300	0	0	1,379	0	821,782	5,948	
Jun-01	642,248	-173,586	0	0	0	82	0	82	0	0	-82	2,300	0	0	2,218	0	645,978	3,730	
Jul-01	549,059	-93,189	0	0	0	4,948	0	4,948	0	0	-4,948	2,300	0	0	-2,648	0	555,437	6,378	
Aug-01	515,197	-33,862	0	0	0	2,016	0	2,016	0	0	-2,016	2,300	0	0	284	0	521,291	6,094	
Sep-01	516,007	810	0	0	0	947	0	947	0	0	-947	2,300	0	0	1,353	0	520,748	4,741	
Oct-01	357,700	-158,307	0	0	0	395	0	395	0	0	-395	2,300	0	0	1,905	0	360,536	2,836	
Nov-01	412,836	55,136	0	0	0	0	0	0	0	0	0	1,600	0	0	1,600	0	414,072	1,236	
Dec-01	675,995	263,159	0	2,589	0	740	0	3,329	0	0	-3,329	1,100	0	0	-2,229	0	679,460	3,465	

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

6/15/2007
N. Clemm

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-02	912,332	236,337	0	0	4,532	0	109,171	113,703	0	0	-113,703	80,000	0	0	-33,703	0	949,500	37,168	- SWP allocation in 2002 was 70%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January and February would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January's delivery would have been made that month. However, that January delivery reduction would instead have been made in February as additional Table A water. - Without Monterey water management program deliveries, SWP San Luis would have filled slightly sooner, resulting in an added demand for Article 21 water in March. - Water otherwise delivered from April through December to replace flexible storage, to out-of-service area storage, or through the Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-02	1,030,871	118,539	0	0	6,919	0	4,549	11,468	0	0	-11,468	34,000	0	0	22,532	0	1,045,507	14,636	
Mar-02	1,078,173	47,302	2,793	1,190	643	0	13	4,639	2,793	0	-1,846	0	0	16,000	14,154	0	1,078,655	482	
Apr-02	973,457	-104,716	2,991	4,760	1,520	0	0	9,271	2,991	0	-6,280	10,500	0	0	4,220	0	969,719	-3,738	
May-02	744,784	-228,673	0	8,630	0	1,501	0	10,131	0	0	-10,131	19,500	0	0	9,369	0	731,677	-13,107	
Jun-02	488,121	-256,663	0	8,630	0	4,694	0	13,324	0	0	-13,324	19,500	0	0	6,176	0	468,838	-19,283	
Jul-02	398,657	-89,464	0	8,630	0	23,061	0	31,691	0	0	-31,691	19,500	0	0	-12,191	0	391,565	-7,092	
Aug-02	467,946	69,289	0	0	1,000	15,996	0	16,996	0	0	-16,996	19,500	0	0	2,504	0	458,350	-9,596	
Sep-02	393,795	-74,151	0	0	8,332	0	0	8,332	0	0	-8,332	19,500	0	0	11,168	0	373,031	-20,764	
Oct-02	237,482	-156,313	0	16,468	12,819	0	0	29,287	0	0	-29,287	19,500	0	0	-9,787	0	226,505	-10,977	
Nov-02	219,224	-18,258	0	13,342	3,408	0	0	16,750	0	0	-16,750	13,500	0	0	-3,250	0	211,497	-7,727	
Dec-02	319,803	100,579	0	13,342	4,441	0	0	17,783	0	0	-17,783	9,000	0	0	-8,783	0	320,859	1,056	
Jan-03	569,838	250,035	0	0	5,800	0	9,486	15,286	0	0	-15,286	9,000	0	0	-6,286	0	577,180	7,342	- SWP allocation in 2003 was 90%. Since all Table A demand was not met, allocations would have been increased, probably to 100%. - Carryover deliveries in January-March would have been Table A deliveries instead. - The increase in SWP San Luis storage compared to historic at the end of February would have been an added Art. 21 unscheduled water delivery in March. Note that SWP San Luis was "full" in March, after consideration of EWA debt to SWP. - Water otherwise delivered to out-of-service area storage from April-December or through the Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December. - Any Table A delivery increase from April on would have been limited to those contractors that purchased from the Turnback Pool (Zone 7, Alameda, Santa Clara, Oak Flat, Co. Kings, Dudley, KCWA, Tulare, AVEK, Castaic, Desert, Coachella, MWD) or dry year purchase program (Dudley, KCWA), or that used all of their 90% allocation.
Feb-03	837,137	267,299	0	0	3,400	0	25,521	28,921	0	0	-28,921	26,000	0	0	-2,921	0	847,400	10,263	
Mar-03	984,556	147,419	4,632	0	0	0	40,577	45,209	4,632	0	-40,577	41,000	0	10,000	10,423	0	984,396	-160	
Apr-03	920,243	-64,313	0	0	0	16,006	0	16,006	0	0	-16,006	9,800	0	0	-6,206	0	926,289	6,046	
May-03	684,343	-235,900	0	0	15,477	0	0	15,477	0	0	-15,477	18,200	0	0	2,723	0	687,666	3,323	
Jun-03	557,749	-126,594	0	0	40,927	4,373	0	45,300	0	0	-45,300	18,200	0	0	-27,100	0	588,172	30,423	
Jul-03	521,880	-35,869	0	0	13,290	9,339	0	22,629	0	0	-22,629	18,200	0	0	-4,429	0	556,732	34,852	
Aug-03	529,944	8,064	0	0	19,706	52	0	19,758	0	0	-19,758	18,200	0	0	-1,558	0	566,354	36,410	
Sep-03	652,744	122,800	0	0	10,900	0	0	10,900	0	0	-10,900	18,200	0	0	7,300	0	681,854	29,110	
Oct-03	607,364	-45,380	2,413	0	5,020	0	0	7,433	2,413	0	-5,020	18,200	0	0	13,180	0	623,294	15,930	
Nov-03	613,477	6,113	16,789	0	675	0	0	17,464	16,789	0	-675	12,600	0	0	11,925	0	617,482	4,005	
Dec-03	615,769	2,292	16,190	0	4,220	0	0	20,410	16,190	0	-4,220	8,400	0	0	4,180	0	615,594	-175	

Effect of Monterey Amendment Water Management Programs
On SWP Deliveries and Operations

6/15/2007
N. Clemm

Month	Historical SWP Operations and SWP Water Deliveries (AF): SWP San Luis Storage: End-of-Month Storage	Historical: SWP San Luis Storage: Change in Storage from Previous Month	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries to Kern Water Bank (for Kern Co. Participants)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Flexible Storage Replacement of Previous-Year(s) Withdrawal (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Storage Outside Servie Area (all SWP water types)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Turnback Pool Water	Historical: SWP Water Deliveries Under Monterey Water Management Programs: SWP Water Deliveries Under Article 56: Carryover Water (delivered to service area)	Historical: SWP Water Deliveries Under Monterey Water Management Programs: Total Water Deliveries Under Monterey Water Mgmt Programs	Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs (AF): Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to KWB That Could Have Been Stored in Other Kern Fan Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Deliveries to Storage Outside Serv Area That Could Have Been Stored in Other Programs	Estimated: Change in SWP Water Del's Related to Water Mgmt Progs: Total Change in SWP Deliveries Under Water Mgmt Programs	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Table A Deliveries (for non-Retired Table A Amts)	Estimated: Resulting Change in Other SWP Water Deliveries: Article 21 Surplus Water Deliveries	Estimated: Resulting Change in Other SWP Water Deliveries: Additional Article 21 Unscheduled Water Deliveries	Estimated: Total Change in all SWP Deliveries	Estimated: Change in Diversions at Banks Pumping Plant	Estimated: SWP San Luis Storage: End-of-Month Storage	Estimated: SWP San Luis Storage: Change in Storage Compared to Historic	Assumptions About Estimated SWP Operations and Deliveries Without Monterey Amendment Water Management Programs
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
---	Actual	= col 2:(row *n*) - col 2:(row *n-1*)	Actual	Actual	Actual	Actual	Actual	= sum(cols 4 thru 8)	Calculated	Calculated	= - (cols 9 - 10 - 11)	Estimated	Estimated	Estimated	= sum(cols 12 thru 15)	Estimated	=col 18:(n-1) + col 3 - col 16 + col 17	= col 18 - col 2	
Jan-04	809,033	193,264	0	0	6,543	0	120,099	126,642	0	0	-126,642	100,000	0	0	-26,642	0	835,500	26,467	- SWP allocation in 2004 was 65%. Since all Table A demand was not met, allocations would have been increased. - Carryover deliveries in January-March would have been Table A deliveries instead. Given the low initial allocation and without the fear of losing carryover, not all of January and February's delivery would have been made as Table A water. However, since SWP San Luis storage was nearing full in February, any January and February deliveries not made as Table A water would instead have been made in February as Art. 21 unscheduled water and in March as added Table A water. - Without Monterey water management program deliveries, SWP San Luis would have nearly filled in February, and Art. 21 unscheduled water would have been made available that month, resulting in an added demand for Art. 21 unscheduled water in February. - Water otherwise delivered to out-of-service area storage from April-December or through Turnback Pool would have allowed increased allocations and been delivered as additional Table A water from April-December.
Feb-04	971,719	162,686	1,914	0	31,004	0	148,915	181,833	1,914	0	-179,919	100,000	0	50,000	-29,919	0	1,028,105	56,386	
Mar-04	1,069,446	97,727	14,494	0	6,372	0	6,883	27,749	14,494	0	-13,255	50,000	0	0	36,745	-20,000	1,069,087	-359	
Apr-04	938,544	-130,902	0	0	0	4,815	0	4,815	0	0	-4,815	1,500	0	0	-3,315	0	941,500	2,956	
May-04	674,017	-264,527	0	0	0	5,075	0	5,075	0	0	-5,075	2,700	0	0	-2,375	0	679,348	5,331	
Jun-04	434,812	-239,205	0	0	0	6,402	0	6,402	0	0	-6,402	2,700	0	0	-3,702	0	443,845	9,033	
Jul-04	369,739	-65,073	0	0	2,000	291	0	2,291	0	0	-2,291	2,700	0	0	409	0	378,363	8,624	
Aug-04	408,702	38,963	0	0	2,000	657	0	2,657	0	0	-2,657	2,700	0	0	43	0	417,283	8,581	
Sep-04	513,536	104,834	0	0	0	0	0	0	0	0	0	2,700	0	0	2,700	0	519,417	5,881	
Oct-04	522,176	8,640	0	0	0	0	0	0	0	0	0	2,700	0	0	2,700	0	525,357	3,181	
Nov-04	603,410	81,234	0	0	0	0	0	0	0	0	0	1,900	0	0	1,900	0	604,691	1,281	
Dec-04	672,181	68,771	0	0	0	0	0	0	0	0	0	1,300	0	0	1,300	0	672,162	-19	
1996-2004																			
1996-2003			**260,595**	**83,547**	**686,357**	**905,457**	**649,364**	**2,585,320**	**260,595**	**0**	**-2,324,725**	**1,039,900**	**391,000**	**465,000**	**-428,825**	**-429,000**			
Total			**277,003**	**83,547**	**734,276**	**922,697**	**925,261**	**2,942,784**	**277,003**	**0**	**-2,665,781**	**1,310,800**	**391,000**	**515,000**	**-448,981**	**-449,000**			
Annual Average			**30,778**	**9,283**	**81,586**	**102,522**	**102,807**	**326,976**	**30,778**	**0**	**-296,198**	**145,644**	**43,444**	**57,222**	**-49,887**	**-49,889**			

EFFECTS OF MONTEREY AMENDMENT WATER MANAGEMENT PROVISIONS ON BANKS DIVERSIONS

Year	Month	Actual Net Delta Ouflow Index[1] (AF)	Actual Banks Diversions[2] (AF)	Change in Banks Diversions without Monterey (AF)
1996	December	5,198,059	211,225	-55,000
1998	January	4,399,140	196,584	-111,000
1998	November	1,227,905	129,489	-40,000
1998	December	2,904,722	128,026	-13,000
1999	January	2,337,832	85,366	-2,000
1999	February	5,487,282	52,203	-7,000
1999	March	4,249,136	182,800	-18,000
2000	February	5,412,226	421,683	-119,000
2000	March	5,400,323	343,011	-13,000
2001	March	1,439,070	360,751	-51,000
2004	March	3,459,039	423,147	-20,000
96-04 Total				-449,000

1. Source: IEP's Dayflow calculations (http://iep.water.ca.gov/dayflow/output/index.html).
2. Source: DWR Division of Operations and Maintenance Operations Control Office annual and monthly reports of operations (http://wwwoco.water.ca.gov/inde

