FINAL EIS/EIR
SCH#2003101106

WATER TRANSFER PROGRAM FOR THE SAN JOAQUIN RIVER EXCHANGE CONTRACTORS WATER AUTHORITY 2005–2014

Prepared for

U.S. Department of the Interior
Bureau of Reclamation
Sacramento and Fresno, California

and

San Joaquin River Exchange Contractors Water Authority
Los Banos, California

December 2004

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26814274.00900

FINAL
ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT
WATER TRANSFER PROGRAM FOR THE
SAN JOAQUIN RIVER EXCHANGE CONTRACTORS WATER AUTHORITY 2005-2014

Lead Agencies: U.S. Department of the Interior, Bureau of Reclamation (Reclamation), Mid-Pacific Region, Sacramento and Fresno, California; and San Joaquin River Exchange Contractors Water Authority (Exchange Contractors), Los Banos, California

This Final Environmental Impact Statement/Environmental Impact Report (Final EIS/EIR) has been prepared in compliance with the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), and Reclamation procedures for NEPA compliance. Reclamation and the Exchange Contractors prepared this Final EIS/EIR for the Water Transfer Program for the period March 1, 2005, through February 28, 2014. The program would consist of the transfer of up to 130,000 acre-feet of substitute water (a maximum of 80,000 acre-feet of developed water from conservation measures, including tailwater recovery, and groundwater pumping and a maximum of 50,000 acre-feet from temporary land fallowing) annually from the Exchange Contractors to other Central Valley Project (CVP) contractors, to Reclamation for delivery to the San Joaquin Valley wetland habitat areas (wildlife refuges), and to Reclamation and/or the California Department of Water Resources for use by the CALFED Environmental Water Account (EWA) as replacement water for CVP contractors south of Delta. Reclamation would approve and/or execute short-term and/or long-term temporary water transfers or agreements.

The purposes/objectives of the proposed transfer program are to:

- Develop supplemental water supplies from willing sellers in the Exchange Contractors service area through water conservation/tailwater recovery, groundwater pumping, and crop idling/temporary land fallowing activities consistent with district policies.
- Provide water supplies to the refuges consistent with the Incremental Level 4 water quantities for wildlife habitat development.
- Assist CVP agricultural service contractors to obtain additional CVP water for the production of agricultural crops or livestock because of water supply shortages when full contract deliveries cannot otherwise be made.
- Provide Santa Clara Valley Water District (SCVWD) with short-term water supplies to support agriculture and/or municipal and industrial uses in Santa Clara County when full contract deliveries cannot otherwise be made.

The Final EIS/EIR examines the following alternatives that were determined to meet the program's purpose and need:

- **Alternative A (80,000 acre-feet)** would provide up to 80,000 acre-feet of water during noncritical years through a combination of conservation, groundwater, and crop idling/land fallowing sources; and during critical years, up to 50,000 acre-feet of water may be made available through crop idling/land fallowing only.
- **Alternative B (50,000 acre-feet)** would develop up to 50,000 acre-feet from crop idling/temporary land fallowing in any year.
- **Alternative C (130,000 acre-feet)** would develop up to 130,000 acre-feet of water during noncritical years, with up to 80,000 acre-feet of water made available through conservation (up to 80,000 acre-feet, including tailwater recovery) and groundwater (up to 20,000 acre-feet), and up to 50,000 acre-feet of water made available through crop idling/temporary land fallowing. During critical years, up to 50,000 acre-feet of water may be made available through crop fallowing, and no water is to be made available from conservation/tailwater recovery and groundwater sources. Alternative C is the Proposed Action.

The Proposed Action is located in Fresno, Kern, Kings, Madera, Merced, San Benito, San Joaquin, Santa Clara, Stanislaus, and Tulare counties in California.

Reclamation will not make a decision on the Proposed Action until 30 days after release of the Final EIS/EIR. After the 30-day waiting period, Reclamation will complete a Record of Decision (ROD). The ROD will state the action that will be implemented and will discuss all factors leading to the decision. The Exchange Contractors expect to certify the EIS/EIR, to consider approval of the Proposed Action, and to make any findings required by CEQA at a meeting of the Board of Directors to be held on January 7, 2005, and then issue a Notice of Determination pursuant to CEQA.

For further information regarding this Final EIS/EIR, contact Mr. Bob Eckart, U.S. Bureau of Reclamation, 2800 Cottage Way, Sacramento, CA 95825, (916) 978-5051, fax: (916) 978-5055; or Ms. Joann Toscano, Exchange Contractors, P.O. Box 2115, 541 H Street, Los Banos, CA 93635-1122, (209) 827-8616, fax: (209) 827-9703.

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ES.1 BACKGROUND

This report examines the specific environmental effects of the transfer of up to 130,000 acre-feet of substitute water[1] from the San Joaquin River Exchange Contractors Water Authority[2] (Exchange Contractors) to the San Joaquin Valley wetland habitat areas, to other Central Valley Project (CVP) contractors, and/or to the CALFED Environmental Water Account (EWA). This report has been prepared in accordance with the National Environmental Policy Act of 1969, as amended (NEPA), and the California Environmental Quality Act of 1970 (CEQA).

The proposed Federal action is to (1) acquire water for the wildlife refuges (Incremental Level 4 under the Central Valley Project Improvement Act [CVPIA]), (2) approve transfers and/or exchanges of CVP water from the Exchange Contractors to other CVP contractors, and (3) enter into EWA contracts that would benefit CVP operations. The Exchange Contractors, as the lead agency for the State, have prepared this document to examine the environmental impacts of the transfer and/or exchange of their CVP water (up to 130,000 acre-feet per year for the next 10 years) in the San Joaquin Valley, the Sacramento-San Joaquin River Delta (Delta), San Benito County, and Santa Clara County (receiving areas). The Exchange Contractors propose to make water available for transfer and/or exchange to either the refuges, CVP contractors for municipal/industrial (M&I) and/or agricultural areas, the Bureau of Reclamation (Reclamation) or the California Department of Water Resources (DWR) for use by the EWA in the CVP Delta export service area, or to some combination of these users.

In 1995, Reclamation and the U.S. Fish and Wildlife Service initiated a 3-year Interim Water Acquisition Program to acquire incremental Level 4 water for the refuges designated in the CVPIA. This program concluded in February 1998. During this 3-year period, Reclamation met the Level 4 water supply requirements of the San Joaquin Valley refuges primarily through annual temporary transfers of water from the Exchange Contractors. In 1998, no water was acquired from the Exchange Contractors for the refuges. In 1999, the Exchange Contractors transferred 20,000 acre-feet to Reclamation for the refuges and 40,000 acre-feet to westside agricultural users. Transfers conducted by the Exchange Contractors have been made annually since 1999. Table 1-1 (in Section 1.1) shows water transfers made in recent years.

The duration of the proposed program is for 10 consecutive years beginning March 1, 2005, through February 28, 2015 (water service years 2005–2014).

The Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) is provided herein in one volume. It includes comments received on the Draft EIS/EIR, the lead agencies' responses to those comments, and changes to the text and figures needed to address the comments. The changes to the text and figures do not provide significant new information.

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[1] The transfer involves "substitute water" because the Exchange Contractors' water supply involves the substitution of CVP water in lieu of surface water diversions from the San Joaquin River (which halted with the development of Friant Dam/Millerton Lake by Reclamation).

[2] The San Joaquin River Exchange Contractors Water Authority consists of Central California Irrigation District, San Luis Canal Company, Firebaugh Canal Water District, and Columbia Canal Company. These entities are commonly known as the "Exchange Contractors."

Rather, the changes provide clarification to respond directly to public comments or to provide internal consistency.

ES.2 PROJECT PURPOSE AND NEED/OBJECTIVES

The purpose of the proposed program is to allow the annual transfer and/or exchange of CVP water from the Exchange Contractors to:

- The Department of the Interior (Interior) Water Acquisition Program (WAP) to acquire water supplies (Incremental Level 4) for San Joaquin Valley wildlife refuges and the Tulare Lake Basin wildlife areas
- Other CVP contractors to meet demands of agriculture and M&I uses
- DWR or Reclamation for use by the EWA to the extent that this would benefit CVP operations by improving water supply reliability for CVP water users south of the Delta

The proposed temporary water transfers/acquisitions are needed to maximize the use of limited water resources for agriculture, fish and wildlife resources, and M&I purposes with the following objectives:

- Develop supplemental water supplies from willing sellers in the Exchange Contractors service area through water conservation/tailwater recovery, groundwater pumping, and crop idling/fallowing activities consistent with district policies.
- Provide water supplies to the refuges consistent with the Incremental Level 4 water quantities for wildlife habitat development.
- Assist CVP agricultural service contractors to obtain additional CVP water for the production of agricultural crops or livestock because of water supply shortages when full contract deliveries cannot otherwise be made.
- Provide Santa Clara Valley Water District (SCVWD) with short-term water supplies to support agriculture and/or M&I uses in Santa Clara County when full contract deliveries cannot otherwise be made.

No new lands would be brought into agricultural production by any of the CVP water users; water would be used on lands irrigated within the last 3 years. The project objectives can be further clarified by the following:

Refuge Water Supplies. Pursuant to CVPIA Section 3406(d)(2), the Secretary of the Interior has established a program (the Water Acquisition Program [WAP]) to acquire, by voluntary measures that include water conservation, conjunctive use, purchase, lease, donations, or similar activities, or a combination of such activities that do not require involuntary reallocations of project yield, Incremental Level 4 water supplies for delivery to wetland habitat areas in the Sacramento and San Joaquin valleys. During the annual water service periods (March 1, 2005–February 28, 2015, water service years 2005–2014), WAP has a need to acquire 100 percent of the Incremental Level 4 refuge water supplies to fully implement the requirements of CVPIA Section 3406(d)(2). Therefore, one of the purposes of the proposed program discussed in this EIS/EIR is to acquire some water to meet the Incremental Level 4 water supply requirements for certain wetland habitat areas in the San Joaquin Valley.

Agricultural Water Use. Another purpose of the Proposed Action includes the transfer of water from the Exchange Contractors to as many as nine water districts (CVP agricultural service contractors), specifically to provide additional irrigation water for agricultural use in the San Joaquin Valley, San Benito County, and Santa Clara County and to participating districts in the Friant Unit[3] of the CVP. In most years, CVP contractors do not receive full contract amounts, and seasonal irrigation water deficits occur under all but the wettest hydrologic conditions. In most years, the districts receive only 50 to 75 percent of their total contract amounts.

Santa Clara Valley Water District. SCVWD operates three water treatment plants and 10 local reservoirs and annually provides 390,000 acre-feet of water to over 1.8 million M&I and agricultural water users in Santa Clara County. Half of the M&I water need is met by underground aquifers within the 1,300 square-mile county region. Nearly 39 percent of this water, up to 152,500 acre-feet, is obtained from the CVP (119,400 acre-feet per year for M&I needs and 33,100 acre-feet per year for agricultural needs). SCVWD negotiated a Water Service Contract (No. 7-07-20-W0023) that sets the dry year delivery base at 75 percent of contract quantity for M&I deliveries (or 89,550 acre-feet) (Reclamation 2001h). The proposed transfer would help to meet needs of M&I or agricultural users in years when full contract deliveries cannot be made.