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	KWB DELIVERIES				FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55									
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water					
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR
Jan-96	11,587	11,565	0	11,565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0
Feb-96	10,740	9,678	0	9,678	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,062	0	0	0
Mar-96	6,497	5,829	0	5,829	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	668	0	0	0
Apr-96	1,409	1,409	0	1,409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-96	2,103	2,103	0	2,103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-96	255	255	0	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-96	2,015	2,015	0	2,015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-96	11,456	11,456	0	11,456	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-96	10,695	10,695	0	10,695	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-96	9,079	9,079	0	9,079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-96	5,601	5,601	0	5,601	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-96	16,055	13,676	0	13,676	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**87,492**	**83,361**	**0**	**83,361**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,752**	**0**	**0**	**0**
Jan-97	987	873	0	873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0
Feb-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-97	5,627	1,299	0	1,299	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,328	0	0	0
Apr-97	2,772	2,772	0	2,772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-97	2,769	2,769	0	2,769	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-97	2,563	2,563	0	2,563	0	0	0	0	0	0	0	0	0	0	0	0	0	1,600	0	0	1,600	0	0	0	0	0	0
Nov-97	11,165	11,165	0	11,165	0	0	0	0	0	0	645	0	645	0	645	0	645	0	0	0	0	0	0	0	0	0	0
Dec-97	14,166	13,266	0	13,266	0	0	0	0	0	0	611	0	611	0	611	0	611	0	0	0	0	0	0	0	0	0	0
Total	**40,049**	**34,707**	**0**	**34,707**	**0**	**0**	**0**	**0**	**0**	**0**	**1,256**	**0**	**1,256**	**0**	**1,256**	**0**	**1,256**	**1,600**	**0**	**0**	**1,600**	**0**	**0**	**4,442**	**0**	**0**	**0**
Jan-98	13,952	13,541	0	13,541	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	411	0	0	0
Feb-98	3,118	2,545	0	2,545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	573	0	0	0
Mar-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-98	6,447	6,391	0	6,391	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-98	15,270	10,685	0	10,685	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-98	3,804	3,804	0	3,804	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-98	8,564	8,264	0	8,264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**51,155**	**45,230**	**0**	**45,230**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**984**	**0**	**0**	**0**
Jan-99	1,525	204	0	204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	0	1,321	0	600	0
Feb-99	1,149	1,149	0	1,149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	830	0	0	0	5,390	0
Mar-99	1,022	1,022	0	1,022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,140	0	0	0	7,620	2,040
Apr-99	2,274	2,274	0	2,274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	1,870	870
May-99	347	347	0	347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-99	5,758	5,758	0	5,758	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-99	10,780	10,780	0	10,780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-99	3,156	3,156	0	3,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**26,011**	**24,690**	**0**	**24,690**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2,380**	**0**	**1,321**	**0**	**15,480**	**2,910**
Jan-00	224	224	0	224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-00	4,896	4,733	0	4,733	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	880	0	163	0	5,210	1,340
Mar-00	14,002	13,212	0	13,212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,500	0	790	0	8,520	2,400
Apr-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	0	0	0	0	3,471	3,471	0	3,471	3,471	0	0	0	0	0	0	0	0	0	0	0
Jul-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	KWB DELIVERIES				FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55									
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water					
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR
Oct-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	900	0	900	0	0	0	0	0	0
Nov-00	333	333	0	333	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**19,455**	**18,502**	**0**	**18,502**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,471**	**3,471**	**0**	**3,471**	**3,471**	**0**	**0**	**900**	**0**	**900**	**2,380**	**0**	**953**	**0**	**13,730**	**3,740**
Jan-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-01	10,030	8,297	0	8,297	0	4,710	4,710	0	0	0	0	0	0	0	4,710	0	4,710	0	0	0	0	0	0	933	0	0	0
Apr-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0	0	0	2,589	2,589	0	2,589	0	0	0	0	0	0	0	0	0	0
Total	**10,030**	**8,297**	**0**	**8,297**	**0**	**4,710**	**4,710**	**0**	**0**	**0**	**0**	**0**	**0**	**2,589**	**7,299**	**0**	**7,299**	**0**	**0**	**0**	**0**	**0**	**0**	**933**	**0**	**0**	**0**
Jan-02	0	-140	0	-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-02	3,039	2,793	0	2,793	0	1,190	1,190	0	0	0	0	0	0	0	1,190	0	1,190	0	0	0	0	0	0	246	0	0	397
Apr-02	3,341	2,991	0	2,991	0	4,760	4,760	0	0	0	0	0	0	0	4,760	0	4,760	0	0	0	0	83	0	350	0	0	1,087
May-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0
Jun-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0
Jul-02	0	0	0	0	0	0	0	0	0	0	0	8,630	8,630	0	8,630	0	8,630	0	0	0	0	0	0	0	0	0	0
Aug-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-02	0	0	0	0	0	0	0	0	0	0	0	16,468	16,468	0	16,468	0	16,468	0	0	0	0	0	0	0	0	0	0
Nov-02	0	0	0	0	0	0	0	0	0	0	0	13,342	13,342	0	13,342	0	13,342	0	0	0	0	0	0	0	0	0	0
Dec-02	0	0	0	0	0	0	0	0	0	0	0	13,342	13,342	0	13,342	0	13,342	0	0	0	0	0	0	0	0	0	0
Total	**6,380**	**5,644**	**0**	**5,644**	**0**	**5,950**	**5,950**	**0**	**0**	**0**	**0**	**69,042**	**69,042**	**0**	**74,992**	**0**	**74,992**	**0**	**0**	**0**	**0**	**83**	**0**	**596**	**0**	**0**	**1,484**
Jan-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-03	0	0	0	0	0	0	0	0	7,100	7,100	0	0	0	0	7,100	7,100	0	0	0	0	0	0	0	0	0	0	0
Mar-03	4,632	4,632	0	4,632	0	13,139	13,139	0	38,500	38,500	0	0	0	0	51,639	51,639	0	0	0	0	0	0	0	0	0	0	0
Apr-03	0	0	0	0	0	4,483	4,483	0	0	0	0	32,575	32,575	0	37,058	37,058	0	0	0	0	0	0	0	0	0	0	0
May-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-03	2,413	2,413	0	2,413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,100	3,100	0	0	0	0	0	0
Nov-03	16,789	16,789	0	16,789	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-03	16,540	16,190	0	16,190	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**40,374**	**40,024**	**0**	**40,024**	**0**	**17,622**	**17,622**	**0**	**45,600**	**45,600**	**0**	**32,575**	**32,575**	**0**	**95,797**	**95,797**	**0**	**0**	**0**	**3,100**	**3,100**	**0**	**0**	**0**	**0**	**0**	**0**
Jan-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb-04	1,914	1,914	0	1,914	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-04	16,151	14,494	0	14,494	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,657	0	0	0
Apr-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-04	0	0	0	0	0	0	0	0	0	0	0	50,061	50,061	0	50,061	50,061	0	0	0	0	0	0	0	0	0	0	0
Jun-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,100	3,100	0	0	0	0	0	0
Nov-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**18,065**	**16,408**	**0**	**16,408**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**50,061**	**50,061**	**0**	**50,061**	**50,061**	**0**	**0**	**0**	**3,100**	**3,100**	**0**	**0**	**1,657**	**0**	**0**	**0**
Jan-05	29,486	28,593	0	28,593	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	845	0	0	0
Feb-05	39,919	37,596	0	37,596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,323	0	0	0
Mar-05	50,106	46,729	0	46,729	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	0	0	0
Apr-05	49,900	46,946	0	46,946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,954	0	0	0
May-05	14,278	13,629	0	13,629	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649	0	764	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	KWB DELIVERIES				FLEXIBLE STORAGE REPLACEMENT DELIVERIES UNDER ARTICLE 54													DELIVERIES FROM NOD UNDER ARTICLE 55									
	All SWP Water Delivered	Del'd for Kern Co. Particpts	Could Not Have Stored	Could've Stored Elsewhere	Article 21 Water			Article 56 Carryover			Table A Water			Local Supply	Total	Replaced Same Yr as Withdrl	Total that Could Impact Supply	Non-Project Water from N of Delta				Article 21 Water					
					CLWA	MWD	Total	CLWA	MWD	Total	CLWA	MWD	Total	CLWA				MWA	MWD	SCVWD	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*
Source / Formula	KCWA	= cols 1 - 24 - 31 - 38	KCWA Analysis	= cols 2 - 3	DWR	DWR	= cols 5 + 6	DWR	DWR	= cols 8 + 9	DWR	DWR	= cols 11 + 12	DWR	= cols 7 + 10 + 13 + 14	DWR	= cols 15 -16	DWR	DWR	DWR	= cols 18 + 19 + 20	DWR	DWR	DWR	DWR	DWR	DWR
Jun-05	30,897	29,833	0	29,833	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,064	0	2,351	0
Jul-05	234	234	0	234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug-05	11,025	11,025	0	11,025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep-05	25,520	25,520	0	25,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-05	32,256	30,756	0	30,756	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-05	21,818	20,818	0	20,818	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-05	21,979	20,045	0	20,045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,934	0	0	0
Total	**327,418**	**311,724**	**0**	**311,724**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,146**	**0**	**3,115**	**0**
Totals																											
96-03	**280,946**	**260,455**	**0**	**260,455**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**105,088**	**106,344**	**2,589**	**182,815**	**99,268**	**83,547**	**1,600**	**900**	**3,100**	**5,600**	**4,843**	**0**	**10,981**	**0**	**29,210**	**8,134**
96-04	**299,011**	**276,863**	**0**	**276,863**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**155,149**	**156,405**	**2,589**	**232,876**	**149,329**	**83,547**	**1,600**	**900**	**6,200**	**8,700**	**4,843**	**0**	**12,638**	**0**	**29,210**	**8,134**
96-05	**626,429**	**588,587**	**0**	**588,587**	**0**	**28,282**	**28,282**	**0**	**45,600**	**45,600**	**1,256**	**155,149**	**156,405**	**2,589**	**232,876**	**149,329**	**83,547**	**1,600**	**900**	**6,200**	**8,700**	**4,843**	**0**	**25,784**	**0**	**32,325**	**8,134**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																									
	Storage Outside Service Area (all water types)																				Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)																Could Not Have Stored	Could Have Been Stored in Other Existing Programs								
		Article 56 Carryover							Table A and other SWP Water							Total						Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total						
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
Source / Formula	= sum(cols 22 thru 27)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jan-96	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0
Feb-96	1,062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,062	0	0	0	0	0	0	0	0	0	0
Mar-96	668	0	0	0	0	0	0	0	0	0	0	0	0	0	0	668	0	0	0	0	0	0	0	0	0	0
Apr-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27,290	0	0	0	0	0
May-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,632	0	0	0	0	0
Jun-96	0	0	0	0	0	0	0	0	0	0	0	0	25,000	0	25,000	25,000	0	0	25,000	25,000	31,774	0	0	0	0	0
Jul-96	0	0	0	0	0	0	0	0	0	0	0	0	20,000	0	20,000	20,000	0	0	20,000	20,000	34,774	0	0	0	0	0
Aug-96	0	0	0	0	0	0	0	0	6,200	0	0	0	0	0	6,200	6,200	0	0	0	0	44,165	0	0	0	0	0
Sep-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,274	0	0	0	0	0
Oct-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-96	0	0	0	0	0	0	0	0	0	0	2,379	0	0	0	2,379	2,379	0	0	0	0	0	0	0	0	0	0
Total	**1,752**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,200**	**0**	**2,379**	**0**	**45,000**	**0**	**53,579**	**55,331**	**0**	**0**	**45,000**	**45,000**	**174,909**	**0**	**0**	**0**	**0**	**0**
Jan-97	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114	0	0	0	0	0	0	0	0	0	0
Feb-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar-97	4,328	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,328	0	0	0	0	0	0	0	0	0	0
Apr-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,505	0	0	0	0	0
Jun-97	0	0	0	0	0	0	0	0	0	0	0	0	35,000	0	35,000	35,000	0	0	35,000	35,000	11,505	0	0	0	0	0
Jul-97	0	0	0	0	0	0	0	0	10,000	0	0	0	0	0	10,000	10,000	0	0	0	0	12,504	0	0	0	0	0
Aug-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,294	0	0	0	0	0
Sep-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,842	0	0	0	0	0
Oct-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,298	0	0	0	0	0
Nov-97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,298	0	0	0	0	0
Dec-97	0	0	0	0	0	0	0	0	0	0	900	1,486	0	0	2,386	2,386	0	1,486	0	1,486	4,298	0	0	0	0	0
Total	**4,442**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10,000**	**0**	**900**	**1,486**	**35,000**	**0**	**47,386**	**51,828**	**0**	**1,486**	**35,000**	**36,486**	**62,544**	**0**	**0**	**0**	**0**	**0**
Jan-98	411	0	0	0	8,797	0	0	8,797	0	0	0	2,176	0	0	2,176	11,384	0	10,973	0	10,973	0	34,963	407	8,797	0	25,759
Feb-98	573	0	0	0	0	0	0	0	0	0	0	336	0	0	336	909	0	336	0	336	0	0	0	0	0	0
Mar-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,000	0	0	0	0	0
Jun-98	0	0	0	0	0	0	0	0	0	0	0	0	23,800	0	23,800	23,800	0	0	23,800	23,800	15,000	0	0	0	0	0
Jul-98	0	0	0	0	0	0	0	0	3,780	0	0	0	0	1,970	5,750	5,750	0	0	0	0	15,000	0	0	0	0	0
Aug-98	0	0	0	0	0	0	0	0	0	0	0	1,759	0	0	1,759	1,759	0	1,759	0	1,759	15,000	0	0	0	0	0
Sep-98	0	0	0	0	0	0	0	0	0	0	56	12,519	0	0	12,575	12,575	0	12,519	0	12,519	15,000	0	0	0	0	0
Oct-98	0	0	0	0	0	0	0	0	0	0	4,585	4,147	0	0	8,732	8,732	0	4,147	0	4,147	0	0	0	0	0	0
Nov-98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-98	0	0	0	0	0	0	0	0	0	0	300	0	0	0	300	300	0	0	0	0	0	0	0	0	0	0
Total	**984**	**0**	**0**	**0**	**8,797**	**0**	**0**	**8,797**	**3,780**	**0**	**4,941**	**20,937**	**23,800**	**1,970**	**55,428**	**65,209**	**0**	**29,734**	**23,800**	**53,534**	**75,000**	**34,963**	**407**	**8,797**	**0**	**25,759**
Jan-99	2,011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,011	0	0	600	600	0	0	0	0	0	0
Feb-99	6,220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,220	0	0	5,390	5,390	0	0	0	0	0	0
Mar-99	10,800	0	0	0	0	0	0	0	0	0	0	8,041	0	0	8,041	18,841	0	8,041	7,620	15,661	0	0	0	0	0	0
Apr-99	3,060	0	0	0	0	0	0	0	0	0	0	15,916	0	0	15,916	18,976	6,098	9,818	1,870	11,688	0	0	0	0	0	0
May-99	0	0	0	0	0	0	0	0	0	0	0	16,024	0	0	16,024	16,024	9,839	6,185	0	6,185	347	0	0	0	0	0
Jun-99	0	0	0	0	0	0	0	0	12,620	0	0	10,425	14,520	17,300	54,865	54,865	0	10,425	14,520	24,945	15,217	0	0	0	0	0
Jul-99	0	0	0	0	0	0	0	0	1,100	0	0	0	0	2,700	3,800	3,800	0	0	0	0	26,600	0	0	0	0	0
Aug-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,534	0	0	0	0	0
Sep-99	0	0	0	0	0	0	0	0	0	0	0	2,958	0	0	2,958	2,958	0	2,958	0	2,958	34,503	0	0	0	0	0
Oct-99	0	0	0	0	0	0	0	0	0	0	0	137	0	0	137	137	0	137	0	137	45,573	0	0	0	0	0
Nov-99	0	0	0	0	0	0	0	0	0	0	0	4,292	0	0	4,292	4,292	0	4,292	0	4,292	44,173	0	0	0	0	0
Dec-99	0	0	0	0	0	0	0	0	0	0	0	4,369	0	0	4,369	4,369	0	4,369	0	4,369	31,490	0	0	0	0	0
Total	**22,091**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13,720**	**0**	**0**	**62,162**	**14,520**	**20,000**	**110,402**	**132,493**	**15,937**	**46,225**	**30,000**	**76,225**	**217,437**	**0**	**0**	**0**	**0**	**0**
Jan-00	0	0	0	0	12,049	0	0	12,049	0	0	0	0	0		0	12,049	0	12,049	0	12,049	0	93,447	1,417	12,049	0	79,981
Feb-00	7,593	0	0	0	4,475	0	0	4,475	0	0	0	0	0	0	0	12,068	0	4,475	5,210	9,685	0	77,589	0	4,475	0	73,114
Mar-00	13,210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,210	0	0	8,520	8,520	0	0	0	0	0	0
Apr-00	0	0	0	0	0	0	0	0	0	0	0	10,801	0	0	10,801	10,801	0	10,801	0	10,801	10,000	0	0	0	0	0
May-00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,100	0	0	0	0	0
Jun-00	0	0	0	0	0	0	0	0	3,750	0	0	21,130	0	3,000	27,880	27,880	0	21,130	0	21,130	12,290	0	0	0	0	0
Jul-00	0	0	0	0	0	0	0	0	5,750	0	0	24,803	0	8,000	38,553	38,553	0	24,803	0	24,803	122,832	0	0	0	0	0
Aug-00	0	0	0	0	0	0	0	0	0	0	0	16,675	0	8,000	24,675	24,675	0	16,675	0	16,675	106,860	0	0	0	0	0
Sep-00	0	0	0	0	0	0	0	0	1,500	0	0	17,166	10,000	1,200	29,866	29,866	0	17,166	10,000	27,166	2,041	0	0	0	0	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																									
	Storage Outside Service Area (all water types)																					Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)																Could Not Have Stored	Could Have Been Stored in Other Existing Programs			Turnbk Pool					
		Article 56 Carryover							Table A and other SWP Water							Total						Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total						
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
Source / Formula	= sum(cols 22 thru 27)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Oct-00	0	0	0	0	0	0	0	0	0	0	0	21,119	0	0	21,119	21,119	0	21,119	0	21,119	16,182	0	0	0	0	0
Nov-00	0	0	0	0	0	0	0	0	0	0	0	15,752	0	0	15,752	15,752	0	15,752	0	15,752	0	0	0	0	0	0
Dec-00	0	0	0	0	0	0	0	0	0	0	0	5,761	0	0	5,761	5,761	0	5,761	0	5,761	0	0	0	0	0	0
Total	**20,803**	**0**	**0**	**0**	**16,524**	**0**	**0**	**16,524**	**11,000**	**0**	**0**	**133,207**	**10,000**	**20,200**	**174,407**	**211,734**	**0**	**149,731**	**23,730**	**173,461**	**282,305**	**171,036**	**1,417**	**16,524**	**0**	**153,095**
Jan-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133,186	1,941	0	0	131,245
Feb-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79,326	803	0	0	78,523
Mar-01	933	0	0	800	0	0	5,000	5,800	0	0	0	0	0	0	0	6,733	0	0	0	0	0	77,225	0	5,800	0	71,425
Apr-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,191	0	0	0	0	0
May-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	921	0	0	0	0	0
Jun-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82	0	0	0	0	0
Jul-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,948	0	0	0	0	0
Aug-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,016	0	0	0	0	0
Sep-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	947	0	0	0	0	0
Oct-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	395	0	0	0	0	0
Nov-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	740	0	0	0	0	0
Total	**933**	**0**	**0**	**800**	**0**	**0**	**5,000**	**5,800**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6,733**	**0**	**0**	**0**	**0**	**18,240**	**289,737**	**2,744**	**5,800**	**0**	**281,193**
Jan-02	0	0	0	0	0	0	1,081	1,081	0	0	140	0	3,311	0	3,451	4,532	0	0	3,311	3,311	0	110,529	277	1,081	0	109,171
Feb-02	0	0	0	0	0	0	6,919	6,919	0	0	0	0	0	0	0	6,919	0	0	0	0	0	11,587	119	6,919	0	4,549
Mar-02	643	0	0	0	0	0	0	0	0	0	0	0	0	0	0	643	0	0	0	0	0	545	532	0	0	13
Apr-02	1,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,520	0	0	0	0	0	776	776	0	0	0
May-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,501	290	290	0	0	0
Jun-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,694	660	660	0	0	0
Jul-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23,061	714	714	0	0	0
Aug-02	0	0	0	0	0	0	0	0	0	0	0	0	0	1,000	1,000	1,000	0	0	0	0	15,996	316	316	0	0	0
Sep-02	0	0	0	0	0	0	0	0	2,000	3,332	0	0	0	3,000	8,332	8,332	0	0	0	0	0	59	59	0	0	0
Oct-02	0	0	0	0	0	0	0	0	0	12,819	0	0	0	0	12,819	12,819	0	0	0	0	0	0	0	0	0	0
Nov-02	0	0	0	0	0	0	0	0	0	3,408	0	0	0	0	3,408	3,408	0	0	0	0	0	0	0	0	0	0
Dec-02	0	0	0	0	0	0	0	0	0	4,441	0	0	0	0	4,441	4,441	2,785	-2,785	0	-2,785	0	0	0	0	0	0
Total	**2,163**	**0**	**0**	**0**	**0**	**0**	**8,000**	**8,000**	**2,000**	**24,000**	**140**	**0**	**3,311**	**4,000**	**33,451**	**43,614**	**2,785**	**-2,785**	**3,311**	**526**	**45,252**	**125,476**	**3,743**	**8,000**	**0**	**113,733**
Jan-03	0	2,000	0	0	0	0	3,800	5,800	0	0	0	0	0	0	0	5,800	0	0	0	0	0	15,286	0	5,800	0	9,486
Feb-03	0	700	0	0	0	0	2,700	3,400	0	0	0	0	0	0	0	3,400	0	0	0	0	0	36,021	0	3,400	7,100	25,521
Mar-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79,077	0	0	38,500	40,577
Apr-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16,006	0	0	0	0	0
May-03	0	0	0	0	0	0	0	0	10,000	0	0	5,477	0	0	15,477	15,477	0	5,477	0	5,477	0	0	0	0	0	0
Jun-03	0	0	0	0	0	0	0	0	6,100	0	0	14,827	20,000	0	40,927	40,927	0	14,827	20,000	34,827	4,373	0	0	0	0	0
Jul-03	0	0	0	0	0	0	0	0	0	0	0	13,290	0	0	13,290	13,290	0	13,290	0	13,290	9,339	0	0	0	0	0
Aug-03	0	0	0	0	0	0	0	0	0	0	0	19,706	0	0	19,706	19,706	0	19,706	0	19,706	52	0	0	0	0	0
Sep-03	0	0	0	0	0	0	0	0	0	0	0	1,400	9,500	0	10,900	10,900	0	1,400	9,500	10,900	0	0	0	0	0	0
Oct-03	0	0	0	0	0	0	0	0	0	0	0	1,520	3,500	0	5,020	5,020	0	1,520	3,500	5,020	0	0	0	0	0	0
Nov-03	0	0	0	0	0	0	0	0	0	0	0	675	0	0	675	675	0	675	0	675	0	0	0	0	0	0
Dec-03	0	0	0	0	0	0	0	0	0	0	350	3,870	0	0	4,220	4,220	0	3,870	0	3,870	0	0	0	0	0	0
Total	**0**	**2,700**	**0**	**0**	**0**	**0**	**6,500**	**9,200**	**16,100**	**0**	**350**	**60,765**	**33,000**	**0**	**110,215**	**119,415**	**0**	**60,765**	**33,000**	**93,765**	**29,770**	**130,384**	**0**	**9,200**	**45,600**	**75,584**
Jan-04	0	0	803	0	0	0	5,740	6,543	0	0	0	0	0	0	0	6,543	0	0	0	0	0	127,492	850	6,543	0	120,099
Feb-04	0	4,000	27,004	0	0	0	0	31,004	0	0	0	0	0	0	0	31,004	0	0	0	0	0	180,703	784	31,004	0	148,915
Mar-04	1,657	0	4,715	0	0	0	0	4,715	0	0	0	0	0	0	0	6,372	0	0	0	0	0	11,613	15	4,715	0	6,883
Apr-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,815	0	0	0	0	0
May-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,075	0	0	0	0	0
Jun-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,402	0	0	0	0	0
Jul-04	0	0	0	0	0	0	0	0	2,000	0	0	0	0	0	2,000	2,000	0	0	0	0	291	0	0	0	0	0
Aug-04	0	0	0	0	0	0	0	0	2,000	0	0	0	0	0	2,000	2,000	0	0	0	0	657	0	0	0	0	0
Sep-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,657**	**4,000**	**32,522**	**0**	**0**	**0**	**5,740**	**42,262**	**4,000**	**0**	**0**	**0**	**0**	**0**	**4,000**	**47,919**	**0**	**0**	**0**	**0**	**17,240**	**319,808**	**1,649**	**42,262**	**0**	**275,897**
Jan-05	845	1,952	0	48	0	4,554	845	7,399	0	0	0	0	0	0	0	8,244	0	0	4,554	4,554	0	113,543	947	7,399	0	105,197
Feb-05	2,323	2,648	0	0	0	7,079	4,895	14,622	0	0	0	0	0	0	0	16,945	0	0	7,079	7,079	0	55,665	877	14,622	0	40,166
Mar-05	3,377	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	0	0	0	0	0	0	0	0	0	0
Apr-05	2,954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,954	0	0	0	0	0	0	0	0	0	0
May-05	1,413	0	0	0	0	0	0	0	0	0	0	1,138	0	0	1,138	2,551	0	1,138	764	1,902	0	0	0	0	0	0