Environmental Water Account. The EWA was established in the August 2000 CALFED Programmatic Record of Decision as a cooperative water management program, the purpose of which is to provide protection to at-risk native fish species of the San Francisco Bay/Sacramento-San Joaquin River Delta estuary, while improving water supply reliability for water users. The EWA program makes environmentally beneficial changes in CVP/State Water Project (SWP) operations, and acquires replacement water so that there is no uncompensated water loss to the CVP and SWP water contractors. Beneficial changes in CVP and SWP operations could include changing the timing of some flow releases from storage and the timing of water exports from the CVP and SWP pumping plants in the Delta to coincide with periods of greater or lesser vulnerability of various fish species to environmental conditions in the Delta. For example, the EWA might alter the timing of water diversions from the Delta in order to reduce fish entrainment at the CVP and SWP pumping plants and provide migratory cues for specific anadromous fish species. The timing of the protective actions and operational changes would vary from year to year, depending on many factors such as hydrology and real-time monitoring that indicates fish presence at the pumping plants.

ES.3 PUBLIC AND AGENCY INVOLVEMENT

The consultation process began October 21, 2003, with the issuance of a Notice of Preparation of a Joint Environmental Impact Statement/Impact Report on the Water Transfer Program for the San Joaquin River Exchange Contractors Water Authority, 2005–2014. A Notice of Intent was published on the same day in the *Federal Register*. The notices announced one public scoping meeting for November 18, 2003, and requested that comments on the content of the EIS/EIR be submitted by November 25, 2003. Comments addressed the following concerns: project

[3] Participating districts would be those with storage and conveyance facilities or capability to deliver water to the end user as an exchange or direct transfer.

description, water quality/hydraulics/water supply, groundwater, biological resources, economics, agricultural land use, and cumulative impacts. Comments were received from the following organizations: U.S. Environmental Protection Agency, Stanislaus County, San Joaquin County Community Development Department, Modesto Irrigation District, Oakdale Irrigation District, Westlands Water District, Stockton East Water District, South Delta Water Agency, Grassland Resource Conservation District, Friant Water Users Authority, the Farm Bureau, San Joaquin Valley Air Pollution Control District, Natural Resources Defense Council, and Roy L. Thomas.

Federal, state, and local agencies were involved with Reclamation and the Exchange Contractors in the development of this EIS/EIR through specific consultations. The Draft EIS/EIR was sent to the State Clearinghouse as required by CEQA on June 4, 2004. The Clearinghouse distributed the document to selected state agencies as listed in Appendix E. None of these agencies commented through the Clearinghouse by July 23, 2004, the close of the mandatory 45-day review period. However, comments were provided separately by the DWR and the Department of Food and Agriculture. Consistent with CEQA Guidelines, the Exchange Contractors placed notices in two newspapers of general circulation within the project area: *The Fresno Bee* on June 10, 2004, and *The Modesto Bee* on June 10, 2004.

Consistent with Reclamation's procedures for implementing NEPA, the Draft EIS/EIR was filed with the U.S. Environmental Protection Agency (USEPA) on June 9, 2004, and a notice was placed in the *Federal Register* on June 16, 2004, announcing the availability of the document for public review and commencing the official public review period which closed August 2, 2004. Reclamation also issued a press release on June 17 and placed an announcement on the Reclamation Web site.

Written comments on the Draft EIS/EIR were received from 16 agencies and organizations, and the letters and responses are presented in Appendix E. One public hearing was held on July 7, 2004, in Los Banos, and oral testimony was provided by Paul Olmstead for the Sacramento Municipal Utility District, Mark Rhodes for Westlands Water District, and Jose I. Faria for the DWR. The public hearing transcripts are also provided in Appendix E.

ES.4 ALTERNATIVES CONSIDERED AND PREFERRED ALTERNATIVE

For the Exchange Contractors' water transfer program for water years 2005–2014, the No Action and No Project Alternatives are the same.

- Reclamation describes the No Action Alternative as a projection of conditions that could reasonably occur within the time period associated with the proposed transfer, water years 2005–2014, but without any of the action alternatives being implemented. Under NEPA, it is the future "without project" alternative which is the benchmark for determining environmental effects of the proposed action alternatives.
- Similarly, the No Project Alternative under CEQA is the condition under which the project does not proceed. Where failure to proceed with the project will not result in the preservation of existing environmental conditions, then the practical results of "no transfer" are identified. Where "no transfer" from the Exchange Contractors would result in predictable actions by Reclamation's WAP and the Exchange Contractors, these consequences are discussed.

- Under CEQA, the basis for determining the significance of environmental impacts is existing physical conditions. No Project is evaluated against the existing condition, but it is not the baseline for significance determinations unless it is equivalent to the existing condition, which is the case for this EIS/EIR for most of the affected resources.
- The No Action/No Project Alternative is similar to the existing condition and is the primary environmental baseline. Differences (if any) are discussed in the environmental analysis sections.

The No Action/No Project Alternative would result in no transfer or exchange of water from the Exchange Contractors to either Interior or to any of the other potential water users. The response of the entities directly involved with the Proposed Action to no transfer from the Exchange Contractors would be:

- The Exchange Contractors would recover and reuse for their own operations approximately the same amount of tailwater flows that have recently been otherwise transferred. The reused water would be integrated into the Exchange Contractors' water supply and likely reduce groundwater pumping that currently helps meet irrigation demands.
- Under No Action, deliveries to the refuges would consist of Level 2 and Replacement Water quantities plus a portion of the Incremental Level 4 need that could reasonably be obtained from other sources. For No Project, the practical result would be a reduction in deliveries to the refuges from the Exchange Contractors and a commensurate acquisition of water from other entities through purchases by the WAP.
- Agricultural and M&I water users would get their CVP contractual supplies subject to the limitations in their contracts. Under No Action/No Project, the CVP water users may obtain water from other sources or they would continue to experience shortages.

No Action under NEPA is similar to existing conditions (for most of the affected resources) as depicted in the October 2003 Notice of Intent to Prepare an EIS and Notice of Preparation of an EIR.

The **action/project alternatives** involve multiple sources of developed water and multiple users of that water. The Exchange Contractors propose to develop water from a conservation/tailwater program, groundwater pumping, and crop idling/temporary land fallowing. The action alternatives are designed based on how the water is developed (or source) and the quantity of water developed.

- **Alternative A (80,000 acre-feet)** would provide up to 80,000 acre-feet of water during noncritical years through a combination of conservation/tailwater recovery, groundwater, and crop idling/land fallowing sources; and during critical years, up to 50,000 acre-feet of water may be made available through crop idling/land fallowing only. The maximum amount of water, up to 80,000 acre-feet, would be developed only in noncritical years. It is similar to the program previously implemented in recent calendar years 2000–2003 (64,500–71,637 acre-feet), none of which were critical years. Up to 50,000 acre-feet could be developed from crop idling/temporary land fallowing in both critical and noncritical years. In critical years, only water from crop idling/land fallowing would be available. This water from crop idling is a new component not included in previous annual water transfers. In critical years, no conservation or groundwater pumping (above No Action/No Project) would be available for transfers.

- **Alternative B (50,000 acre-feet)** would develop up to 50,000 acre-feet from crop idling/temporary land fallowing. Alternative B represents a unique transfer program of only utilizing crop idling/land fallowing as the source of transfer water supply. In any type of year, the Exchange Contractors would provide up to 50,000 acre-feet of water through crop idling/land fallowing on approximately 20,000 acres of land within the Exchange Contractors service area. Assuming a transferable quantity of 2.5 acre-feet/acre, the maximum amount of land to be temporarily idled/fallowed is approximately 20,000 acres, 8.3 percent of the irrigable land (240,000 acres) in the Exchange Contractors service area. The affected land would be rotated.
- **Alternative C (130,000 acre-feet)** would develop up to 130,000 acre-feet of water during noncritical years, with up to 80,000 acre-feet of water made available through conservation (up to 80,000 acre-feet, including tailwater recovery) and groundwater (up to 20,000 acre-feet), and up to 50,000 acre-feet of water made available through crop idling/temporary land fallowing. During critical years, up to 50,000 acre-feet of water may be made available through crop fallowing, and no water is to be made available from conservation/tailwater recovery and groundwater sources. Alternative C is the Proposed Action.

Any or all of the available water from the above alternatives could be provided to the refuges, agriculture, EWA, and M&I users subject to the limitations identified as follows (from Sections 2.3.2 and 2.4) and summarized:

- Water transfers made available by conservation measures, such as additional reuse of tailwater, may be only transferred by the Exchange Contractors to CVP contractors in the Delta-Mendota Canal service area, San Luis Unit, San Felipe Unit, San Joaquin Valley refuges (excluding the Tulare Lake Basin wildlife areas), and all of Westlands. These transfers are referred to herein as "in-basin" transfers and are deemed to meet the reduction in consumptive use/irretrievable loss criteria of CVPIA.[4]
- Water transfers to the Friant Unit, including Madera ID, Cross Valley Contractors, Kern County, and to the Tulare Lake Basin wildlife areas are limited to water that can be made available by a reduction in consumptive use or irretrievable loss as set forth in Section 3405 of the CVPIA, the 1993 Transfer Guidelines and State Law. In addition, groundwater substitution meeting the requirements outlined in Section 2.3.1 can be used to support out-of-basin transfers.[4]

The action alternatives also consist of a range of acquisitions by the WAP, the CVP contractors, and the EWA agencies in any year. A multiple year agreement with any of the transferees is possible, including the option of a specific quantity of water in each year of the agreement. The transfers would be monitored and annually reported by Reclamation to calculate the cumulative transfer activity authorized under this EIS/EIR.

Each action alternative has numerous potential options for how and where the water would be used. The action alternatives are composed of the following scenarios for acquisition, transfer, and/or exchange of waters between the Exchange Contractors and other parties to bracket the

[4] This use of the terms "in-basin" and "out-of basin" transfers is different from the out-of-basin definition used in the hydrologic analysis (Section 4 and Appendix B).

maximum allowable water development and delivery for an environmental impact analysis unless otherwise noted:

- **Water to Refuges:** WAP may acquire from the Exchange Contractors up to 80,000 acre-feet of water for delivery to wetland habitat areas under CVPIA Section 3406(d)(2) to meet a portion of the Incremental Level 4 refuge water requirements. The total Incremental Level 4 requirement is 128,767 acre-feet annually (including conveyance losses of 20 percent). For each acre-foot of water developed by the Exchange Contractors for their own use, an equal amount of water would be considered available for delivery to the wetlands. CVP water from the Delta-Mendota Canal would be delivered to the refuges instead of delivering the same amounts of substitute water to the Exchange Contractors. Transfers to the refuges in the Delta-Mendota Canal/San Luis Canal service area are deemed to meet the consumptive use criteria of the CVPIA. Transfers to the Kern and Pixley refuges must comply with the consumptive use requirements of the CVPIA.
- **Water to Agriculture and M&I Uses:** Agricultural and M&I (CVP) water users may obtain up to 100 percent of the available water (50,000 to 130,000 acre-feet, depending on the alternative and year type) subject to operation limitations. Recipients may include any or all of the following:
  - The transfer of up to 130,000 acre-feet of temporary water supplies to "in-basin" CVP water service contractors in the Delta export service area (Delta-Mendota Canal and San Luis Units, San Felipe Division) on the west side of the San Joaquin Valley
  - The transfer and exchange of up to 70,000 acre-feet of temporary water supplies from reductions in consumptive use and groundwater substitution plus the quantifiable decrease in irretrievable losses to "out-of-basin" CVP contractors in the Friant Division on the east side of the San Joaquin Valley
  - The transfer of a portion of the temporary water supplies (up to the amount of shortages incurred by SCVWD in its CVP supply[5]) to SCVWD for agricultural, municipal, and/or industrial uses
  - The transfer of all or a portion of the temporary water supplies to Reclamation and/or DWR for delivery to CVP water users to facilitate EWA actions (replacement water for CVP water users in the Delta export service area)

A combination of the above water transfers/exchanges could occur in any year. Part of the available water supply could go to the refuges, and the remaining amount could be used for CVP agriculture and M&I uses, including the EWA. The numerous combinations of uses are not evaluated herein, but their potential impacts would lie within the range of potential impacts disclosed by the action alternatives. In application, the potential impacts associated with a

[5] Contract supply of 152,500 acre-feet per year, 119,400 acre-feet for M&I and 33,100 acre-feet for agriculture. The M&I component may be shorted by up to 25 percent (29,850 acre-feet), and the agriculture component may be shorted entirely. The Exchange Contractor's transfer to SCVWD will not exceed the amount of shortage anticipated to occur, 62,950 acre-feet total.

specific combination of transfers/exchanges would be determined on an annual basis through the transfer approval process, similar to the 2000–2004 transfer program.[6]

The water transferred or exchanged would not result in land use changes or provide irrigation service to lands not previously cultivated. CVP water deliveries would not exceed quantities contained in long-term supply agreements with Reclamation.

ES.5 SUMMARY COMPARISON OF ALTERNATIVES

Table ES-1 provides a summary of the environmental effects and mitigation for No Action/No Project, Alternative A: 80,000 Acre-Feet, Alternative B: 50,000 Acre-Feet, and Alternative C: 130,000 Acre-Feet. The existing conditions set the baseline against which the alternatives are evaluated for CEQA, while No Action is the baseline for comparison of alternatives for NEPA. For this EIS/EIR, No Action/No Project is comparable to existing conditions for most resources. Refer to the summary sections at the end of Sections 4 through 11 for complete statements of impact. The Mitigation Monitoring and Reporting Program required by CEQA is provided in Chapter 13.

Significance thresholds for CEQA are more restrictive than for NEPA and are controlling for this document. With regard to environmental consequences, CEQA requires that impacts that are regarded as "significant" be identified as such. In this EIS/EIR, for CEQA purposes, "CEQA significance criteria" are set forth by resource area. For all impacts that are identified as significant, appropriate mitigation measures are identified to reduce the impacts to a less-than-significant level. NEPA significance criteria (as listed in 40 Code of Federal Regulations [CFR] 1508.27) are broader and generally less stringent than CEQA significance criteria. For these reasons, identification of impacts as potentially significant under CEQA will identify all potentially significant/negative effects under NEPA, and the mitigation measures set forth to address potentially significant impacts for CEQA will also mitigate potentially significant/negative effects for NEPA.

Where potentially significant impacts may occur (to surface water resources), mitigation measures that could reduce the impacts to either no impact or a less-than-significant impact are identified. A thorough discussion of these measures is provided in Section 13.

Symbols used in the table for CEQA determinations of impact including beneficial impacts are:

S: Significant adverse impact

PS: Potentially significant adverse impact

LS: Less-than-significant adverse impact

N: No adverse impact

B: Beneficial impact (either significant or less than significant)

na: Not applicable

[6] This EIS/EIR is expected to provide substantial NEPA/CEQA compliance for many of the transfers, and this will need to be determined through the transfer review and approval process.

No significant or potentially significant unavoidable adverse impacts or effects were identified.

The definition of out-of-basin transfer in Table ES-1 is the definition used in the hydrologic analyses: a transfer occurring outside of the drainage of the San Joaquin River, i.e., not hydraulically connected to the San Joaquin River. The regulatory definition used by Reclamation in the transfer approval process is highlighted in Section ES.4 and explained further in Section 2.4.

Table ES-2 compares the three action alternatives with the project purposes/objectives (Section ES.2). The action alternatives all meet the project purposes/objectives. In contrast, the No Action Alternative failed to meet four purposes/objectives. No Action does not develop supplemental water from the Exchange Contractors and does not make any water available for other CVP contractors for agricultural and M&I purposes. Of the action alternatives, Alternative C is the Preferred Alternative/Proposed Action because it facilities maximum flexibility in water developed and water transferred (subject to the limitations in Section ES.4) and the greatest potential for alleviating water supply shortages while minimizing environmental impacts.

Table ES-1
Summary Comparison of Impacts/Effects of Alternatives

Affected Resource and Area of Potential Impact	No Project Compared to Existing Conditions	Alternative A	Alternative B	Alternative C
Surface Water				
1. Consumptive Use	N			
Water Development		N	N	N
All Water to Refuges		LS	LS	LS
All Water to Agriculture		LS	LS	LS
Out-of-Basin		LS	LS	LS
2. Flows at Vernalis	N			
Water Development		LS	LS	LS
All Water to Refuges		N	LS	N, B
All Water to Agriculture		N, LS	N	LS
Out-of-Basin		N, LS	N	LS

Table ES-1 (continued)

Affected Resource and Area of Potential Impact	No Project Compared to Existing Conditions	Alternative A	Alternative B	Alternative C
3. Water Quality at Vernalis	N			
Water Development		B	B	B
All Water to Refuges		LS	LS	LS
All Water to Agriculture		N	N	B
Out-of-Basin		LS	LS	LS
4. New Melones Reservoir Operation	N			
Water Development		PS, LS with mitigation	PS, LS with mitigation	PS, LS with mitigation
All Water to Refuges		PS, LS with mitigation	PS, LS with mitigation	PS, LS with mitigation
All Water to Agriculture		PS, LS with mitigation	PS, LS with mitigation	PS, LS with mitigation
Out-of-Basin		PS, LS with mitigation	PS, LS with mitigation	PS, LS with mitigation
5. Delta Supply	N			
Water Development		PS, LS with mitigation	PS, LS with mitigation	PS, LS with mitigation
All Water to Refuges		PS, LS with mitigation	N	PS, LS with mitigation
All Water to Agriculture		PS, LS with mitigation	PS, LS with mitigation	PS, LS with mitigation
Out-of-Basin		PS, LS with mitigation	PS, LS with mitigation	PS, LS with mitigation
6. Cumulative	na	LS	LS	LS
Groundwater				
1. Groundwater Supply	LS	LS	B	LS
2. Groundwater Quality	LS	LS	LS	LS
3. Land Subsidence	N	N	N	N
4. Surface Water Flow	LS	LS	LS	LS
5. Cumulative	na	LS	LS	LS

Table ES-1 (continued)

Affected Resource and Area of Potential Impact	No Project Compared to Existing Conditions	Alternative A	Alternative B	Alternative C
Biological Resources				
1. Wetlands	N			
All Water to Refuges		B	LS	B
All Water to Agriculture		N	LS	N
Out-of-Basin		N	LS	N
2. Special-Status Species	N			
All Water to Refuges		LS	LS	LS
All Water to Agriculture		LS, B	LS	LS
Out-of-Basin		LS	LS	LS
3. Aquatic Resources	N			
All Water to Refuges		LS	N	LS
All Water to Agriculture		LS	N	LS
Out-of-Basin		LS	N	LS
4. Cumulative	na	LS	LS	LS
Land Use and Recreation				
1. Agricultural Land Use	LS	LS	LS	LS
2. Recreation Resources	N	LS,B,N	LS,B,N	LS,B,N
3. Other Land Uses	N	N	N	N
4. Cumulative	na	PS	PS	PS
Socioeconomics				
1. Agricultural Production and Income	N			
Four-County Area		LS	LS	LS
Seven-County Area		LS	LS	LS
Two-County Area		LS	LS	LS

Table ES-1 (concluded)

Affected Resource and Area of Potential Impact	No Project Compared to Existing Conditions	Alternative A	Alternative B	Alternative C
2. Regional Demographics and Income	N			
Four-County Area		LS	LS	LS
Seven-County Area		LS	LS	LS
Two-County Area		LS	LS	LS
3. Cumulative	na	LS	LS	LS
Environmental Justice				
1. Economic Resources	na	na	na	na
2. Cumulative	na	LS	LS	LS
Indian Trust Assets				
1. Presence of Indian Trust Assets	N	N	N	N
2. Cumulative	na	N	N	N
Air Quality				
1. Air Quality	N	LS	LS	LS
2. Cumulative	na	LS	LS	LS

Table ES-2
Comparison of Alternatives with Project Purposes

Purpose & Need/Objective Statements	No Action Alternative	Alternative A: 80,000 acre-feet	Alternative B: 50,000 acre-feet	Alternative C: 130,000 acre-feet
Develop supplemental water supplies from willing sellers in the Exchange Contractors service area through water conservation/tailwater recovery, groundwater pumping, and crop idling/fallowing activities consistent with district policies.	No – No supplemental supplies would be developed. Reclamation would have less flexibility to maximize use of limited CVP water resources.	Yes – 80,000-acre-foot transfer program similar to previous program but includes 50,000 acre-feet in a critical year from temporary land fallowing.	Yes – 50,000-acre-foot transfer program smaller than previous years but includes 50,000 acre-feet in a critical year and only from temporary land fallowing.	Yes – 130,000-acre-foot transfer program larger than previous years overall. Refuges limited to 80,000 acre-feet. Greater potential to maximize water development from all sources and use by all transferees.
Provide water supplies to the refuges consistent with the Level 4 water quantities for fish and wildlife habitat development.	Yes – Water deliveries to refuges would be 75,694 acre-feet, but would have to be obtained from other sources (not from the Exchange Contractors).	Yes – Under the All Water to Refuges scenario, the managed seasonal wetlands and aquatic habitat could continue to receive approximately 65 percent of the full Level 4 supply of 103,014 acre-feet for each water service year.	Yes – Under the All Water to Refuges scenario, the refuges, special-status species, and aquatic habitat would receive all of the available water in any year to reach 40 percent of full Level 4 increment for each water service year. This amount of water is slightly lower than the average amount of water that refuges have received under the current transfer program.	Yes – Under the All Water to Refuges scenario (maximum of 80,000 acre-feet), improvements in wetland habitat quality would occur similar to Alternative A.

Table ES-2 (concluded)

Purpose & Need/Objective Statements	No Action Alternative	Alternative A: 80,000 acre-feet	Alternative B: 50,000 acre-feet	Alternative C: 130,000 acre-feet
Assist CVP agricultural service contractors to obtain CVP water for the production of agricultural crops or livestock because of water supply shortages when full contract deliveries cannot otherwise be made.	No – Contractors would have to obtain temporary supplies from other sources or idle land. Crop idling that occurs under the No Action Alternative, in either noncritical or critical years, would be temporary. Land farmed in the study areas varies between years because of crop rotations and other factors.	Yes – Some of the districts' water deficits could be met.	Yes – Some of the districts' water deficits could be met.	Yes – Some of the districts' water deficits could be met.
Provide SCVWD with short-term water supplies to support agriculture and/or M&I uses in Santa Clara County when full contract deliveries cannot otherwise be made.	No – SCVWD would not obtain any water from the Exchange Contractors.	Yes – Needs could be met, up to 31,100 acre-feet for agriculture and 29,850 acre-feet for M&I.	Yes – Needs could be met, up to 31,100 acre-feet for agriculture and 29,850 acre-feet for M&I.	Yes – Needs could be met, up to 31,100 acre-feet for agriculture and 29,850 acre-feet for M&I.
Annual transfer and/or exchange of CVP water from the Exchange Contractors to EWA to the extent that this would benefit CVP operations by improving water supply reliability for CVP water users south of the Delta.	No	Yes – Results are similar to those of water transferred or exchanged for agricultural or M&I uses.	Yes – Results are similar to those of water transferred or exchanged for agricultural or M&I uses.	Yes – Results are similar to those of water transferred or exchanged for agricultural or M&I uses.