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

HISTORIC SWP DELIVERIES UNDER MONTEREY AMENDMENT WATER MANAGEMENT PROGRAMS

Month	SWP DELIVERIES UNDER ARTICLE 56																									
	Storage Outside Service Area (all water types)																				Turnbk Pool	Carryover (to Service Area)				
	Total Amount Delivered (excluding MWD Semitropic)																Could Not Have Stored	Could Have Been Stored in Other Existing Programs								
		Article 56 Carryover							Table A and other SWP Water							Total										
	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total	ACWD	CLWA	DRWD	MWD	SCVWD	Zone 7	Total		MWD	MWD	SCVWD	Total	Total	Total	N of Delta	Out of Serv Area Storage	Flexible Storage Replacmt	S of Delta to Serv Area
	28	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*	*51*	*52*	*53*
Source / Formula	= sum(cols 22 thru 27)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 29 thru 34)	DWR	DWR	DWR	DWR	DWR	DWR	= sum(cols 36 thru 41)	= cols 28 + 35 + 42	MWD Analysis	= cols 25 + 32 + 39 - 44	= cols 25 + 32 + 39	= cols 44 + 45				=col 35	= col 10	= cols 49 - 50 - 51 - 52
Jun-05	3,415	0	0	0	0	0	0	0	0	0	0	1,324	0	0	1,324	4,739	0	1,324	2,351	3,675	0	0	0	0	0	0
Jul-05	0	0	0	0	0	0	0	0	10,100	0	0	10,000	23,041	0	43,141	43,141	0	10,000	23,041	33,041	32,844	0	0	0	0	0
Aug-05	0	0	0	0	0	0	0	0	15,600	0	0	2,538	7,792	0	25,930	25,930	0	2,538	7,792	10,330	5,089	0	0	0	0	0
Sep-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	342	0	0	0	0	0
Oct-05	0	0	0	0	0	0	0	0	0	0	1,500	576	0	0	2,076	2,076	0	576	0	576	0	0	0	0	0	0
Nov-05	0	0	0	0	0	0	0	0	0	12,869	1,000	0	0	0	13,869	13,869	0	0	0	0	0	0	0	0	0	0
Dec-05	1,934	0	0	0	0	0	0	0	0	7,131	0	0	1,500	0	8,631	10,565	0	0	1,500	1,500	0	0	0	0	0	0
Total	**16,261**	**4,600**	**0**	**48**	**0**	**11,633**	**5,740**	**22,021**	**25,700**	**20,000**	**2,500**	**15,576**	**32,333**	**0**	**96,109**	**134,391**	**0**	**15,576**	**47,081**	**62,657**	**38,275**	**169,208**	**1,824**	**22,021**	**0**	**145,363**
Totals																										
96-03	**53,168**	**2,700**	**0**	**800**	**25,321**	**0**	**19,500**	**48,321**	**62,800**	**24,000**	**8,710**	**278,557**	**164,631**	**46,170**	**584,868**	**686,357**	**18,722**	**285,156**	**193,841**	**478,997**	**905,457**	**751,596**	**8,311**	**48,321**	**45,600**	**649,364**
96-04	**54,825**	**6,700**	**32,522**	**800**	**25,321**	**0**	**25,240**	**90,583**	**66,800**	**24,000**	**8,710**	**278,557**	**164,631**	**46,170**	**588,868**	**734,276**	**18,722**	**285,156**	**193,841**	**478,997**	**922,697**	**1,071,404**	**9,960**	**90,583**	**45,600**	**925,261**
96-05	**71,086**	**11,300**	**32,522**	**848**	**25,321**	**11,633**	**30,980**	**112,604**	**92,500**	**44,000**	**11,210**	**294,133**	**196,964**	**46,170**	**684,977**	**868,667**	**18,722**	**300,732**	**240,922**	**541,654**	**960,972**	**1,240,612**	**11,784**	**112,604**	**45,600**	**1,070,624**

Note: DWR delivery data is from SWPAO delivery files, as of 5/18/2006.

SAN LUIS RESERVOIR STORAGE

Elevation: 543' · SAN LUIS CR basin · Operator: CA Dept of Water Resources
Provisional data, subject to change.
Data obtained from CDEC 5/15/2006

STORAGE (from CDEC) (AF)

Date	Total (1)	SWP (2)	CVP (3)	Total Check (4) (2+3)	Diff (5) (4-1)
Jan-95	1,789,637	1,091,587	698,050	1,789,637	0
Feb-95	2,024,025	1,171,880	852,145	2,024,025	0
Mar-95	2,034,447	1,169,817	864,630	2,034,447	0
Apr-95	2,026,819	1,086,588	940,231	2,026,819	0
May-95	2,009,440	1,061,812	947,628	2,009,440	0
Jun-95	1,876,744	1,048,887	827,857	1,876,744	0
Jul-95	1,763,906	1,073,430	690,476	1,763,906	0
Aug-95	1,499,314	1,077,656	421,658	1,499,314	0
Sep-95	1,524,232	1,081,845	442,387	1,524,232	0
Oct-95	1,637,786	1,133,031	504,755	1,637,786	0
Nov-95	1,664,769	1,048,190	616,579	1,664,769	0
Dec-95	1,646,822	911,417	735,465	1,646,882	60
Jan-96	1,934,442	1,061,411	873,031	1,934,442	0
Feb-96	2,024,533	1,076,912	947,621	2,024,533	0
Mar-96	2,023,644	1,058,720	964,924	2,023,644	0
Apr-96	1,885,781	972,070	913,711	1,885,781	0
May-96	1,643,454	843,235	800,219	1,643,454	0
Jun-96	1,350,109	787,228	562,881	1,350,109	0
Jul-96	979,318	750,346	228,972	979,318	0
Aug-96	753,481	628,876	124,605	753,481	0
Sep-96	914,750	740,379	174,371	914,750	0
Oct-96	1,175,411	843,170	332,241	1,175,411	0
Nov-96	1,596,193	1,048,478	547,719	1,596,197	4
Dec-96	1,903,404	1,109,158 r	794,246	1,903,404	0
Jan-97	1,999,062	1,101,867	897,195	1,999,062	0
Feb-97	1,978,868	1,105,151	873,717	1,978,868	0
Mar-97	2,009,693	1,085,462	924,231	2,009,693	0
Apr-97	1,778,698	944,918	833,780	1,778,698	0
May-97	1,266,881	721,579	545,302	1,266,881	0
Jun-97	871,579	593,083	278,496	871,579	0
Jul-97	553,683	445,203	108,480	553,683	0
Aug-97	396,307	334,549	61,758	396,307	0
Sep-97	593,428	461,649	131,779	593,428	0
Oct-97	827,147	547,915	279,232	827,147	0
Nov-97	1,165,611	713,723	451,888	1,165,611	0
Dec-97	1,642,982	953,588	649,394	1,602,982	-40,000
Jan-98	1,858,715	1,068,183	790,532	1,858,715	0
Feb-98	2,025,549	1,062,277	963,272	2,025,549	0
Mar-98	2,028,090	1,063,334	964,756	2,028,090	0
Apr-98	1,999,821	1,062,227	937,594	1,999,821	0
May-98	2,028,725	1,061,880	966,845	2,028,725	0
Jun-98	2,024,025	1,060,880	963,145	2,024,025	0
Jul-98	1,824,308	1,004,087	820,221	1,824,308	0
Aug-98	1,566,459	873,994	692,465	1,566,459	0
Sep-98	1,613,068	900,000	713,008	1,613,008	-60
Oct-98	1,861,058	1,014,790	846,268	1,861,058	0
Nov-98	1,970,810	1,063,595	904,215	1,967,810	-3,000
Dec-98	1,898,186	1,074,246	823,940	1,898,186	0
Jan-99	1,929,319	1,103,949	825,370	1,929,319	0
Feb-99	1,985,676	1,097,321	888,355	1,985,676	0
Mar-99	2,027,831	1,061,800	966,035	2,027,835	4
Apr-99	1,913,855	1,011,650	902,205	1,913,855	0
May-99	1,496,796	863,254	633,542	1,496,796	0
Jun-99	936,402	555,473	380,929	936,402	0
Jul-99	611,617	476,215	135,402	611,617	0
Aug-99	520,283	451,049	69,234	520,283	0
Sep-99	702,409	591,796	110,613	702,409	0
Oct-99	801,279	573,547	227,732	801,279	0
Nov-99	1,073,901	683,127	390,774	1,073,901	0
Dec-99	1,187,142	716,955	470,187	1,187,142	0
Jan-00	1,505,272	914,717	590,555	1,505,272	0
Feb-00	1,825,778	1,057,575	768,203	1,825,778	0
Mar-00	2,026,438	1,061,880	964,558	2,026,438	0
Apr-00	1,876,126	969,343	906,783	1,876,126	0
May-00	1,462,484	762,064	700,520	1,462,584	100
Jun-00	1,051,334	580,449	470,885	1,051,334	0
Jul-00	771,746	401,285	370,461	771,746	0
Aug-00	666,538	307,591	358,947	666,538	0
Sep-00	850,828	387,635	463,193	850,828	0
Oct-00	1,051,945	421,304	630,641	1,051,945	0
Nov-00	1,299,262	460,177	839,085	1,299,262	0
Dec-00	1,470,439	481,677	988,762	1,470,439	0

STORAGE (from CDEC) (AF)

Date	Total (1)	SWP (2)	CVP (3)	Total Check (4) (2+3)	Diff (5) (4-1)
Jan-01	1,595,959	556,930	1,039,029	1,595,959	0
Feb-01	1,797,186	747,404	1,049,782	1,797,186	0
Mar-01	1,977,986	996,764	981,222	1,977,986	0
Apr-01	1,910,991	984,617	926,374	1,910,991	0
May-01	1,493,135	815,834	677,301	1,493,135	0
Jun-01	1,033,071	642,248	390,823	1,033,071	0
Jul-01	829,778	549,059	280,719	829,778	0
Aug-01	760,039	515,197	244,842	760,039	0
Sep-01	829,590	516,007	313,583	829,590	0
Oct-01	764,056	357,700	406,356	764,056	0
Nov-01	964,447	412,836	551,611	964,447	0
Dec-01	1,385,632	675,995	709,637	1,385,632	0
Jan-02	1,807,066	912,332	894,734	1,807,066	0
Feb-02	1,925,324	1,030,871	894,453	1,925,324	0
Mar-02	2,027,963	1,078,173	949,790	2,027,963	0
Apr-02	1,844,188	973,457	870,731	1,844,188	0
May-02	1,402,950	744,784	658,166	1,402,950	0
Jun-02	873,969	488,121	385,848	873,969	0
Jul-02	646,887	398,657	248,230	646,887	0
Aug-02	643,876	467,946	175,930	643,876	0
Sep-02	688,435	393,795	294,640	688,435	0
Oct-02	649,730	237,482	412,248	649,730	0
Nov-02	787,573	219,224	568,349	787,573	0
Dec-02	1,010,089	319,803	690,286	1,010,089	0
Jan-03	1,437,576	569,838	867,738	1,437,576	0
Feb-03	1,739,389	837,137	902,252	1,739,389	0
Mar-03	1,953,851	984,556	969,295	1,953,851	0
Apr-03	1,818,676	920,243	898,433	1,818,676	0
May-03	1,428,330	684,343	743,987	1,428,330	0
Jun-03	1,217,645	557,749	659,896	1,217,645	0
Jul-03	918,347	521,880	396,467	918,347	0
Aug-03	787,480	529,944	257,536	787,480	0
Sep-03	939,243	652,744	286,499	939,243	0
Oct-03	961,975	607,364	354,611	961,975	0
Nov-03	1,122,517	613,477	509,040	1,122,517	0
Dec-03	1,316,540	615,769	700,771	1,316,540	0
Jan-04	1,664,413	809,033	855,380	1,664,413	0
Feb-04	1,878,476	971,719	906,757	1,878,476	0
Mar-04	2,020,089	1,069,446	950,643	2,020,089	0
Apr-04	1,768,145	938,544	829,601	1,768,145	0
May-04	1,213,592	674,017	539,575	1,213,592	0
Jun-04	719,890	434,812	285,078	719,890	0
Jul-04	492,864	369,739	123,125	492,864	0
Aug-04	498,397	408,702	89,695	498,397	0
Sep-04	670,373	513,536	156,837	670,373	0
Oct-04	787,850	522,176	265,674	787,850	0
Nov-04	1,057,649	603,410	454,239	1,057,649	0
Dec-04	1,283,146	672,181	610,965	1,283,146	0
Jan-05	1,810,485	1,013,425	797,060	1,810,485	0
Feb-05	1,968,294	1,099,874	868,420	1,968,294	0
Mar-05	2,029,615	1,063,312	966,303	2,029,615	0
Apr-05	1,898,434	933,372	965,062	1,898,434	0
May-05	1,696,202	801,190	895,012	1,696,202	0
Jun-05	1,566,575	764,709	801,866	1,566,575	0
Jul-05	1,343,373	773,382	569,991	1,343,373	0
Aug-05	1,197,211	819,673	377,538	1,197,211	0
Sep-05	1,328,065	925,423	402,642	1,328,065	0
Oct-05	1,462,938	990,340	472,598	1,462,938	0
Nov-05	1,627,412	1,022,206	605,206	1,627,412	0
Dec-05	1,893,469	1,167,668	725,801	1,893,469	0
Jan-06	2,030,250	1,153,152	877,098	2,030,250	0
Feb-06	2,019,836	1,144,384	875,452	2,019,836	0
Mar-06	2,031,649	1,063,143	968,506	2,031,649	0
Apr-06	2,024,025	1,059,354	964,671	2,024,025	0

HISTORIC AND ESTIMATED
ADDITIONAL
ARTICLE 21 DELIVERIES

Month	Historic Art. 21 Water Deliveries			
	Total	N of Delta	S of Delta	Estimated
Jan-96	2,117	0	2,117	0
Feb-96	22,519	0	22,519	0
Mar-96	4,011	0	4,011	0
Apr-96	0	0	0	0
May-96	0	0	0	0
Jun-96	0	0	0	0
Jul-96	0	0	0	0
Aug-96	0	0	0	0
Sep-96	0	0	0	0
Oct-96	0	0	0	0
Nov-96	0	0	0	0
Dec-96	0	0	0	0
Jan-97	3,044	0	3,044	0
Feb-97	1,572	0	1,572	0
Mar-97	16,420	0	16,420	0
Apr-97	396	0	396	0
May-97	0	0	0	0
Jun-97	0	0	0	0
Jul-97	0	0	0	0
Aug-97	0	0	0	0
Sep-97	0	0	0	0
Oct-97	0	0	0	0
Nov-97	0	0	0	0
Dec-97	0	0	0	16,000
Jan-98	9,576	58	9,518	0
Feb-98	1,208	482	726	0
Mar-98	62	0	62	0
Apr-98	0	0	0	0
May-98	614	614	0	20,000
Jun-98	1,497	1,497	0	30,000
Jul-98	3,549	3,549	0	0
Aug-98	3,782	3,782	0	0
Sep-98	0		0	0
Oct-98	0		0	15,000
Nov-98	0		0	10,000
Dec-98	0		0	0
Jan-99	28,555	161	28,394	0
Feb-99	27,220	425	26,795	0
Mar-99	73,062	168	72,894	0
Apr-99	29,233	0	29,233	0
May-99	0	0	0	0
Jun-99	0	0	0	0
Jul-99	0	0	0	0
Aug-99	0	0	0	0
Sep-99	0	0	0	0
Oct-99	0	0	0	0
Nov-99	0	0	0	0
Dec-99	0	0	0	0

Month	Historic Art. 21 Water Deliveries			
	Total	N of Delta	S of Delta	Estimated
Jan-00	0	0	0	13,000
Feb-00	94,467	0	94,467	0
Mar-00	214,318	1,337	212,981	0
Apr-00	0	0	0	0
May-00	0	0	0	0
Jun-00	0	0	0	0
Jul-00	0	0	0	0
Aug-00	0	0	0	0
Sep-00	0	0	0	0
Oct-00	0	0	0	0
Nov-00	0	0	0	0
Dec-00	0	0	0	0
Jan-01	0	0	0	0
Feb-01	1,324	1,324	0	175,000
Mar-01	45,833	988	44,845	160,000
Apr-01	0	0	0	0
May-01	0	0	0	0
Jun-01	0	0	0	0
Jul-01	0	0	0	0
Aug-01	0	0	0	0
Sep-01	0	0	0	0
Oct-01	0	0	0	0
Nov-01	0	0	0	0
Dec-01	988	988	0	0
Jan-02	532	532	0	0
Feb-02	46	46	0	0
Mar-02	9,709	355	9,354	16,000
Apr-02	29,842	340	29,502	0
May-02	1,796	1,769	27	0
Jun-02	0	0	0	0
Jul-02	0	0	0	0
Aug-02	0	0	0	0
Sep-02	0	0	0	0
Oct-02	0	0	0	0
Nov-02	0	0	0	0
Dec-02	0	0	0	0
Jan-03	0	0	0	0
Feb-03	0	0	0	0
Mar-03	49,616	376	49,240	10,000
Apr-03	7,928	0	7,928	0
May-03	1,210	1,210	0	0
Jun-03	1,070	1,070	0	0
Jul-03	0	0	0	0
Aug-03	0	0	0	0
Sep-03	0	0	0	0
Oct-03	0	0	0	0
Nov-03	0	0	0	0
Dec-03	0	0	0	0
Jan-04	1,145	1,145	0	0
Feb-04	658	658	0	50,000
Mar-04	209,741	482	209,259	0
Apr-04	1,126	1,126	0	0
May-04	5,786	5,786	0	0
Jun-04	0	0	0	0
Jul-04	0	0	0	0
Aug-04	0	0	0	0
Sep-04	0	0	0	0
Oct-04	0	0	0	0
Nov-04	0	0	0	0
Dec-04	40	40	0	0
Total	905,612	30,308	875,304	515,000

Net Delta Outflow Index and Diversions at Banks Pumping Plant

Date	Historic Data		Estimated Data			Annual Totals				
	Net Delta Outflow Index[1] (AF)	Total Diversns at Banks Pumpg Plant[2,3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)	Net Delta Outflow Index (AF)	Total Diversns at Banks Pumping Plant[3] (AF)	Change in Diversions at Banks PP (AF)	Net Delta Outflow Index w/ Change in Banks Div's (AF)	Diversions at Banks w/ Change in Banks Div's (AF)
Jan-96	1,976,479	348,376	0	1,976,479	348,376					
Feb-96	7,300,090	171,418	0	7,300,090	171,418					
Mar-96	5,481,485	174,082	0	5,481,485	174,082					
Apr-96	2,501,101	105,770	0	2,501,101	105,770					
May-96	2,829,723	156,749	0	2,829,723	156,749					
Jun-96	908,612	295,490	0	908,612	295,490					
Jul-96	562,986	370,341	0	562,986	370,341					
Aug-96	589,805	379,999	0	589,805	379,999					
Sep-96	433,942	344,926	0	433,942	344,926					
Oct-96	291,578	336,186	0	291,578	336,186					
Nov-96	597,120	346,661	0	597,120	346,661					
Dec-96	5,198,059	211,225	-55,000	5,253,059	156,225	28,670,980	3,241,223	-55,000	28,725,980	3,186,223
Jan-97	16,129,761	45,266	0	16,129,761	45,266					
Feb-97	6,591,947	90,350	0	6,591,947	90,350					
Mar-97	2,072,091	162,393	0	2,072,091	162,393					
Apr-97	841,525	105,648	0	841,525	105,648					
May-97	753,673	78,830	0	753,673	78,830					
Jun-97	487,902	153,328	0	487,902	153,328					
Jul-97	570,976	322,379	0	570,976	322,379					
Aug-97	531,217	268,048	0	531,217	268,048					
Sep-97	232,923	339,410	0	232,923	339,410					
Oct-97	296,727	265,902	0	296,727	265,902					
Nov-97	604,147	293,437	0	604,147	293,437					
Dec-97	943,910	419,695	0	943,910	419,695	30,056,800	2,544,686	0	30,056,800	2,544,686
Jan-98	4,399,140	196,584	-111,000	4,510,140	85,584					
Feb-98	12,820,968	7,285	0	12,820,968	7,285					
Mar-98	6,421,827	14,315	0	6,421,827	14,315					
Apr-98	5,259,868	1,871	0	5,259,868	1,871					
May-98	4,157,282	43,225	0	4,157,282	43,225					
Jun-98	4,268,561	128,947	0	4,268,561	128,947					
Jul-98	1,897,277	213,401	0	1,897,277	213,401					
Aug-98	1,223,161	263,272	0	1,223,161	263,272					
Sep-98	1,193,669	266,204	0	1,193,669	266,204					
Oct-98	755,082	294,791	0	755,082	294,791					
Nov-98	1,227,905	129,489	-40,000	1,267,905	89,489					
Dec-98	2,904,722	128,026	-13,000	2,917,722	115,026	46,529,461	1,687,410	-164,000	46,693,461	1,523,410
Jan-99	2,337,832	85,366	-2,000	2,339,832	83,366					
Feb-99	5,487,282	52,203	-7,000	5,494,282	45,203					
Mar-99	4,249,136	182,800	-18,000	4,267,136	164,800					
Apr-99	2,112,934	185,666	0	2,112,934	185,666					
May-99	1,361,205	99,261	0	1,361,205	99,261					
Jun-99	813,084	59,277	0	813,084	59,277					
Jul-99	643,315	376,107	0	643,315	376,107					
Aug-99	364,641	409,354	0	364,641	409,354					
Sep-99	284,666	408,580	0	284,666	408,580					
Oct-99	261,832	303,546	0	261,832	303,546					
Nov-99	404,817	310,792	0	404,817	310,792					
Dec-99	643,569	233,883	0	643,569	233,883	18,964,313	2,706,835	-27,000	18,991,313	2,679,835
Jan-00	1,324,485	395,929	0	1,324,485	395,929					
Feb-00	5,412,226	421,683	-119,000	5,531,226	302,683					
Mar-00	5,400,323	343,011	-13,000	5,413,323	330,011					
Apr-00	1,620,468	180,473	0	1,620,468	180,473					
May-00	1,356,250	97,696	0	1,356,250	97,696					
Jun-00	525,019	251,955	0	525,019	251,955					
Jul-00	560,955	359,191	0	560,955	359,191					
Aug-00	370,417	376,809	0	370,417	376,809					
Sep-00	275,036	387,824	0	275,036	387,824					
Oct-00	351,975	306,668	0	351,975	306,668					
Nov-00	282,180	322,182	0	282,180	322,182					
Dec-00	368,684	292,231	0	368,684	292,231	17,848,018	3,735,652	-132,000	17,980,018	3,603,652