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Appendices

Acronyms

Bay-Delta	San Francisco Bay/Sacramento-San Joaquin River Delta
bgs	below ground surface
CCID	Central California Irrigation District
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
Contract	*Second Amendatory Contract for Exchange of Waters, Contract No. I1r-1144* (Reclamation 1968)
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
Delta	Sacramento-San Joaquin River Delta
DFG	California Department of Fish and Game
DO	dissolved oxygen
DWR	California Department of Water Resources
EC	electrical conductivity

Acronyms, continued

EIS/EIR	Environmental Impact Statement/Report
ESU	evolutionarily significant unit
EWA	Environmental Water Account
Exchange Contractors	San Joaquin River Exchange Contractors Water Authority
FESA	Federal Endangered Species Act
FLI	Farmland of Local Importance
FSI	Farmland of Statewide Importance
HCP	Habitat Conservation Plan
ID	Irrigation District
Interior	U.S. Department of the Interior
I-O	input-output
ITA	Indian Trust Asset
IWRP	Integrated Water Resources Plan
M&I	municipal and industrial
MOU	Memorandum of Understanding
µmhos/cm	micromhos per centimeter
µS/cm	microSiemen(s) per centimeter
mg/kg	milligram(s) per kilogram
µg/L	microgram(s) per liter
mg/L	milligram(s) per liter
MOU	Memorandum of Understanding
MUD	Municipal Utility District
NAICS	North American Industrial Classification System
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWR	National Wildlife Refuge
PDA	public domain allotment
RCD	Resource Conservation District
Reclamation	Bureau of Reclamation

Acronyms, continued

Regional Board	Central Valley Regional Water Quality Control Board
ROD	Record of Decision
RPC	Regional Purchase Coefficient
SBCWD	San Benito County Water District
SCVWD	Santa Clara Valley Water District
Service	U.S. Fish and Wildlife Service
SIC	Standard Industrial Classification (System)
SJRA	San Joaquin River Agreement
State Board	State Water Resources Control Board
SWP	State Water Project
TDS	total dissolved solids
TMDL	total maximum daily load
USEPA	U.S. Environmental Protection Agency
VAMP	Vernalis Adaptive Management Plan
WAP	Water Acquisition Program
WD	Water District
WMA	Wildlife Management Area

The Bureau of Reclamation (Reclamation), as the Federal lead agency, has prepared this document pursuant to the National Environmental Policy Act (NEPA) to examine the specific environmental effects of the transfer of up to 130,000 acre-feet of substitute water[1] from the San Joaquin River Exchange Contractors Water Authority[2] (Exchange Contractors) to several potential users. The Exchange Contractors would develop up to 80,000 acre-feet of this water through conservation measures including but not limited to tailwater recapture, savings to a saline sink, other efficiency measures, and groundwater pumping. The remaining 50,000 acre-feet would be developed through temporary land fallowing. The water from the Exchange Contractors would be transferred to San Joaquin Valley refuges, to other Central Valley Project (CVP) contractors, and/or to the CALFED Environmental Water Account (EWA). The proposed Federal action is to (1) acquire water for the wildlife refuges (Incremental Level 4 under the Central Valley Project Improvement Act [CVPIA]), (2) approve transfers and/or exchanges of CVP water from the Exchange Contractors to other CVP contractors, and (3) enter into EWA contracts that would benefit CVP operations.

The Exchange Contractors, as the lead agency for the State, have prepared this document pursuant to the California Environmental Quality Act (CEQA) to examine the environmental impacts of the transfer and/or exchange of their CVP water (up to 130,000 acre-feet per year for the next 10 years) in the San Joaquin Valley, the Sacramento-San Joaquin River Delta (Delta), San Benito County, and Santa Clara County (receiving areas). The Exchange Contractors propose to make water available for transfer and/or exchange to either the refuges, CVP contractors for municipal/industrial (M&I) and/or agricultural areas, Reclamation or the California Department of Water Resources (DWR) for use by the EWA in the CVP Delta export service area, or to some combination of these users.

The duration of the proposed program is for 10 consecutive years beginning March 1, 2005, through February 28, 2015 (water service years 2005–2014).

1.1 HISTORY AND BACKGROUND

In 1995, Reclamation and the U.S. Fish and Wildlife Service (the Service) initiated a 3-year Interim Water Acquisition Program to acquire Incremental Level 4 water for the refuges designated in the CVPIA. This program concluded in February 1998. During this 3-year period, Reclamation met the Incremental Level 4 water supply requirements of the San Joaquin Valley refuges primarily through annual temporary transfers of water from the Exchange Contractors. In 1998, no water was acquired from the Exchange Contractors for the refuges. In 1999, the Exchange Contractors transferred 20,000 acre-feet to the U.S. Department of the Interior (Interior) Water Acquisition Program (WAP) for the refuges and 40,000 acre-feet to westside agricultural users. The WAP is administered by Reclamation and the Service. Table 1-1 shows water transfers conducted by the Exchange Contractors in recent years.

[1] The transfer involves "substitute water" because the Exchange Contractors' water supply involves the substitution of Central Valley Project water in lieu of surface water diversions from the San Joaquin River in most years (which halted with the development of Friant Dam/Millerton Lake by Reclamation).

[2] The San Joaquin River Exchange Contractors Water Authority consists of Central California Irrigation District, San Luis Canal Company, Firebaugh Canal Water District, and Columbia Canal Company. These entities are commonly known as the "Exchange Contractors."

Table 1-1
Exchange Contractors Water Transfer Summary

Year	To Westside Agricultural Users (acre-feet)	To WAP for Refuges (acre-feet)	Other CVP (acre-feet)	Total (acre-feet)
1999	40,000	20,000	0	60,000
2000	43,000	21,500	0	64,500
2001	15,500	49,000	0	64,500
2002	0	64,500	2,134	66,634
2003	400	60,000	11,237	71,637

Source: J. Toscano, pers. comm., 2003, 2004a.

1.1.1 Wetland Habitat Water Requirement

CVPIA Section 3406(d)(2) requires the Secretary of the Interior, immediately upon enactment, to provide firm delivery of Level 2 water supplies to the various wetland habitat areas identified in Reclamation's *Report on Refuge Water Supply Investigations* (1989) and *San Joaquin Basin Action Plan/Kesterson Mitigation Plan* (1983). These reports describe water needs and delivery requirements for each wetland habitat area to accomplish stated refuge management objectives. In the *Report on Refuge Water Supply Investigations*, average annual historical supplies were termed "Level 2," and the quantity of water needed to achieve full habitat development was termed "Level 4." In the *San Joaquin Basin Action Plan/Kesterson Mitigation Plan*, the term "Full Habitat Development" was introduced. The meaning of this term is similar to "Level 4" and will herein be referred to as "Level 4." The meaning of the term "2/3 Full Habitat Development" is similar to the term "Level 2" and will herein be referred to as "Level 2." This discussion of Level 2 is for information purposes, as the Level 2 requirement is not to be met with water transfers from the Exchange Contractors.

CVPIA Section 3406(d)(2) further directs the Secretary of the Interior to acquire the increment between Level 2 and Level 4 water requirements described in these reports through "voluntary measures which include water conservation, conjunctive use, purchase, lease, donations, or similar activities, or a combination of such activities which do not require involuntary reallocations of project yield." This defined increment is known as "Incremental Level 4." The quantity of water required to meet the full Incremental Level 4 water supplies (100 percent) for the San Joaquin Valley and Tulare Lake Basin wildlife areas is estimated to be up to 128,767 acre-feet of water inclusive of conveyance losses (103,014 acre-feet exclusive of conveyance losses) by February 2015 (from Table 1-2 in Section 1.2.1). A deficit in the full Incremental Level 4 water supply currently exists absent the constraints of the current WAP budget. The action alternatives represent how the Incremental Level 4 need could be met in part by the Exchange Contractors.

1.1.2 Central Valley Project Contractors

CVP contractors who could participate in a water transfer and/or exchange from the Exchange Contractors include westside CVP agriculture (Westlands Water District [WD], Panoche WD, Pacheco WD, San Luis WD, Del Puerto WD, and Patterson WD), CVP Friant Unit agriculture

(including Madera Irrigation and Chowchilla Water Districts), and other CVP contractors in the San Felipe Division, specifically San Benito County Water District (SBCWD) and Santa Clara Valley Water District (SCVWD). These districts may not receive 100 percent of their current contract amounts from the CVP and would purchase water from other sources such as the Exchange Contractors to alleviate part of their supply shortage.

The westside irrigation districts could receive transfer water through the facilities that currently provide their CVP supplies, the Delta-Mendota Canal and San Luis Unit facilities. Friant Unit contractors could receive transfer water through wheeling arrangements using CVP and State Water Project (SWP) (California Aqueduct) facilities and other third-party facilities (e.g., Cross-Valley Canal). Additional water exchange arrangements may also be necessary to provide deliveries to specific Friant Unit contractors.

1.1.3 Environmental Water Account

One purpose of the proposed water transfer program (Proposed Action) involves the potential transfer and/or exchange of water to the EWA to assist in responding to the need for an immediate solution to the conflicts between fish protection and Delta water exports including CVP contractors. Specifically, the water asset acquisition and management strategy that was introduced in the CALFED Record of Decision of December 2000 focuses on two primary elements: facilitation of fish population recovery through asset (water) acquisition and management, and use of the acquired assets to replace water not exported due to changes in project operations. The EWA program meets these objectives by obtaining from willing sellers supplemental water assets by acquiring, banking, transferring, or borrowing water, then arranging for its conveyance. The EWA facilitates, protects, and enhances fish population recovery by acquiring alternative sources of water supply from willing providers with delivery capabilities within the CVP and SWP, and then using that water to replace water not exported due to fish actions. This replacement water acquisition is the action considered in the Exchange Contractors' proposed water transfer program and only to the extent that it benefits CVP operations.

The timing and location of asset use in fish actions are determined by three Federal and State management agencies (the Service, NOAA Fisheries, and California Department of Fish and Game [DFG]). Fish actions directed by these EWA agencies include reductions in export pumping, Delta cross-channel gates closures, instream flow augmentation, and Delta outflow augmentation.

Asset (water) acquisition for the EWA is the responsibility of two Federal and State project agencies: Reclamation and DWR. EWA assets are used to replace the water that would have otherwise been delivered to export service area contractors when fish actions are taken. Asset acquisition measures available to the EWA agencies include stored reservoir water purchase, crop idling/shifting, Delta diversions, groundwater substitution, and stored groundwater purchase. EWA asset management measures available to Reclamation and DWR include source shifting, groundwater storage services, and borrowing project water (Reclamation and DWR 2004). Water made available to the EWA through conservation practices was not covered in a 2004 Environmental Impact Statement/Environmental Impact Report (EIS/EIR) prepared for the short-term EWA. However, a forthcoming EIS/EIR for the long-term EWA will include conserved water as a potential acquisition measure available to the EWA agencies.