Date	Historic Data: Net Delta Outflow Index[1] (AF)	Historic Data: Total Diversns at Banks Pumpg Plant[2,3] (AF)	Estimated Data: Change in Diversions at Banks PP (AF)	Estimated Data: Net Delta Outflow Index w/ Change in Banks Div's (AF)	Estimated Data: Diversions at Banks w/ Change in Banks Div's (AF)	Annual Totals: Net Delta Outflow Index (AF)	Annual Totals: Total Diversns at Banks Pumping Plant[3] (AF)	Annual Totals: Change in Diversions at Banks PP (AF)	Annual Totals: Net Delta Outflow Index w/ Change in Banks Div's (AF)	Annual Totals: Diversions at Banks w/ Change in Banks Div's (AF)
Jan-01	935,280	240,845	0	935,280	240,845					
Feb-01	1,086,720	260,853	0	1,086,720	260,853					
Mar-01	1,439,070	360,751	-51,000	1,490,070	309,751					
Apr-01	723,447	98,528	0	723,447	98,528					
May-01	590,993	33,823	0	590,993	33,823					
Jun-01	440,594	9,233	0	440,594	9,233					
Jul-01	285,612	217,665	0	285,612	217,665					
Aug-01	193,843	248,539	0	193,843	248,539					
Sep-01	245,322	212,698	0	245,322	212,698					
Oct-01	261,870	60,306	0	261,870	60,306					
Nov-01	488,210	192,176	0	488,210	192,176					
Dec-01	1,520,785	376,553	0	1,520,785	376,553	8,211,744	2,311,970	-51,000	8,262,744	2,260,970
Jan-02	2,381,690	397,017	0	2,381,690	397,017					
Feb-02	668,037	274,484	0	668,037	274,484					
Mar-02	1,043,088	239,304	0	1,043,088	239,304					
Apr-02	707,623	125,217	0	707,623	125,217					
May-02	829,043	38,455	0	829,043	38,455					
Jun-02	438,772	127,719	0	438,772	127,719					
Jul-02	348,127	382,608	0	348,127	382,608					
Aug-02	231,693	413,948	0	231,693	413,948					
Sep-02	244,463	245,835	0	244,463	245,835					
Oct-02	257,288	106,270	0	257,288	106,270					
Nov-02	436,243	187,071	0	436,243	187,071					
Dec-02	1,776,079	254,341	0	1,776,079	254,341	9,362,146	2,792,269	0	9,362,146	2,792,269
Jan-03	3,162,940	355,592	0	3,162,940	355,592					
Feb-03	1,645,127	352,731	0	1,645,127	352,731					
Mar-03	969,098	384,529	0	969,098	384,529					
Apr-03	1,310,801	151,526	0	1,310,801	151,526					
May-03	2,574,908	54,101	0	2,574,908	54,101					
Jun-03	697,299	353,803	0	697,299	353,803					
Jul-03	592,205	405,355	0	592,205	405,355					
Aug-03	422,678	427,610	0	422,678	427,610					
Sep-03	205,091	399,796	0	205,091	399,796					
Oct-03	263,675	180,443	0	263,675	180,443					
Nov-03	394,288	223,840	0	394,288	223,840					
Dec-03	1,464,633	258,531	0	1,464,633	258,531	13,702,742	3,547,857	0	13,702,742	3,547,857
Jan-04	1,973,974	424,781	0	1,973,974	424,781					
Feb-04	3,916,633	366,266	0	3,916,633	366,266					
Mar-04	3,459,039	423,147	-20,000	3,479,039	403,147					
Apr-04	1,305,985	123,026	0	1,305,985	123,026					
May-04	759,616	45,042	0	759,616	45,042					
Jun-04	336,236	95,039	0	336,236	95,039					
Jul-04	449,905	381,724	0	449,905	381,724					
Aug-04	319,958	405,404	0	319,958	405,404					
Sep-04	278,231	299,316	0	278,231	299,316					
Oct-04	523,137	170,003	0	523,137	170,003					
Nov-04	399,136	227,664	0	399,136	227,664					
Dec-04	765,485	263,441	0	765,485	263,441	14,487,334	3,224,853	-20,000	14,507,334	3,204,853

Notes: 1. Historic Net Delta Outflow Index data is from IEP's Dayflow calculations (accessed from http://iep.water.ca.gov/dayflow/output/index.html). Monthly volumes were determined by summing the average daily cfs for all the days in each month and multiplying those sum by 1.983471 to convert from cfs to acre-feet.

2. Historic Total Diversions at Banks Pumping Plant data is from DWR Division of Operations and Maintenance annual and monthly reports of operations. Data for 1996 through 2001 is from the "State Water Project Annual Report of Operations" reports for each of those years, from Table 1. Data from 2002 through 2004 is from the "State Water Project Operations Data" reports for each month, from Table 9.

3. Total Diversions at Banks Pumping Plant are total diversions, including diversions for SWP, CVP, and others.

Month where diversions for CVP and/or others is greater than zero (i.e., diversions for SWP purposes is less than amount shown).

3/7/2007
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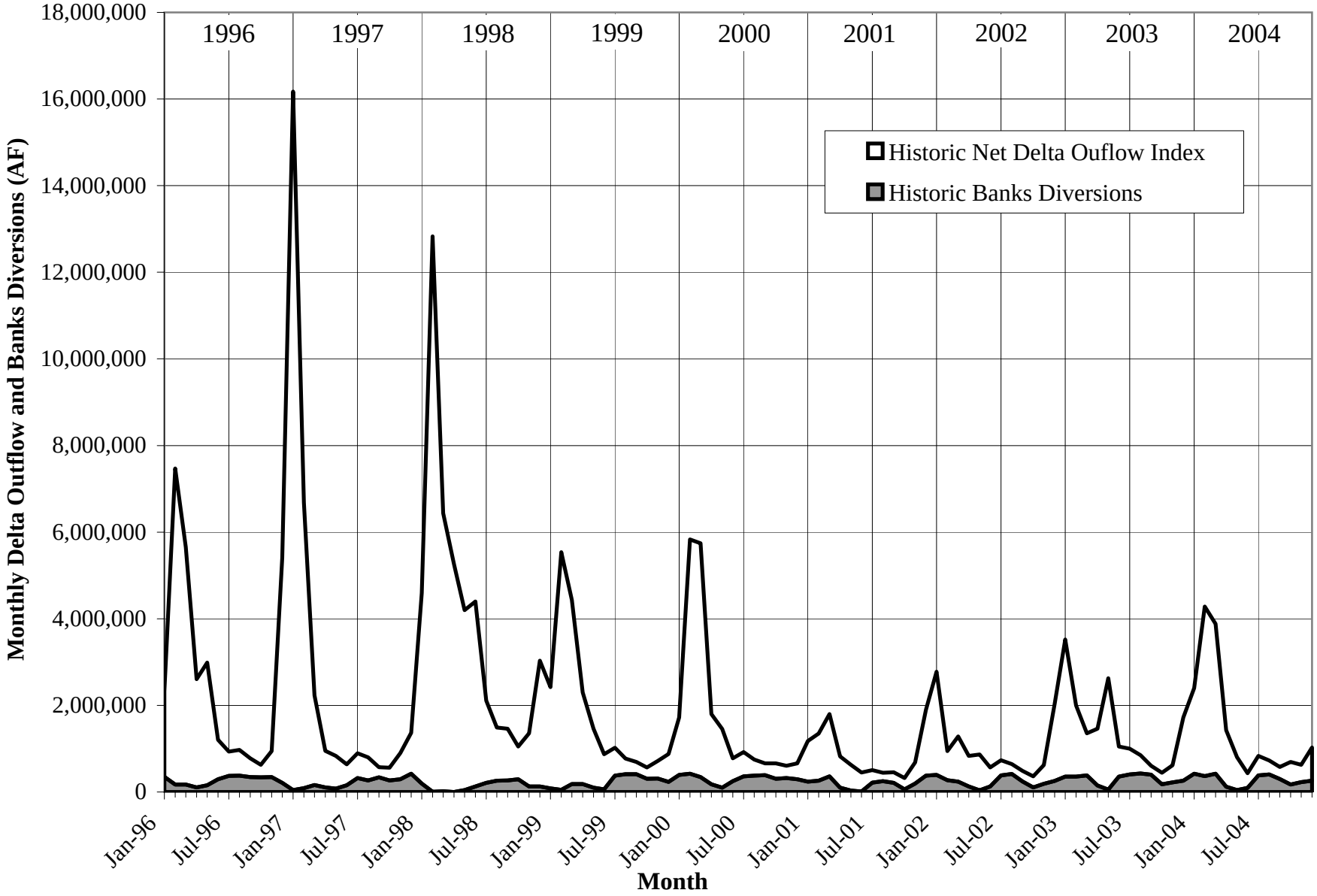
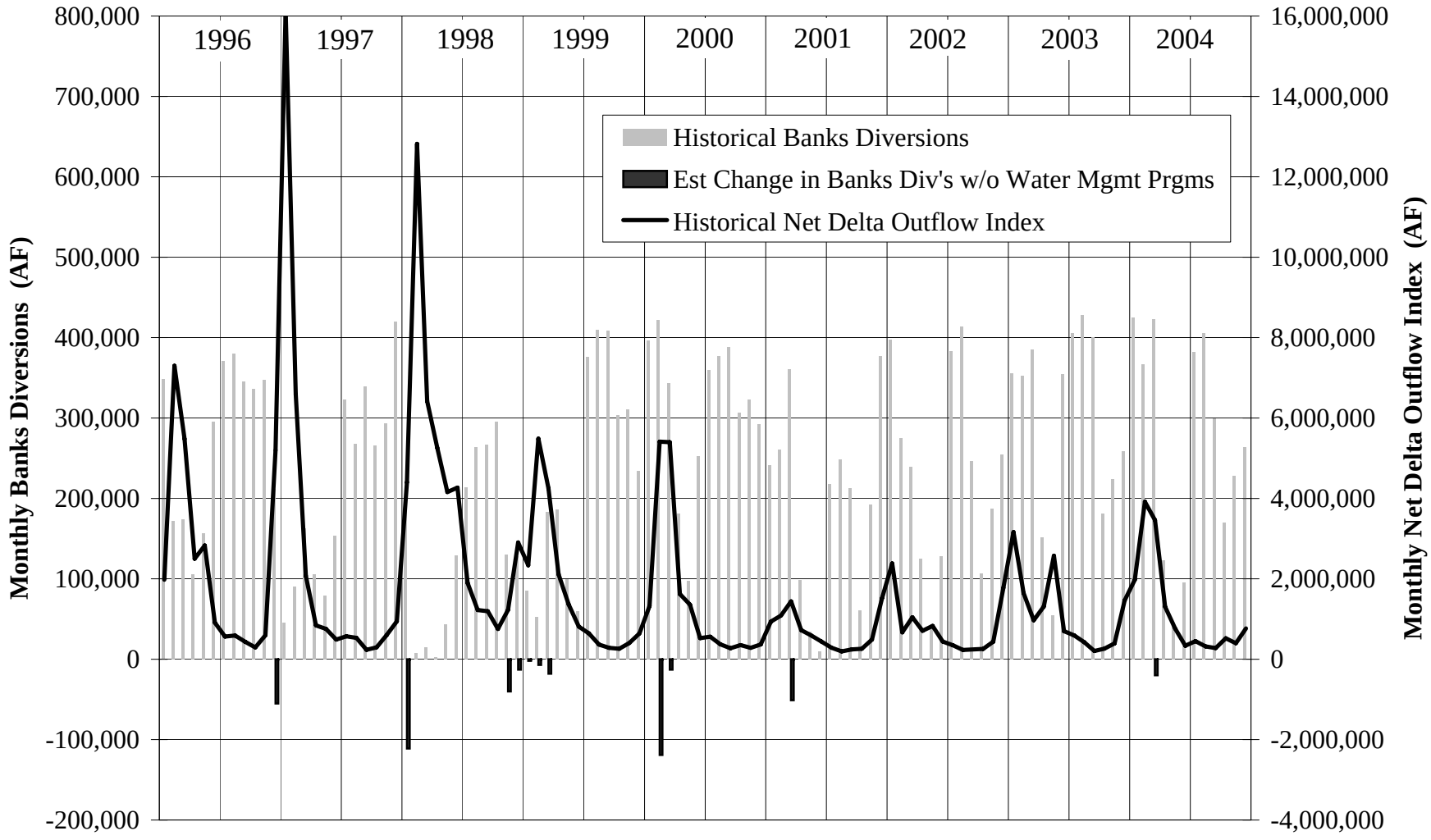
Net Delta Ouflow Index and SWP Banks Pumping Plant Diversions

Monthly Historic Data: 1996-2004



Monterey Water Mgmt Prog Analysis-wo stor assump (2007Jun15 Clemm).xls

Net Delta Ouflow Index and SWP Banks Pumping Plant Diversions



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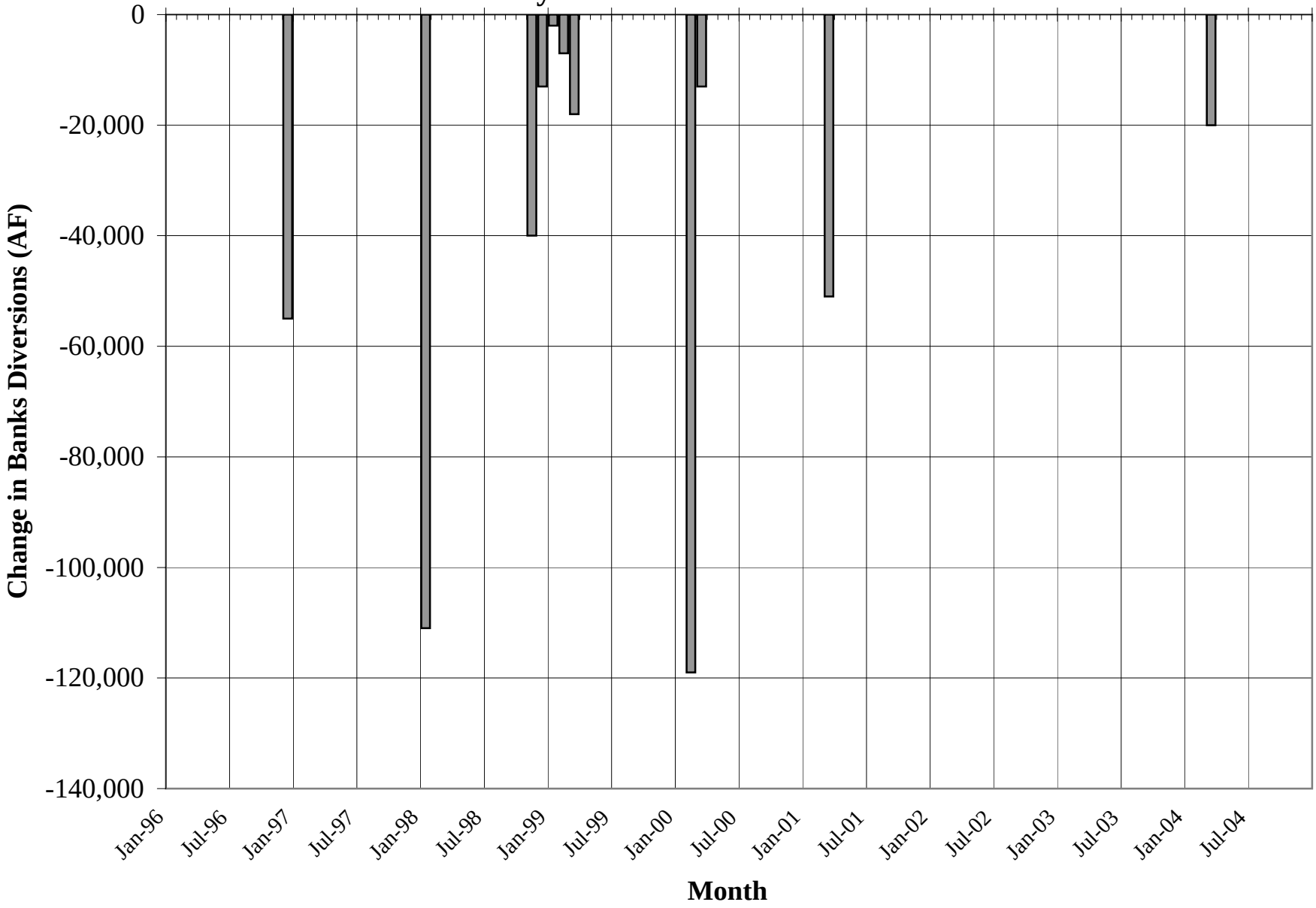
Change in Monthly SWP Banks Pumping Plant Diversions

Monthly Estimated Data: 1996-2004



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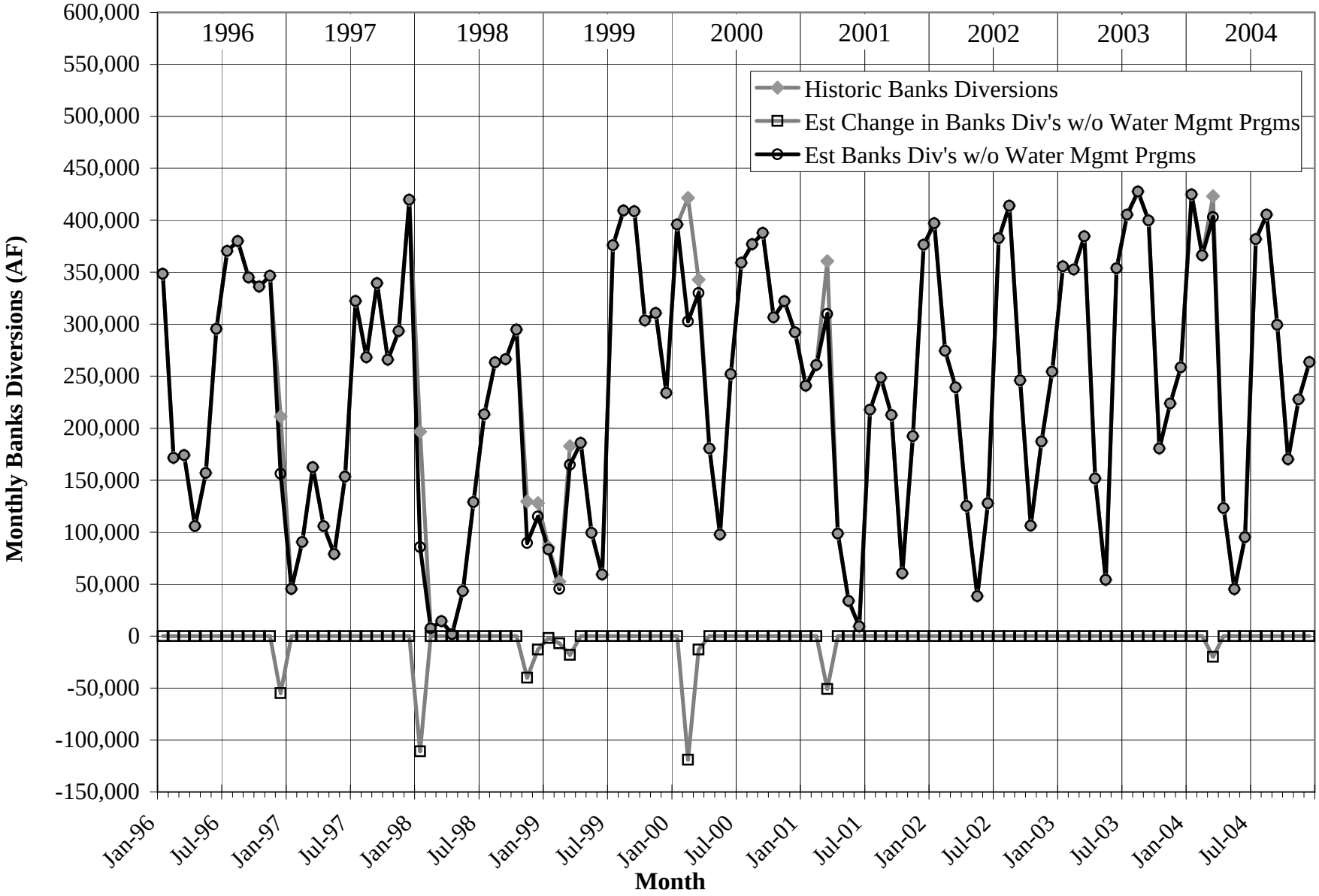
SWP Banks Pumping Plant Diversions
Monthly Historic and Estimated Data: 1996-2004



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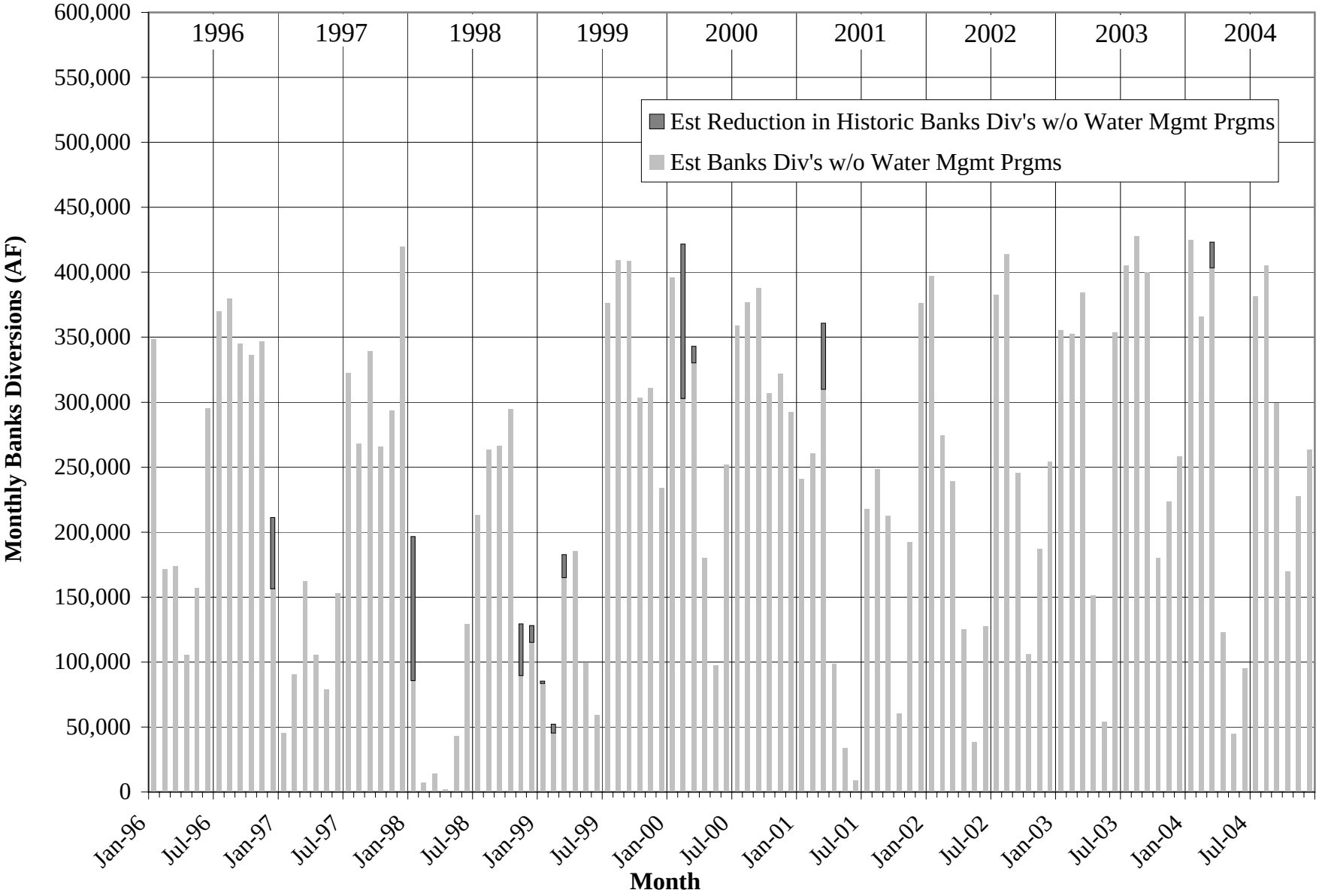
SWP Banks Pumping Plant Diversions
Monthly Historic and Estimated Data: 1996-2004



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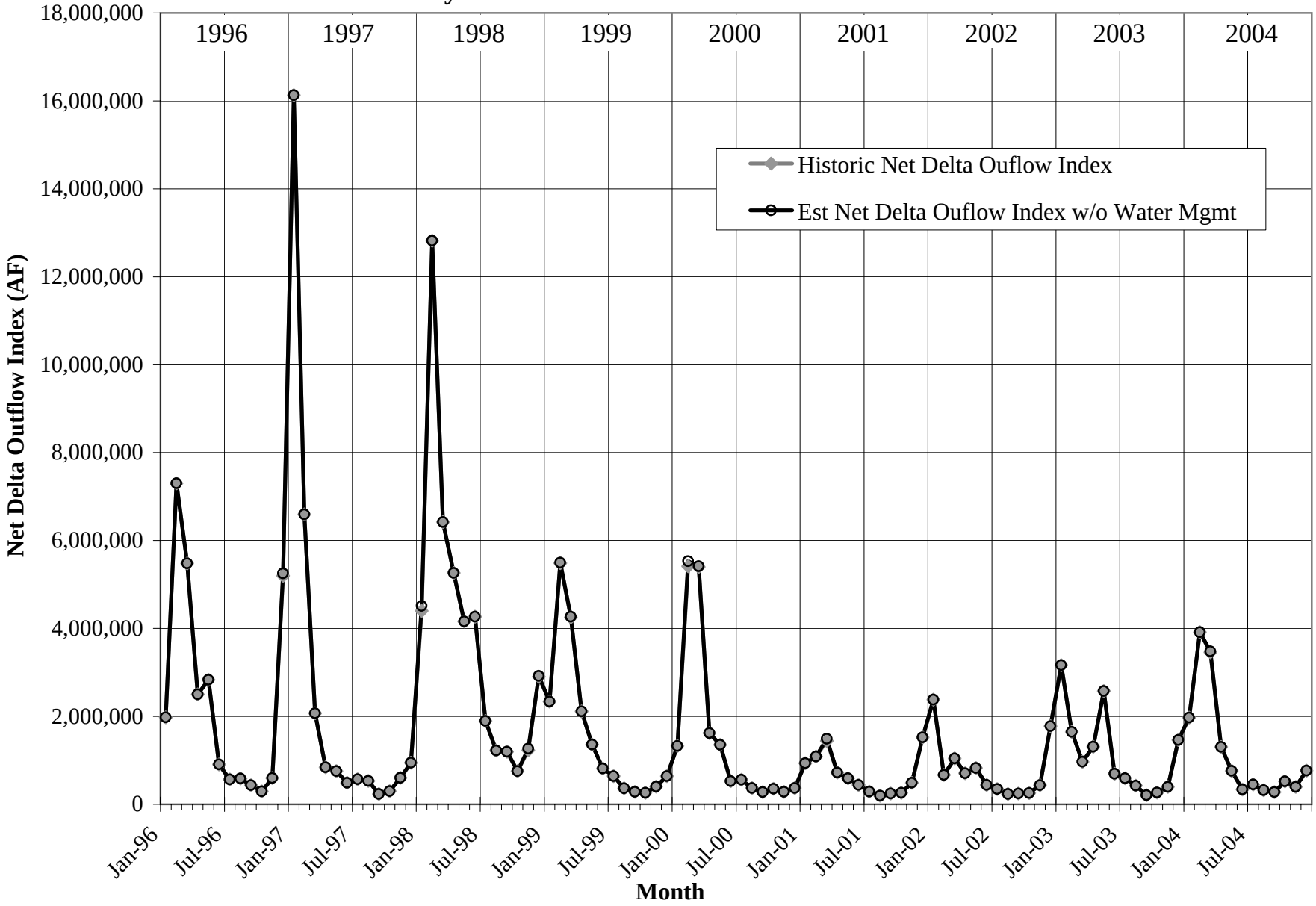
Net Delta Ouflow Index