1.2 PURPOSE AND NEED/PROJECT OBJECTIVES

The purpose of the proposed program is to allow the annual transfer and/or exchange of CVP water from the Exchange Contractors to:

- The WAP to acquire water supplies (Incremental Level 4) for San Joaquin Valley wildlife refuges and the Tulare Lake Basin wildlife areas
- Other CVP contractors to meet demands of agriculture and M&I uses
- DWR or Reclamation for use by the EWA to the extent that this would benefit CVP operations by improving water supply reliability for CVP water users south of the Delta

The proposed temporary water transfers/acquisitions are needed to maximize the use of limited water resources for agriculture, fish and wildlife resources, and M&I purposes with the following objectives:

- Develop supplemental water supplies from willing sellers in the Exchange Contractors service area through water conservation/tailwater recovery, groundwater pumping, and crop idling/fallowing activities consistent with district policies.
- Provide water supplies to the refuges consistent with the Incremental Level 4 water quantities for wildlife habitat development.
- Assist CVP agricultural service contractors to obtain additional CVP water for the production of agricultural crops or livestock because of water supply shortages when full contract deliveries cannot otherwise be made.
- Provide SCVWD with short-term water supplies to support agriculture and/or M&I uses in Santa Clara County when full contract deliveries cannot otherwise be made.

The following sections provide additional clarification of this purpose of and need for the proposed water transfer/exchange.

1.2.1 Refuge Water Supplies

Pursuant to CVPIA Section 3406(d)(2), the Secretary of the Interior established the WAP to acquire, by voluntary measures that include water conservation, conjunctive use, purchase, lease, donations, or similar activities, or a combination of such activities that do not require involuntary reallocations of project yield, Incremental Level 4 water supply for delivery to wetland habitat areas in the Sacramento and San Joaquin valleys. During the annual water service periods (March 1, 2005–February 28, 2015, water service years 2005–2014), WAP has a need to acquire 100 percent of the Incremental Level 4 refuge water supplies to fully implement the requirements of CVPIA Section 3406(d)(2). Therefore, one of the purposes of the proposed program discussed in this EIS/EIR is to acquire some water to meet the Incremental Level 4 water supply requirements for certain wetland habitat areas in the San Joaquin Valley.

As described in the *Report on Refuge Water Supply Investigations* (Reclamation 1989), the total available acreage of wetlands within the Central Valley has declined from about 4 million acres in 1850 to about 300,000 acres in the 1980s. Federal National Wildlife Refuges (NWRs) and State Wildlife Management Areas (WMAs) comprise approximately one-third of this acreage. Level 4 water is needed to optimally manage these wetland habitat areas. The difference between

water supplies for optimum management (Level 4) and average annual deliveries (Level 2) is related to management for habitat diversity, which includes timing and duration of fall and late winter flooding, summer water for food production, and permanent wetland habitat maintenance. A 1995 *San Joaquin Basin Action Plan* (Reclamation 1995a) updated the 1989 *Report on Refuge Water Supply Investigations* for some refuges in the San Joaquin Basin.

To meet the full water supply needed for full habitat development (full Incremental Level 4 supply) for certain wetland habitat areas in the San Joaquin Valley, plus an adequate amount to account for conveyance losses, it is estimated that up to an additional 103,014 acre-feet will be required at the point of delivery. A summary of the estimated quantities to be delivered to the wetlands (at their boundaries) is presented in Table 1-2. The actual amount of water to be acquired may vary due to hydrologic conditions, Reclamation budget constraints, and/or conveyance limitations. This EIS/EIR will address the potential acquisition of up to 128,767 acre-feet per year for full habitat development purposes (including conveyance losses estimated at approximately 20 percent).

Table 1-2
San Joaquin Valley Refuge Incremental Water Supply Needs,
Water Service Years 2005–2014

San Joaquin Valley Wetlands	Level 4 Increments (Acre-Feet) At Point of Delivery
San Luis*	0
Freitas*	0
Kesterson*	0
E. Bear Creek	4,432
W. Bear Creek	3,603
Volta	3,000
China Island	3,483
Salt Slough	3,340
Los Banos	8,330
Mendota	2,056
Grassland	55,000
Kern	15,050
Pixley	4,720
Total	103,014

Source: S. Carter, pers. comm., 2003a.

*The Memorandum of Understanding with the Service clarifies the Level 4 increment for these refuges. In accordance with a Reclamation commitment prior to CVPIA, a total of 18,550 acre-feet of full habitat development water supplies will be provided. The 18,550 acre-feet includes conveyance losses for delivery of the full habitat water supplies.

1.2.2 Agricultural Water Use

Another purpose of the Proposed Action includes the transfer of water from the Exchange Contractors to as many as nine water districts (CVP agricultural service contractors), specifically to provide additional irrigation water for agricultural use in the San Joaquin Valley, San Benito

County, and Santa Clara County and to participating districts in the Friant Unit[3] of the CVP. In most years, CVP contractors do not receive full contract amounts, and seasonal irrigation water deficits occur under all but the wettest hydrologic conditions. In most years, the districts receive only 50 to 75 percent of their total contract amounts.

Since passage of the CVPIA in 1992 with its changes in CVP management to redirect 800,000 acre-feet of yield to environmental protection, restoration, and enhancement, some CVP water service contractors have not received their full contract amounts from the CVP. Consequently, shortages are commonplace, and the proposed water transfer is needed to assist in meeting the shortages experienced by the affected districts. The deficits for the individual districts considered herein range from 0 to 1,265,433 acre-feet. In recent water years (2000–2004), CVP agricultural service contractors in the San Joaquin Valley have received only 49 to 75 percent of their contract amounts (S. Carter, pers. comm., 2003b).

Table 1-3
Existing Seasonal Irrigation Water Deficit for Districts in Project Area

Water District	Wet Year with 100 Percent Contract Water Supply		Dry Year with 25 Percent Contract Water Supply	
	Contract Water (acre-feet)[1]	Seasonal Irrigation Water Deficit (acre-feet)	Contract Water (acre-feet)	Seasonal Irrigation Water Deficit (acre-feet)
Westlands	1,150,000	85,869	287,500	1,265,433
Panoche	93,904	0	23,476	74,859
Pacheco	10,000	0	2,500	9,219
San Luis	124,502	0	31,126	107,031
Del Puerto	140,210	0	35,053	88,017
Patterson	22,500	11,275	5,625	41,640
Plainview	20,600	0	5,150	4,662
San Benito County	35,550	11,505	8,888	48,379
Santa Clara Valley	33,100	410	8,275	39,633
Friant Unit[2,3]	2,137,225	0	183,938	2,621,447
All Districts	3,767,591	109,059	591,529	4,300,320

Source: Water Balance Analysis (Appendix A).

Notes:
[1] Contracted water amounts were obtained from interim and long-term renewal contracts (Reclamation 2001a–2001i, 2003a). Westlands' surface water supply/maximum Reclamation total delivery is 1,130,463 acre-feet for 1989 and 1,150,000 acre-feet for 2025, as reported in their October 11, 2000, Water Needs Assessment.
[2] The Friant Division was assumed to receive 100 percent of both Class 1 and Class 2 deliveries in a wet year, although this is unlikely to occur.
[3] The Friant Division was assumed to receive no Class 2 deliveries and 25 percent of Class 1 deliveries in a dry year.

[3] Participating districts would be those with storage and conveyance to deliver water to the user as an exchange or a direct transfer.

Table 1-3 summarizes the irrigation shortages from the water balance analysis under wet and dry hydrologic scenarios and with 25 to 100 percent of contracted water (see Appendix A). It is important to note that even in wet years, many districts including Madera Irrigation District are still subject to deficit irrigation circumstances and need supplemental water supplies such as those being proposed by the Exchange Contractors.

The availability of water for plant use during the growing season (primarily April through October) is the most limiting factor in crop production. Short water supplies reduce crop yields and quality and increase the risks of farming. Adequate irrigation increases the level and uniformity of crop yields and improves crop quality, thereby reducing these economic risks. In the western and eastern San Joaquin Valley, farmers have been irrigating cropland for more than 120 years. With the increased availability of groundwater and surface water, the acreage of irrigated cropland in the San Joaquin Valley has increased more than 80 percent since the 1950s (Exchange Contractors 1997a). For the Proposed Action, no new lands would be brought into production; water would be used on lands irrigated within the last 3 years.

1.2.3 Santa Clara Valley Water District

SCVWD operates three water treatment plants and 10 local reservoirs and annually provides 390,000 acre-feet of water to over 1.8 million M&I and agricultural water users in Santa Clara County. Half of the M&I water need is met by underground aquifers within the 1,300 square-mile county region. Nearly 39 percent of this water, up to 152,500 acre-feet, is obtained from the CVP (119,400 acre-feet per year for M&I needs and 33,100 acre-feet per year for agricultural needs). SCVWD negotiated a Water Service Contract (No. 7-07-20-W0023) that sets the dry year delivery base at 75 percent of contract quantity for M&I deliveries (or 89,550 acre-feet) (Reclamation 2001h). The proposed transfer would help to meet needs of M&I or agricultural users in years when full contract deliveries cannot be made.

1.2.4 Environmental Water Account

The EWA was established in the August 2000 CALFED Programmatic Record of Decision as a cooperative water management program, the purpose of which is to provide protection to at-risk native fish species of the San Francisco Bay/Sacramento–San Joaquin River Delta (Bay-Delta) estuary, while improving water supply reliability for water users. The EWA program makes environmentally beneficial changes in CVP/SWP operations, and acquires replacement water so that there is no uncompensated water loss to the CVP and SWP water contractors. Beneficial changes in CVP and SWP operations could include changing the timing of some flow releases from storage and the timing of water exports from the CVP and SWP pumping plants in the Delta to coincide with periods of greater or lesser vulnerability of various fish species to environmental conditions in the Delta. For example, the EWA might alter the timing of water diversions from the Delta in order to reduce fish entrainment at the CVP and SWP pumping plants and provide migratory cues for specific anadromous fish species. The timing of the protective actions and operational changes would vary from year to year, depending on many factors such as hydrology and real-time monitoring that indicates fish presence at the pumping plants.

The EWA program replaces any regular water supply interrupted by the environmentally beneficial changes to CVP and SWP operations. Replacement water (EWA assets) is obtained by acquisition through voluntary purchases in the water transfer market or through operational flexibility of the CVP and SWP pumping plants. In most years, voluntary purchases typically range from 200,000 to 300,000 acre-feet in order to protect fish; however, in a few very dry years, potentially up to 600,000 acre-feet may need to be acquired. For the Proposed Action, the replacement water supply from the Exchange Contractors is available to the EWA program only to the extent that CVP operations would benefit.

The EIS/EIR Record of Decision for the short-term EWA was signed in March 2004. The analysis covers the effects on areas/users who willingly sell water to the EWA through September 2007.