Monthly Historic and Estimated Data: 1996-2004



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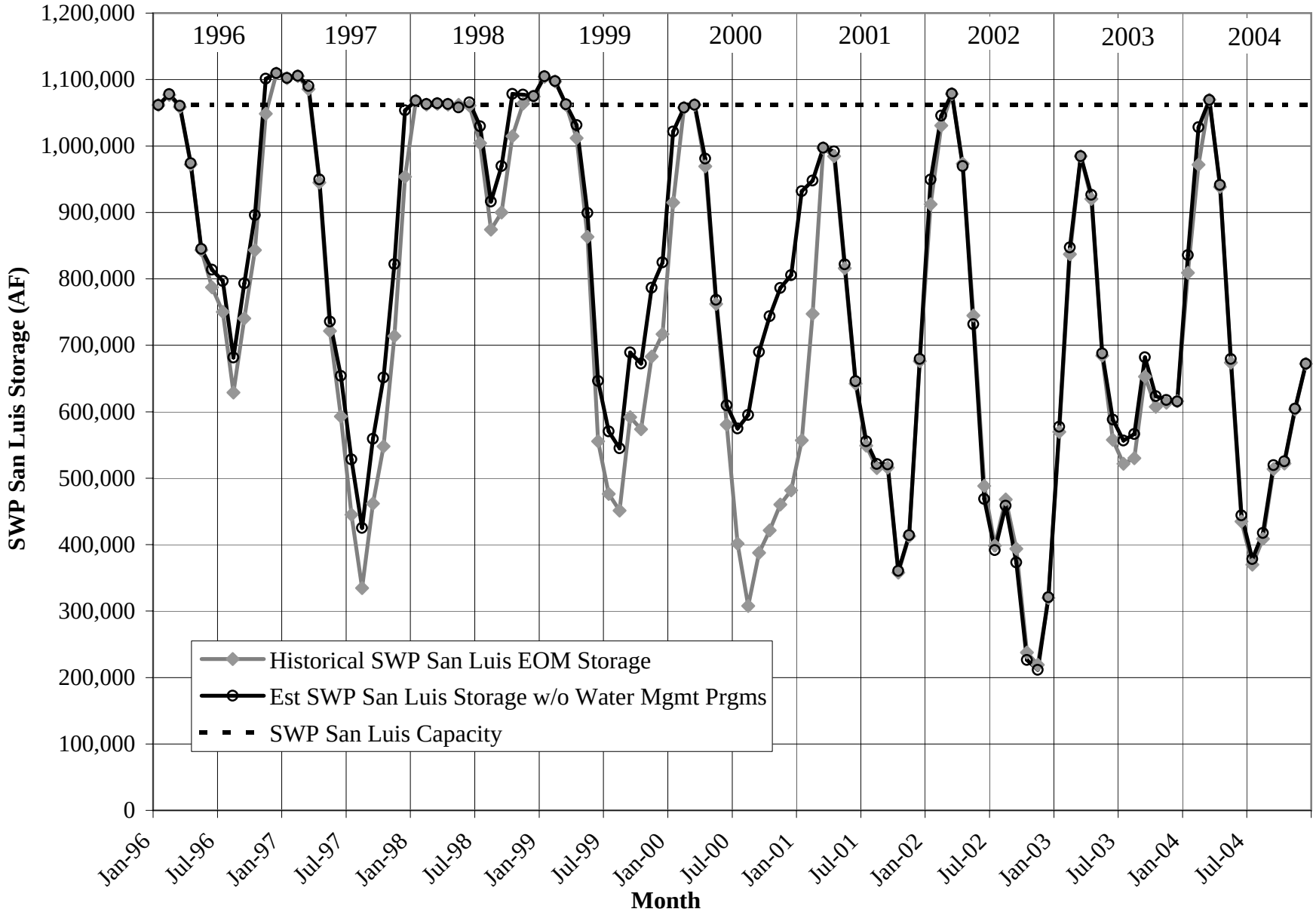
SWP End-Of-Month Storage in San Luis Reservoir



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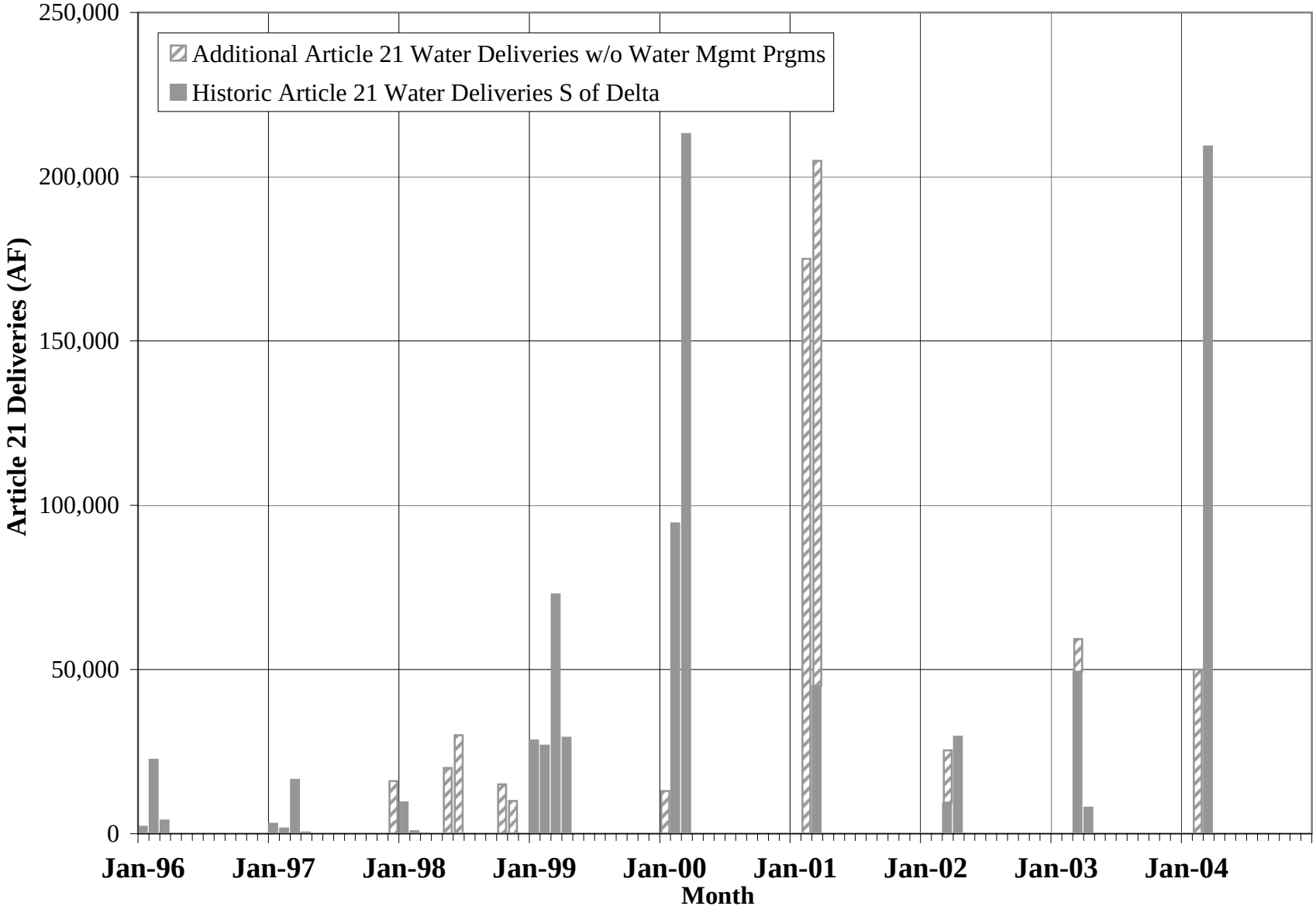
Monthly Article 21 Water Deliveries



Monterey Water Mgmt Prog Analysis-wo stor assump (2007Jun15 Clemm).xls

L. ANALYSIS OF EFFECTS ON CVP USE OF JPOD (STUDY NO. 6)

Effect of Monterey Amendment (Proposed Project) on CVP Use of JPOD to Fill CVP San Luis Reservoir

Historical

The Department analyzed the historical record to determine whether the Proposed Project had any impact on the CVP share of San Luis Reservoir storage any time between 1995 and 2005. Any impacts would have been confined to those periods when the SWP Banks Pumping Plant was continuing to operate at its full permitted capacity under the Proposed Project in periods when the pumping rate would have otherwise been reduced in the baseline circumstances. There are 12 months in the historical period when the Department estimates such pumping differences occurred.

Each of the 12 months was reviewed carefully to determine whether the CVP would have been likely to want to use Joint Point of Diversion (JPOD) to fill CVP San Luis Reservoir, supplementing the capacity at the Tracy Pumps. The use of JPOD involves added energy costs for the CVP, and the decision whether to use JPOD is also dependent on Reclamations' judgment of whether the CVP share of San Luis Reservoir can be filled using only the Tracy pumps.

The CVP would only use any Banks capacity freed up due to reductions in SWP Delta diversions if storage in CVP San Luis was not anticipated to fill (and power cost considerations might limit that even further). Actual CVP San Luis filled in every year but one year (1997), and in that year was only short by about 40,000 acre-feet. Given conditions in that year, it appears that there was already available JPOD capacity that the USBR chose not to use. Therefore, the Department has concluded that there would have been no additional usage of Banks capacity by CVP during this analysis period, and thus there was no impact of the Proposed Project on the CVP use of JPOD.

Future

The Department also analyzed the potential for future impacts on CVP use of JPOD to fill CVP San Luis Reservoir. The analysis was performed by reviewing CALSIM II data on SWP San Luis storage and CVP San Luis storage from both the 2020 baseline and 2020 Proposed Project model studies to identify candidate years when the CVP might desire to use JPOD. Identification of these candidate years provides the maximum potential for JPOD use by CVP. For a number of reasons discussed in more detail below, it would be extremely difficult to determine in these candidate years whether or not Reclamation would elect to use JPOD, or how the Proposed Project, including the water management provisions not modeled in CALSIM, would have affected this use. Therefore, the analysis focuses on identifying the maximum potential JPOD use to fill CVP San Luis. Any effects of the Proposed Project on CVP JPOD use would likely be considerably less than this maximum potential impact.

Maximum Potential Impact

The analysis focused on those times when the SWP share of San Luis Reservoir was full because those are the times that added pumping at Banks may occur due to the Monterey Amendment actions described for the Proposed Project. While the CVP may seek and use JPOD at other times, the only impact of the Proposed Project on CVP JPOD use would occur when the SWP share of San Luis Reservoir is full and the CVP share is not full.

The analysis was performed by first comparing the timing of fill for the SWP and CVP shares of San Luis Reservoir between the baseline and Proposed Project model studies. Because the timing of fill was nearly identical between the two studies, the analysis focused on specific data from the 2020 Proposed Project study. The next step was to determine if SWP San Luis Reservoir filled; in years when it did not fill there would be no impact on CVP potential to use Banks to fill the CVP share of San Luis because the SWP would generally be making the full use of Banks pumps consistent with upstream releases, Delta inflow, and permitting constraints.

The next step was to determine whether and when CVP San Luis filled. If both CVP and SWP shares of the reservoir filled within a month of each other, it would be unlikely that Reclamation would request the use of Banks to help fill the CVP share of San Luis Reservoir because Reclamation would be able to project that the reservoir could be filled from the Tracy pumps alone, without the added energy costs of CVP JPOD use at Banks. Such years were excluded from the analysis. Also, in years when both CVP and SWP San Luis demonstrated a strong fill rate early, showing a likelihood of CVP San Luis filling by March, it was assumed that Reclamation would not request JPOD use.

In those years when the SWP share of San Luis filled (1,062,180 acre-feet) and the CVP share (965,660 acre-feet) did not fill, or the CVP share filled two months later than the SWP share, the potential for CVP use of JPOD was identified. Those years, and the judgment as to possible JPOD use, are tabulated below.

Table xxxxxx
Analysis of Potential Use of JPOD by the CVP to Fill CVP San Luis Reservoir

Year	Data	Judgment on JPOD Use
1940	SWP filled March, dropped quickly in April; CVP only 644 TAF max	Possibly yes, but brief – less than a month; SWP full only in one month.
1943	SWP almost filled early in December 1942, full in January 1943, slightly lower in February, full again in March; CVP filled late: March	Probably yes.
1951	SWP filled in January; CVP filled late: March	Probably not; CVP nearly full in January and CVP likely assumed could fill on own.

Year	Data	Judgment on JPOD Use
1952	SWP filled in March; CVP at 871 in March, 943 in April	Probably not; CVP likely assumed could fill on own.
1954	SWP filled in March, dropped quickly in April; CVP only at 856 TAF max	Probably yes; brief – less than a month, SWP full only in one month.
1958	SWP filled in March, but nearly full in February; CVP filled late, in April	Probably yes.
1963	SWP filled in March; CVP at 905 at March, 887 April	Probably yes; for a brief period only – month or less.
1966	SWP filled in January; CVP just shy of full in March: 951 TAF	Probably not; CVP likely assumed could fill on own.
1973	SWP filled in January; CVP filled March, nearly full in February	Probably not; CVP likely assumed could fill on own.
1974	SWP filled in March, dropped quickly in April; CVP nearly full in March at 913 TAF, dropped quickly in April	Possibly yes; for a brief period only – month or less.
1975	SWP filled in March; CVP at 924 TAF in March, 919 TAF in April	Probably yes; for a brief period only – month or less.
1978	SWP filled January, CVP filled March	Probably not; CVP likely assumed could fill on own.

From the analysis summary above, it was concluded that the CVP may have wanted to use JPOD to help fill CVP San Luis reservoir in 7 of 73 years, or in other words, there was about a 10% probability of CVP JPOD use. To estimate the maximum potential impact of the Monterey Amendment on CVP JPOD use, it was assumed that all of the possible or probable use identified above would be precluded by the Proposed Project and would not occur. The magnitude of the maximum potential impact was based on CALSIM II output of San Luis storage and a rough estimate of the available fill period. The impact was limited by the amount of the unfilled storage in the CVP share of San Luis reservoir for each year of potential impact. Other factors, listed later in this section, may further limit any impact on the CVP. If CVP San Luis eventually filled, there was no water supply impact.

For each of the above years, the following results were determined:

1940: CVP could have used JPOD for less than a month around the end of March; no more than 100,000 acre-feet (CVP San Luis was 322,000 acre-feet less than full)
1943: CVP filled late March: no water supply impact
1951: CVP filled late March: no water supply impact
1952: CVP could have used JPOD for a month or less in late March-early April, until VAMP; probably would not have requested JPOD considering close to full; if had requested JPOD, might have filled CVP San Luis (CVP San Luis was 23,000 acre-feet less than full)

1954: CVP could have used JPOD for less than a month around the end of March; no more than 100,000 acre-feet (CVP San Luis was 110,000 acre-feet less than full)
1963: CVP could have used JPOD for a month or less in late March-early April, until VAMP; might have filled CVP San Luis (CVP San Luis was 61,000 acre-feet less than full)
1974: CVP could have used JPOD for a month or less in late March-early April, until VAMP; might have filled CVP San Luis (CVP San Luis was 53,000 acre-feet less than full)
1975: CVP could have used JPOD for a month or less in late March-early April, until VAMP; might have filled CVP San Luis (CVP San Luis was 42,000 acre-feet less than full)

Based on these results, in six of 73 years, or about an 8% probability of occurrence, there could be a water supply impact to the CVP. The maximum potential impact would occur if the Proposed Project completely foreclosed CVP JPOD use in any of those years because Banks was meeting increased SWP diversions related to the Proposed Project. The maximum water supply impact is estimated at a maximum of 100,000 acre-feet in any year, which occurred in two years (about a 3% probability of occurrence), and in smaller amounts ranging from 23,000 to 61,000 acre-feet in four years (about a 5% probability of occurrence). The average of this maximum potential impact over the 73-year study period is about 5,000 acre-feet per year.

Note that given the monthly time step of the CALSIM II model output, the short durations available for JPOD use to fill CVP San Luis when the SWP share is full (frequently less than a month or two), fluctuations in demand as influenced by daily weather conditions, and the daily real-time operation of the Delta, these estimates derived from CALSIM II results are rough approximations. The fisheries evaluation in this EIR provides estimates of the daily impact of the Proposed Project on the availability of added capacity at Banks. The reader may want to review that analysis for added insight into the daily accounting that influences the availability of Banks for JPOD.