1.3 RELATED PROJECTS

Water transfers and/or exchanges occur throughout California and are an important component of the water market and good water management. Specific projects related to the Proposed Action are described in the following documents, which are incorporated by reference into this EIS/EIR because they provide information that is substantive to the discussion and conclusions provided herein:

- *Second Amendatory Contract for Exchange of Waters, Contract No. I1r-1144, February 14, 1968* (Reclamation 1968)
- *Grassland Bypass Project Environmental Impact Statement and Environmental Impact Report* (Reclamation and San Luis & Delta-Mendota Water Authority 2001)
- *San Joaquin Basin Action Plan and North Grasslands Area Conveyance Facilities, Final Environmental Assessment/Initial Study* (Reclamation 1997a)
- *Report on Refuge Water Supply Investigations, Central Valley Hydrologic Basin, California* (Reclamation 1989)
- *Refuge Water Supply, Long-Term Water Supply Agreements, San Joaquin Basin* (Reclamation et al. 2001)
- *Friant Division, Long-Term Contract Renewal, Final Environmental Assessment* (Reclamation 2001j)
- *Delta-Mendota Canal Unit, Long-Term Contract Renewal, Draft Environmental Assessment* (Reclamation 2000a)
- *Central Valley Project Long-Term Water Service Contract Renewal for San Felipe Division, Draft Environmental Assessment* (Reclamation 2000b)
- *EWA Final EIS/EIR* (Reclamation and DWR 2004)

An EIS for the San Luis Unit long-term contract renewal is under preparation and will be considered in preparing the Final EIS/EIR for the Exchange Contractors' proposed water transfer program.

Other projects or studies are underway that affect water quality and flows in the San Joaquin River. The hydrologic analysis in Section 4 and Appendix B incorporates the following recent activities/approved projects and regulatory constraints:

- San Joaquin River Agreement
- Grassland Bypass Project
- State Water Resources Control Board's (SWRCB's) Decision 1641 for Delta operations
- Interim Plan of Operation (1997) for New Melones Reservoir
- San Joaquin Valley Refuge Water Balance Model

In addition to these activities, which have been incorporated quantitatively into the hydrologic analyses, other studies and regulations are under consideration that could affect the hydrologic analysis of baseline conditions and future cumulative conditions for the San Joaquin River. These projects are identified here (and referenced in Sections 4.1.2 and 4.2.3) to emphasize the dynamic regional context in which the proposed water transfer would occur. The annual transfer approval process described in Section 13.3.3 will capture dynamic changes to the underlying hydrology of the San Joaquin River caused by future actions over the next 10 years from the activities that may be implemented under the following programs.

1.3.1 Total Maximum Daily Load and Basin Plan Amendment for Salt and Boron (Regional Board)

The California Regional Water Quality Control Board, Central Valley Region (Regional Board) amended the Basin Plan for the Sacramento River and San Joaquin River Basins for the control of salt and boron discharges into the Lower San Joaquin River on September 10, 2004. The Basin Plan Amendment includes a schedule for developing water quality objectives and priorities for implementing load allocations. For the Lower San Joaquin River from Mendota Dam to Vernalis, Total Maximum Daily Load (TMDL) and water quality objectives are to be considered for adoption in June 2006. The San Joaquin River Water Quality Management Group (including the Exchange Contractors) will be submitting a proposed management plan for implementation of the TMDLs to the Regional Board in December 2004 (L. Ploss, pers. comm., 2004).

1.3.2 TMDL and Basin Plan Amendment for Organic Enrichment/Low Dissolved Oxygen in the Stockton Deepwater Ship Channel

A TMDL and Basin Plan Amendment are being developed for organic enrichment/low dissolved oxygen (DO) in the San Joaquin River. The proposed Basin Plan Amendment contains a TMDL that apportions responsibility to the three causative factors of low DO and allocations of oxygen demanding substances and their precursors. Implementation of the TMDL is phased to allow time for studies to be conducted to better understand the sources and linkages of oxygen demanding substances and their precursors to the oxygen impairment problem. The Basin Plan is scheduled for a hearing in December 2004. The San Joaquin River Water Quality Management Group (including the Exchange Contractors) will be submitting a proposed management plan for implementation of the TMDLs to the Regional Board in December 2004.

1.3.3 Irrigated Lands Waiver (Regional Board)

The Regional Board's Irrigated Lands Program addresses irrigation return flows and storm water runoff from agricultural lands that are currently exempted from the National Pollutant Discharge Elimination System (NPDES) permit program. On July 11, 2003, the Regional Board adopted two conditional waivers of Waste Discharge Requirements for discharges from irrigated lands: coalition group waiver and individual discharger waiver. The conditional waivers allow time for coalition groups to form and begin to identify and deal with water quality problems in their watersheds. The Exchange Contractors are participating in the Westside San Joaquin River Watershed Coalition.

1.3.4 Westside Regional Drainage Plan

A collaborative effort of the Exchange Contractors and Panoche, Westlands, and Broadview Water Districts, this drainage plan was submitted to Reclamation in March 2003 with a request to incorporate it into the San Luis Drainage Feature Re-evaluation described below.

1.3.5 San Luis Drainage Feature Re-evaluation

The Re-evaluation has estimated drainage quantity and quality from the San Luis Unit and has identified seven action alternatives for drainage management and disposal, including several components of the Westside Plan identified above. The focus is on drainwater with a high selenium content that needs careful management to avoid large-scale adverse environmental effects in the San Joaquin River and Tulare Lake basins. Reclamation is preparing an Environmental Impact Statement scheduled for public release by May 2005.

1.3.6 San Joaquin River Riparian Habitat Restoration Program

This program is a collaborative effort of the Friant Water Users Authority, the Natural Resources Defense Council, and the Pacific Coast Federation of Fishermen's Associations to pursue mutually acceptable restoration activities along the mainstem of the San Joaquin River. The goal is to bring together diverse interests to cooperatively promote riparian restoration activities. The program is implemented by Reclamation and the Service. The program is directed by a Management Team, which is made up of key stakeholders, and a more locally based Action Team. The program area is the 150-mile stretch of San Joaquin River between Friant Dam and the confluence of the Merced River.

1.3.7 Upper San Joaquin River Conceptual Restoration Plan

The San Joaquin River Resource Management Coalition is developing a conceptual restoration plan for the San Joaquin River from Friant Dam to the confluence with the Merced River. The plan is to be used as a benchmark to assess the feasibility of other restoration plans that may be proposed. The plan is to articulate a vision of restoration on the river from the local perspective while maintaining viable agriculture. The planning process is stakeholder driven. Phase two of the Conceptual Plan is to be completed by mid-2005.

Alternatives developed for evaluation in this EIS/EIR are the No Action and No Project Alternatives, and three action alternatives. The No Action Alternative is the benchmark for comparison of the action alternatives (as required by NEPA). It represents the reasonably foreseeable future without the Exchange Contractors' water transfer program. The No Project Alternative (for CEQA purposes) assumes no water transfer from the Exchange Contractors. The action alternatives involve the development of water by the Exchange Contractors, up to 50,000 acre-feet in a critical dry year to a maximum of 130,000 acre-feet in noncritical water years, and exchange or transfer of that water to any or all of the following users:

- Some or all of the temporary water supplies to meet the Incremental Level 4 requirements for the San Joaquin Valley and Tulare Basin wildlife refuges
- Some or all of the temporary water supplies to westside CVP agricultural service water users to meet irrigation needs when full contract deliveries cannot otherwise be made
- A portion of the temporary water supplies to Friant Division CVP agricultural service water users to meet irrigation needs when full contract deliveries cannot otherwise be made
- A portion of the temporary water supplies for agriculture and M&I uses in SCVWD when full contract deliveries cannot otherwise be made
- A portion of the temporary water supplies to the CVP agricultural service contractors south of the Delta in the West San Joaquin and San Felipe divisions of the CVP as replacement water for CALFED EWA actions.

The Exchange Contractors propose to develop the water from conservation (including tailwater recovery), groundwater pumping, and crop idling/temporary land fallowing activities. Action alternatives have been developed for a range of quantities of water from these sources and the delivery of the water to any or all of these potential water users. A range of water transfers and/or exchanges may be selected as the preferred action/project to respond to hydrologic and economic conditions over the 10-year period. All transfer proposals will be evaluated and approved by Reclamation in accordance with the CVPIA's and Reclamation's guidelines for implementation of water transfers (Reclamation 1993), which are discussed in Section 2.4. No changes are being proposed to these laws and guidelines with the range of alternatives evaluated herein.

This section is organized into the following subsections:

- Project Location
- No Action/No Project Alternative
- Action/Project Alternatives
- Required Approvals and Permits
- Alternatives Considered But Eliminated
- Agency Preferred Alternative
- Summary Comparison of Alternative Impacts

2.1 PROJECT LOCATION

The water exchanges and transfers would occur largely within the San Joaquin Valley of central California. Figure 2-1 is a regional map that shows the general location of the project area in the San Joaquin Valley within the State of California and key hydrologic features. The locations of the Exchange Contractors (transferor) water transfer program's potential recipients (transferees) are illustrated on maps presented on the following pages.

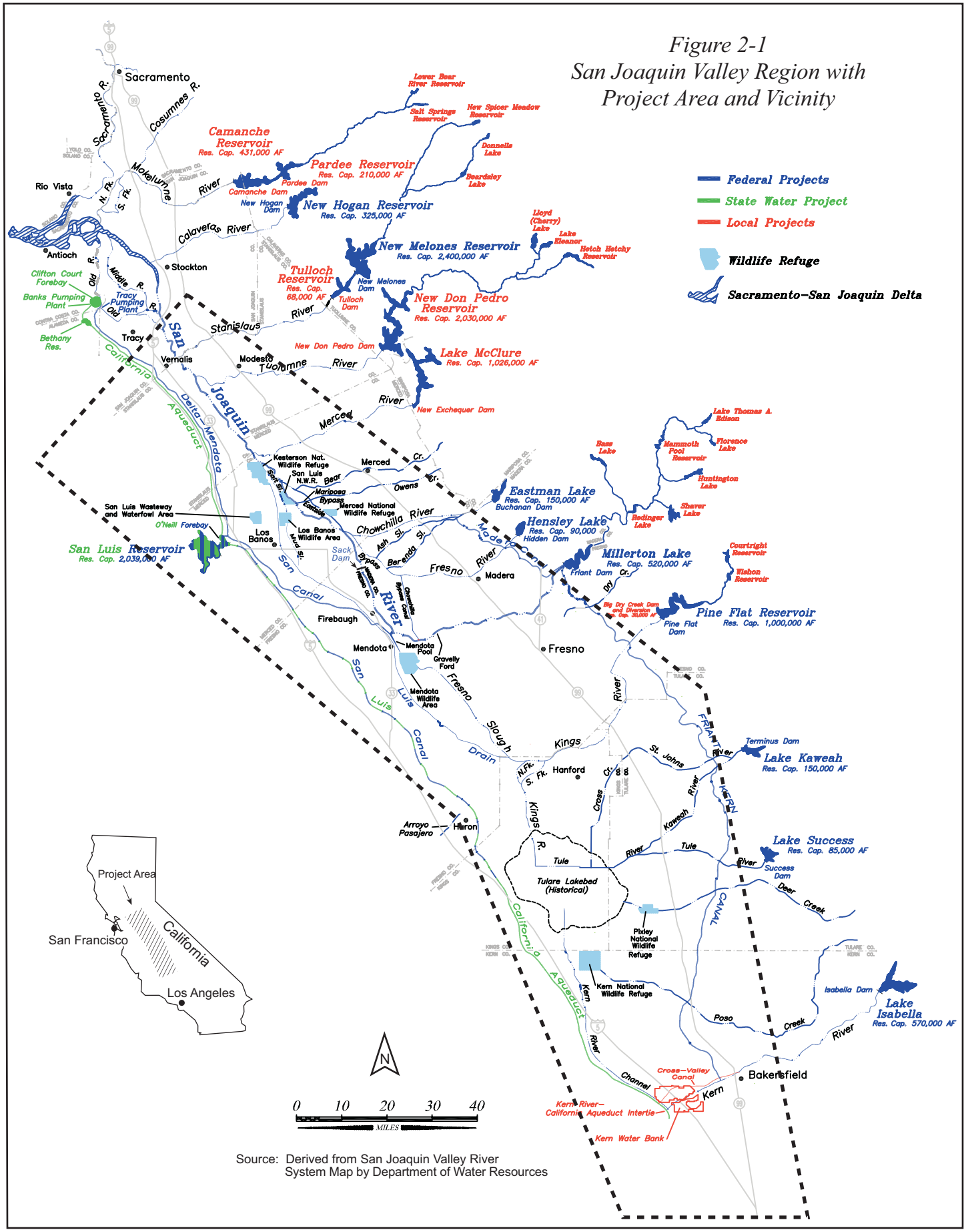
- The Exchange Contractors would develop their water from within their service area. The Exchange Contractors service area covers 240,000 acres of agricultural land in Fresno, Madera, Merced, and Stanislaus counties, shown on Figure 2-2.
- The wetland habitat areas that would receive the water are located in Merced, Fresno, Tulare, and Kern counties, shown on Figure 2-3.
- The agricultural water users that would benefit from the potential transfers are located in Stanislaus, San Joaquin, Merced, Madera, Fresno, San Benito, Santa Clara, Tulare, Kern, and Kings counties, shown on Figure 2-4 (along with the Exchange Contractors and wetland habitat areas).
- Water purchased for use by Reclamation or DWR for the EWA may be provided to CVP contractors south of the Delta (in the West San Joaquin and San Felipe divisions) to replace water foregone at Tracy and Banks pumping plants pursuant to EWA fish protection actions. The West San Joaquin Division (including the San Luis Unit) covers 600,000 acres located in the western portion of Fresno, Kings, and Merced Counties. The San Felipe Division covers the Santa Clara Valley in Santa Clara County, the northern portion of San Benito County, the southern portion of Santa Cruz County, and the northern edge of Monterey County. Only water users in Santa Clara and San Benito counties would benefit.[1]

2.2 NO ACTION / NO PROJECT ALTERNATIVE

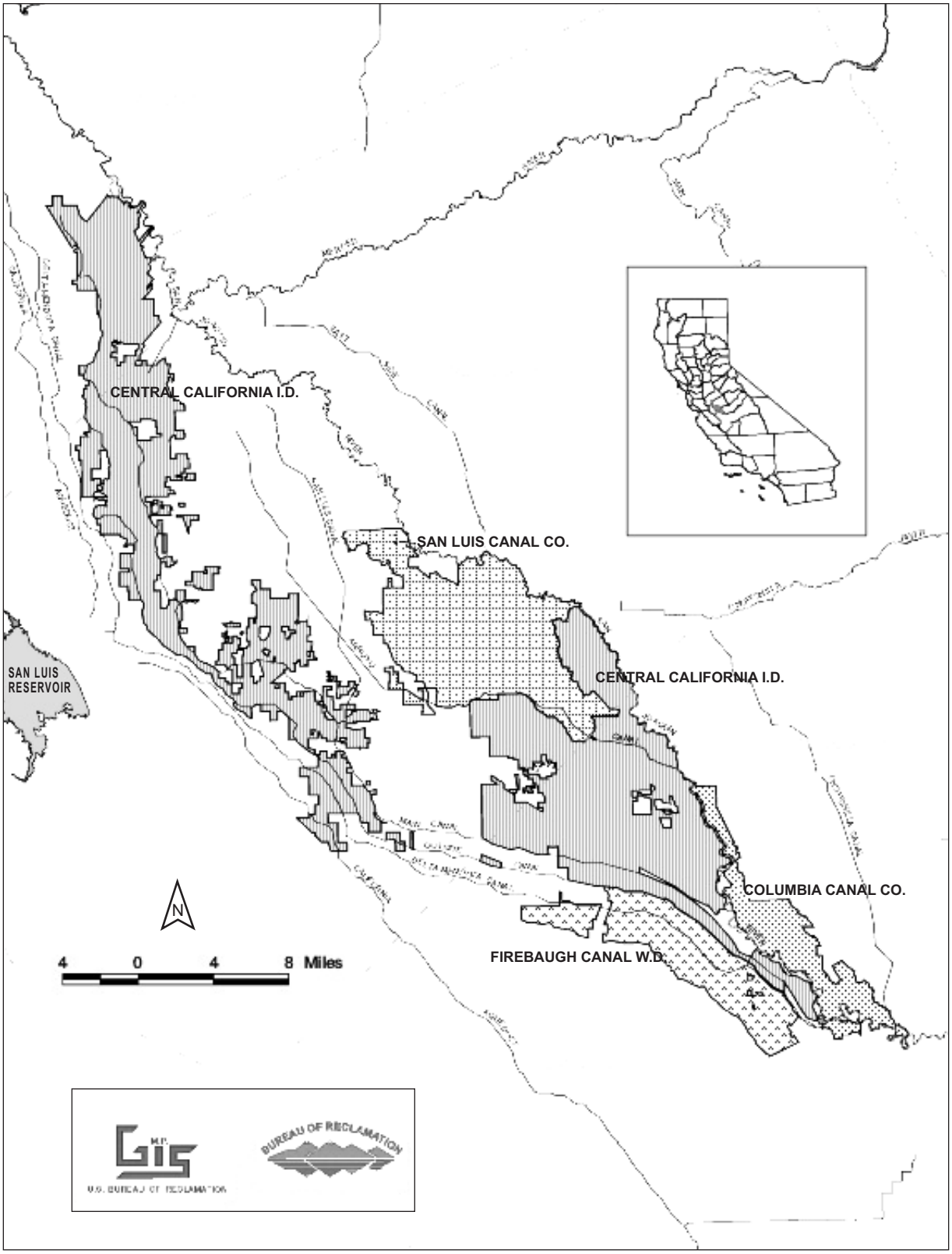
For the Exchange Contractors' water transfer program for water years 2005–2014, the No Action and No Project Alternatives are considered to be the same.

- Reclamation describes the No Action Alternative as a projection of conditions that could reasonably occur within the time period associated with the proposed transfer, water years 2005–2014, but without any of the action alternatives being implemented. Under NEPA, the No Action Alternative is the benchmark for determining environmental effects of the proposed action alternatives.
- Similarly, the No Project Alternative under CEQA is the condition under which the project does not proceed. Where failure to proceed with the project will not result in the preservation of existing environmental conditions, then the practical results of "no transfer" are identified. Where "no transfer" from the Exchange Contractors would result in predictable actions by the WAP and the Exchange Contractors, these consequences are discussed.
- Under CEQA, the basis for determining the significance of environmental impacts is existing physical conditions. No Project is evaluated against the existing condition, but it is not the

[1] Consequently, only Santa Clara and San Benito counties have received the Notice of Availability of this EIS/EIR.

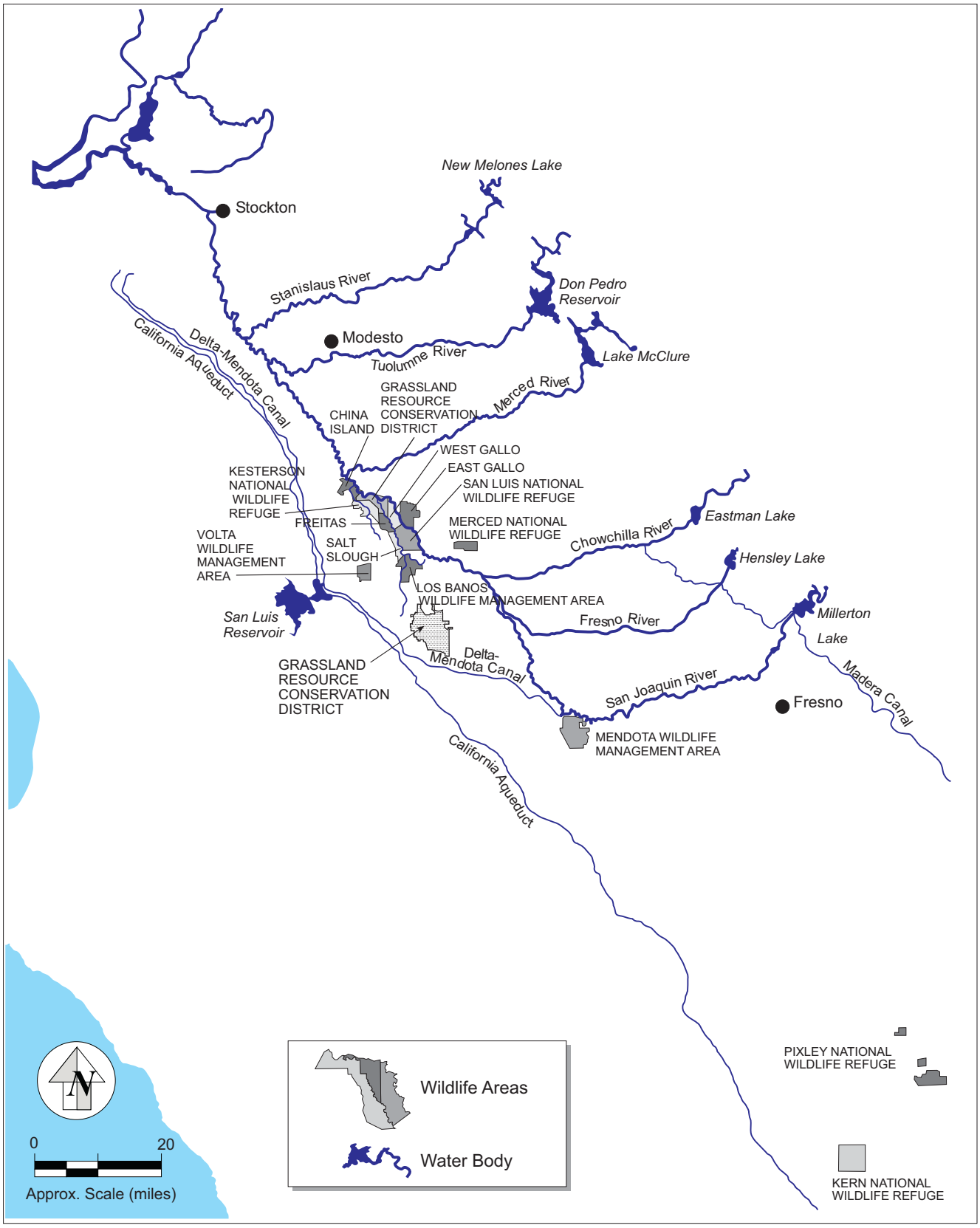


Source: Derived from San Joaquin Valley River System Map by Department of Water Resources



Project No. 26814274	**EIS/EIR**	SAN JOAQUIN RIVER EXCHANGE CONTRACTORS WATER AUTHORITY SERVICE AREA	Figure 2-2

26814274.00100/062603/gos



Project No. 26814274	**EIS/EIR**	SAN JOAQUIN VALLEY WILDLIFE AREAS, 2005 - 2014	Figure 2-3

26814274.00100/100103/gos

Exchange Contractors
Central California ID
Columbia Canal Co.
Firebaugh Canal WD
San Luis Canal Co.