Factors That May Reduce Potential Impact

As noted previously, Reclamation does not necessarily use JPOD every time it is available, even when it is unsure of whether it can completely fill CVP San Luis. The maximum potential impacts identified above would be reduced if for financial reasons Reclamation chose not to use JPOD in a particular year (to avoid the added energy costs it would be charged for that use), or if any of a number of operational factors constrained the amount of JPOD pumping that could physically occur. The operational factors that can reduce the magnitude of the maximum potential impact on CVP JPOD use include:

- SWP demands, which would determine the maximum amount of pumping potentially available to the CVP for JPOD use;

- CVP demands from Tracy, and permitted Tracy pumping capacity, which would determine the amount of water pumped at Tracy that could be used to fill CVP San Luis;
- the pumping capacity of the Gianelli Pumping-Generating Plant as a function of the water surface in San Luis Reservoir: the effective pumping rate decreases as the reservoir fills and the head (lift from O'Neill Forebay to the water surface in San Luis Reservoir) increases;
- the difference between the amount of water pumped at Tracy that could be used to fill CVP San Luis Reservoir and the capacity of the Gianelli pumps to lift the water into San Luis Reservoir: if Tracy is already providing sufficient flows to meet the capacity of the Gianelli pumps, there is no need for JPOD; otherwise JPOD use at Banks would be limited to the difference in these rates;
- the number of days that a difference would occur, as influenced by the start of VAMP or an increase in demands requiring releases from San Luis Reservoir;
- use of JPOD by the EWA Program or its successor to repay debt accrued in San Luis Reservoir and to develop EWA assets in San Luis Reservoir. The EWA Operating Principles Agreement grants EWA a 50% share of JPOD when it can use it; this sharing of JPOD is most beneficial to EWA when San Luis Reservoir is full, and would reduce the CVP use of JPOD by 50% in such instances; and
- relevant SWRCB permitting requirements, specifically approved water quality, water level, and fish response plans. If approved plans are not in place, or physical conditions are not acceptable (e.g., Delta water levels are low enough to adversely affect in-Delta diversions), JPOD use may not be allowed.

Note that the effective rate at which the CVP might be able to use JPOD to fill the CVP share of San Luis Reservoir can vary during the period JPOD is available with changes in SWP and CVP demands during that period, changes in the permitted pumping rate at Banks and Tracy, the EWA's need to share JPOD with the CVP, and the decreasing rate of fill of San Luis Reservoir as it nears 100% of total capacity.

The financial and operational considerations discussed above can limit CVP JPOD use in any year, under both baseline and Proposed Project conditions. Whether the Proposed Project would further limit this use would be difficult to determine. While CALSIM II models certain provisions of the Proposed Project (Table A retirement, permanent Table A transfers, and water allocations), it does not model the water management provisions of Articles 54 and 56.

Some of the water management provisions (such as storage outside a contractor's service area under Article 56) might at times result in an increase in SWP water demand, and thereby increase or extend Banks pumping in the wet winter months, with a potential adverse impact on possible CVP JPOD use. However, as contractor demands increase in the future, any demand increases due to these provisions would likely decrease in magnitude and frequency (due to less unused water to store as demand increases), with a corresponding decrease in potential adverse impacts on CVP JPOD use.

Another water management provision, carryover storage under Article 56, would have a beneficial effect on CVP use of JPOD. Under this provision, SWP contractors would leave more of their supplies in SWP San Luis at year-end as a hedge against the next year's allocations, which would have the effect of allowing SWP San Luis to fill earlier in many years and increase the opportunities for the CVP to use JPOD to fill CVP San Luis. It would be difficult to impossible to estimate the impact of carryover storage on San Luis fill dates, and to determine how that earlier fill might free up added JPOD capacity for the CVP. However, there would be some beneficial effect on CVP use of JPOD because of the carryover storage provision of the Proposed Project, which would likely more than offset any adverse impacts due to the potential, occasional demand increases of other water management provisions.

M. ANALYSIS OF EFFECTS ON THE ENVIRONMENTAL WATER ACCOUNT (STUDY NO. 7)

Impact of Monterey on the Environmental Water Account

As described in Section 7.3.1.2, the EWA provides resources to permit flexibility in Delta pumping to provide protection to the fish of the Bay-Delta estuary through environmentally beneficial changes in the operations of the SWP and CVP. These benefits occur by changing project pumping from the Delta, augmenting streamflows, and increasing Delta outflow at times to benefit fish.

The most common action of the EWA Agencies is to reduce pumping at times when fish are most sensitive to the impacts of Delta export pumping. The costs to the EWA program for reductions in pumping are computed as the difference between the permitted pumping rate that otherwise would have occurred and the reduced pumping rate agreed upon by the five EWA agencies at the Banks and C. W. "Bill" Jones pumps for the duration of the curtailment.

The impact of Monterey on EWA will depend on whether there is a higher level of pumping occurring at the Banks pumps as a result of greater water deliveries under Monterey Project conditions at the times that the EWA Agencies initiate pumping reductions at Banks. An impact on EWA can only occur at those times when Delta pumping would otherwise have been cut back to just meet project demands and all SWP storage was full and EWA debt was otherwise paid.

There can be two types of impact during these periods. The first type of impact is an increased cost to EWA because of a higher base pumping level at the Banks pumps during an EWA-initiated pumping curtailment. The second type of impact is a deferral or elimination of EWA's ability to use Banks capacity to offset prior debt from earlier pumping curtailments. Both types of impact leave EWA with a greater water debt to offset in the future, either through added water purchases or through operational assets.

Figure M-1 provides a graphical guide to determining the times when there could be an impact on the EWA as a result of the Monterey Amendment and other alternatives.

During those times when there could be an impact, the amount of the impact would depend on the duration of an EWA-initiated pumping curtailment (if in effect), the reduced pumping level targeted by the EWA agencies, the distribution of the reduction between the Banks and Jones pumps, contractor requests for deliveries, the baseline Banks pumping rate under the No-Project conditions, the Banks pumping rate under the respective alternatives, and the potential ability for EWA to offset the costs by using operational flexibility at Banks after San Luis Reservoir has been filled and all contractor demands are met.

The complexity of these variables makes estimates of impacts on EWA highly speculative. However, to estimate the frequency with which they might occur, the frequency and duration of the times when there could be an impact can be estimated by review of the historical record from January 1996-December 2004. As noted elsewhere,

there were 12 months during this nine-year period when there would likely have been a higher level of pumping occurring at the Banks pumps as a result of greater water deliveries under Monterey Project conditions. Those months are tabulated below together with a notation of the likelihood that EWA pumping curtailments might have occurred, the maximum estimated pumping difference between the baseline pumping and the Monterey Project pumping, and the likelihood that EWA would repay the cost of the curtailment in the same season using operational flexibility.

In some of those 12 months, EWA would have been able to use the operational flexibility at Banks to pump added water to refill San Luis Reservoir before the start of VAMP and repay the added debt incurred during the earlier fish action. This exercise of operational flexibility, granted in the CALFED ROD, would be dependent on whether the additional pumping would be compatible with fish conditions in the Delta and on the availability of sufficient time prior to the start of VAMP to offset the EWA debt.

An estimate of possible EWA costs is also presented in Table M-1 assuming that all of the curtailment was experienced at Banks and none at Jones; the maximum duration of the EWA action would be two weeks; the maximum daily EWA cost would be 2,000 cfs (about 4,000 acre-feet per day, or 56,000 acre-feet maximum in any month); and that the EWA would use operational flexibility to repay debt whenever the action occurred before March. When the action occurred in March, the potential for repayment exists in the first two weeks of April as well as the last part of March, depending on the exact dates of the action; however, the table notes that such while repayment may be possible, no repayment of the debt is assumed, thereby maintaining a conservative analysis.

Table M-1
Estimated Maximum Impact of Proposed Project on EWA Water Costs

Month/Year of Banks Changes	Banks Diversion Change	EWA Action Likelihood?	Was There an EWA Action?	Initial EWA Impact	Can EWA Offset Any Impact?	Maximum EWA Impact
November 1996	53,000	No	N/A	0	N/A	0
December 1996	2,000	Unlikely	N/A	0	Yes	0
January 1998	110,000	Possible	N/A	56,000	Yes	0
November 1998	40,000	No	N/A	0	N/A	0
December 1998	13,000	Unlikely	N/A	0	Yes	0
January 1999	2,000	Possible	N/A	2,000	Yes	0
February 1999	7,000	Possible	N/A	7,000	Yes	0
March 1999	18,000	Possible	N/A	18,000	Possibly	18,000

Month/Year of Banks Changes	Banks Diversion Change	EWA Action Likelihood?	Was There an EWA Action?	Initial EWA Impact	Can EWA Offset Any Impact?	Maximum EWA Impact
February 2000	119,000	Possible	N/A	56,000	Yes	0
March 2000	13,000	Possible	N/A	13,000	Possibly	13,000
March 2001	46,000	Possible	Yes	46,000	No	46,000
March 2004	30,000	Possible	No	0	Possibly	0

The EWA began operation in December 2000. It should be noted that there was only one fish action (March 2001) that coincided with a time when there could have been an impact of the Monterey Project on EWA from 2000-2004. Whether there was an actual impact on EWA costs in March 2001 depends on the exact timing and duration of the fish action relative to the exact period when the added pumping was occurring. Those variables have not been determined, as the analysis has been conducted using a monthly time step. However, in the 2001 historical case, EWA was unable to use operational flexibility at that time to offset accumulated EWA debt in San Luis Reservoir of 203,000 acre-feet for fish actions from January through March 2001 because pumping curtailments for fish were continued into April.

As noted earlier, during those times when Banks pumping continues at a higher rate under Monterey (such as the twelve months identified earlier), the ability of EWA to use its operational flexibility at Banks to reduce previously accumulated debt in San Luis Reservoir may be reduced. Such events would effectively increase EWA's debt and require greater purchases of water to offset EWA debt. The events in 2001 are illustrative of that type of occurrence. The impact of such events is not possible to estimate absent a daily analysis of the historical period, although the estimates for 2001 above include that aspect of the potential impact.

Based on the above analysis, there could be an impact on EWA costs in roughly one-third of years, with the magnitude depending on a range of factors that are not readily predictable. The average impact in the three years out of nine when it is postulated to occur would be about 26,000 acre-feet. The EWA has averaged about 250,000 acre-feet of pumping curtailments at Banks and Jones combined from 2001-2006. Thus the impact of the added burden on EWA from the times when Banks is pumping at its full permitted rate for a greater amount of time with the Monterey Project than it would pump under No-Project conditions would impact overall EWA actions by about 10% in each of the years when such an impact would occur. As noted above, that impact is postulated to occur in one-third of the years.

The future of the EWA is currently under evaluation in context with the decline in pelagic fish species in the Delta. The EWA Program has allowed a relatively small shift in project pumping to benefit fish (an average of 250,000 acre-feet annually out of as much as 4,500,000 acre-feet pumped at Banks and 3,000,000 acre-feet pumped at Jones). Part of the scientific investigation currently underway is intended to determine causes of

the decline and indicate the relative magnitude and type of resources needed to address the decline. The ultimate role of the EWA or a successor program is not known at this time.

State funding for the EWA is available through 2008 with no state revenue sources identified beyond that time. The CEQA and NEPA coverage for the EWA currently covers the program through December 31, 2007. A supplement to the EWA EIS/EIR is under preparation to allow extension of the current program until a new long-term EWA program is developed and CEQA/NEPA coverage is in place; an equivalent program for fish protection is developed as part of the Bay-Delta Conservation Planning effort, and its CEQA/NEPA coverage is in place; or the EWA program is terminated.

From the federal perspective, Congress has authorized the EWA Program through 2010, and has authorized $90 million for the program. Annual appropriations are required to continue the program operations.

Thus the continuation of the EWA Program as of the time that this EIR is adopted is uncertain, and the impacts outlined above are estimates based on limited data.

Mitigation Measures

The impacts on EWA can be offset by providing offsetting assets to the EWA or a successor program.

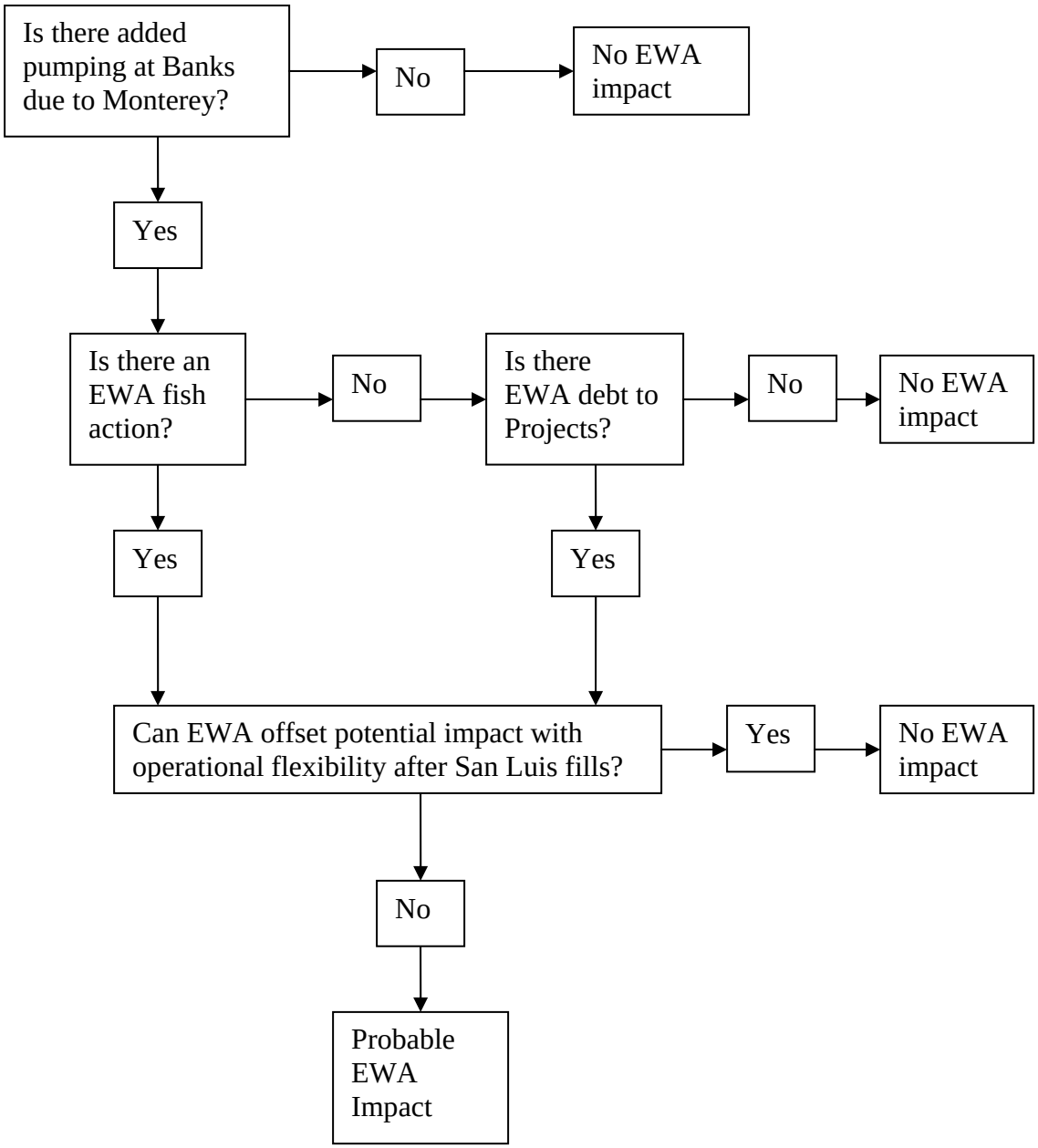



Figure M-1
Evaluation of Potential EWA Impact of Monterey