CVP Westside
Del Puerto WD
Pacheco WD
Panoche WD
Patterson ID
Plain View WD
San Benito Co. WD
San Luis WD
Santa Clara Valley WD
Westlands WD

CVP Eastside (Friant Division)
Arvin-Edison WSD
Chowchilla WD
Delano-Earlimart ID
Exeter ID
Fresno ID
Garfield WD
Gravelly Ford WD
International WD
Ivanhoe ID
Lewis Creek WD
Lindmore ID
Lindsay-Strathmore ID
Lower Tule River ID
Madera ID
Orange Cove ID
Porterville ID
Saucelito ID
Shafter-Wasco ID
Southern San Joaquin MUD
Stone Corral ID
Tea Pot Dome WD
Terra Bella ID
Tulare ID

N

0 3.757.5 15 22.5 30 Miles

Legend

San Joaquin River Exchange Contractors Water Authority

Potential Wildlife Refuges Water Users

Potential CVP Water Users

Project No. 26814274	EIS/EIR	Exchange Contractors 10-Year Water Transfer Program: Source and Receiving Areas	Figure 2-4

URS Corporation L:\Projects\San_Joaquin_Valley_River_System_SJRECWA_26814274\MXD\Draft\public_report\water_districts_both_032504.mxd Date: 3/25/2004 11:51:42 AM Name: akkeele0

baseline for significance determinations unless it is equivalent to the existing condition, which is the case for this EIS/EIR for most of the affected resources.

- The No Action/No Project Alternative is similar to the existing condition and is the primary environmental baseline. Differences (if any) are discussed in the environmental analysis sections.

The No Action/No Project Alternative would result in no transfer or exchange of water from the Exchange Contractors to either Interior or to any of the other potential water users. The response of the entities directly involved with the Proposed Action to no transfer from the Exchange Contractors would be:

- The Exchange Contractors would recover and reuse for their own operations and generate approximately the same amount of tailwater flows that have recently been transferred. The reused water would be integrated into the Exchange Contractors' water supply and likely reduce groundwater pumping that currently helps meet irrigation demands.
- Under No Action, deliveries to the refuges would consist of Level 2 and Replacement Water[2] quantities plus a portion of the Incremental Level 4 need that could reasonably be obtained from other sources. For No Project, the practical result would be a reduction in deliveries to the refuges from the Exchange Contractors and acquisitions of water from other entities through purchases by the WAP.
- Agricultural and M&I water users would get their CVP contractual supplies subject to the limitations in their contracts. Under No Action/No Project, the CVP water users may obtain water from other sources or they would continue to experience shortages.

No Action under NEPA is similar to existing conditions (for most of the affected resources) as depicted in the October 2003 Notice of Intent to Prepare an EIS and Notice of Preparation of an EIR. No Action and existing conditions are similar in terms of the potential effect upon San Joaquin River flows of the transferred water because if water was not transferred from the Exchange Contractors, water would be transferred from other sources. No Action differs slightly from existing conditions in terms of the effect that a transferor of water has upon San Joaquin River flows. Under both No Action and No Project, the Exchange Contractors would not modify their operations relative to San Joaquin River. However, without the Exchange Contractor's transfer water Interior would acquire a portion of the needed water from other sources that may affect San Joaquin River flows. Existing conditions reflect the current environment of the system including the recent actions of the Exchange Contractors that develop and provide transfer water to Interior through 2004.[3]

[2] Replacement Water is the amount of water that the San Luis Unit, Freitas and Kesterson national wildlife refuges, and Volta and Mendota wildlife management areas had historically received and used, which is more than Level 2 amounts but may be less than or equal to their Level 4 amounts. Replacement Water was originally provided by groundwater and tailwater, but due to water quality concerns, Reclamation entered into agreements to provide Replacement Water to the wildlife areas. When willing sellers and funds are available, Reclamation acquires water to supplement supplies to minimize the impact to CVP contractors south of the Delta.

[3] The Environmental Assessment for current transfers is due to expire after 2004 (Reclamation 2000c).

2.2.1 Assumptions Related to the Wetland Habitat Areas

Under the No Action/No Project Alternative, deliveries to wetland habitat areas in the San Joaquin Valley are assumed to consist of Level 2 quantities plus 75,694 acre-feet of the Level 4 Incremental Water Supply. In 2002 and 2003, the WAP obtained an annual average of approximately 79,963 acre-feet from all sources, including 62,250 acre-feet from the Exchange Contractors. Interior would continue to seek to acquire water from other sources and expects that up to the same amount could be purchased (assuming a continuation of recent water prices and recent WAP budget). Of the 75,694 acre-feet in Table 2-1, 63,994 acre-feet could be obtained for San Joaquin River refuges and 11,700 acre-feet for Kern NWR. Lands historically managed for wetland habitat and irrigated for wildlife food supply could be flooded at the wetland habitat areas, consistent with the past 2–3 years' operations. A substantial portion of the Incremental Level 4 Water Supply is used for seasonal irrigation needs at the refuges. Table 2-1 summarizes the quantities of water to be delivered to the wetlands under No Action/No Project Alternative.

Table 2-1
San Joaquin Valley Refuge Annual Water Supplies
No Action/No Project Alternative

San Joaquin Valley Refuges	Level 2 (acre-feet)	Incremental Level 4 (acre-feet)	No Action Total
San Luis NWR Complex			
San Luis Unit	19,000*	0	19,000
West Bear Creek Unit (formerly West Gallo)	7,207	3,082	10,289
Kesterson Unit	10,000*	0	10,000
Freitas Unit	5,290*	0	5,290
East Bear Creek Unit (formerly East Gallo)	8,863	0	8,863
Los Banos WMA	16,670	7,280	23,950
Volta WMA	13,000*	168	13,168
Mendota WMA	27,594*	629	28,223
Grassland Resource Conservation District (RCD)	125,000	47,822	172,822
North Grassland WMA			
China Island Unit	6,967	1,969	8,936
Salt Slough Unit	6,680	3,044	9,724
Kern NWR	9,950	11,700	21,650
Pixley NWR	1,280	0	1,280
Total for San Joaquin Valley Refuges	257,501	75,694	333,195

Sources: Reclamation 1989, 2001k, 2001l; D. Meier, pers. comm., 2004.
Note: Acre-feet of water delivered at refuge boundary. Average of 2002 and 2003 deliveries.
***** Includes Replacement Water as defined in Appendix B.

Additional information is presented in Appendix B on the assumed water supply and management (water balance) of a water supply for the refuges adjacent to the Exchange Contractors service area and hydraulically connected to the San Joaquin River.

2.2.2 Assumptions Related to the Delivery of Water to CVP Contractors

In the absence of the proposed water transfer from the Exchange Contractors, agricultural water users would receive their CVP contractual supplies subject to the limitations and/or shortages in their contracts with Reclamation using existing conveyance facilities. They would also rely on groundwater pumping to supplement surface water deliveries or obtain water from other sources. Absent the transfer, at times these agricultural water users would fallow lands. In a normal year, SCVWD would receive their CVP contractual supply of up to 152,500 acre-feet subject to the limitations and/or shortages in their contract with Reclamation and using existing conveyance facilities. This contract provides for an M&I delivery of up to 119,400 acre-feet, subject to a shortage of up to 25 percent. The remaining 33,100 acre-feet of the contract are for agricultural purposes subject to CVP water service shortage provisions.

2.2.3 Assumptions Related to the Environmental Water Account

Without the water transfer from the Exchange Contractors, the CALFED EWA Program would rely on other operational tools of the CVP and SWP and transfers from SWP/CVP and non-SWP/CVP contractors, to facilitate EWA actions that would otherwise reduce CVP contractual supplies. The EWA is set to expire after September 30, 2004, and it is assumed that the EWA agencies will extend it beyond this time, at least until 2007, an assumption consistent with the EIS/EIR for the short-term EWA (Reclamation/DWR 2004).

2.2.4 Assumptions Related to the Exchange Contractors

Reclamation and the Exchange Contractors are parties to the *Second Amendatory Contract for Exchange of Waters, Contract No. I1r-1144* (Contract), dated February 14, 1968, and incorporated by reference into this EIS/EIR. Under the Contract, the United States supplies the Exchange Contractors with a substitute supply of CVP water to be used in lieu of their rights to certain waters of the San Joaquin River. Pursuant to the terms of the Contract, up to 840,000 acre-feet of substitute CVP water per year is made available for irrigation purposes by Reclamation from the Sacramento River and the Delta, and other sources through the CVP, and up to 650,000 acre-feet in critical dry years. The Exchange Contractors operations consist of the diversion of substitute water from the Delta-Mendota Canal, the Mendota Pool, and possibly the San Joaquin River and north fork of the Kings River. Some flexibility of operation is possible, but pursuant to the Contract, delivery amounts may not exceed certain specified monthly and seasonal maximums. Without the transfers, the Exchange Contractors would divert all of their substitute water supply.

The Exchange Contractors have progressively developed recapture facilities within their service area with the express purpose of providing quantities of water for transfer. Absent transfers, the Exchange Contractors anticipate the continuation of the use of the facilities for their own internal operation needs. Therefore, under the No Action/No Project Alternative, it is assumed that the Exchange Contractors will continue to operate the facilities to the extent currently used for transfers.

As previously described, No Action differs from existing conditions in terms of the Exchange Contractors' recent provision of transfer water. Existing conditions would include the recent provision of up to 71,600 acre-feet of transfer water (Water Year 2003, see Table 1-1) to CVP agricultural and M&I water users and wildlife areas. Those transfers were made by use of water

developed by the Exchange Contractors through several of the sources of water described for the action alternatives. Absent the transfer from the Exchange Contractors, the predictable response by Interior would be to obtain similar refuge water supplies from other sources, excluding the Exchange Contractors. The hydrology of the San Joaquin River would experience no change in terms of the transferees' use of the same amount of transfer water. A slight difference in San Joaquin River hydrology could be anticipated by Interior's response to acquire water from entities other than the Exchange Contractors that have a hydrologic connection with the San Joaquin River. The assumed amount of such acquisitions and the resultant effect upon San Joaquin River hydrology is considered negligible. Therefore, the No Action setting is assumed to equal existing conditions in terms of San Joaquin hydrology.

2.3 ACTION/PROJECT ALTERNATIVES

The action/project alternatives (hereafter called action alternatives) involve multiple sources of developed water and multiple users of that water. The Exchange Contractors propose to develop water from a conservation/tailwater recovery program, groundwater pumping, and crop idling/temporary land fallowing. The action alternatives are designed based on how the water is developed (or source) and the quantity of water developed. Each action alternative has a range of water acquisition scenarios based on how the water could be used. While the focus of this EIS/EIR is on how the water is developed, the effects of how the water is used are also addressed to provide a complete analysis of both direct and indirect impacts.

2.3.1 Water Development Alternatives

Within the action alternatives, the Exchange Contractors would employ their tailwater recovery efforts[4], supplement their tailwater recapture program with other conserved water[5] and provide groundwater pumping. Assuming a maximum of 130,000 acre-feet total from all sources, up to 80,000 acre-feet would be tailwater recapture and other conservation efforts (including reduced conveyance losses, reductions in spillage, canal lining, and other irrigation efficiencies), up to 20,000 acre-feet would be groundwater, and up to 50,000 acre-feet would be developed through temporary land fallowing[6] in any year.

The increased tailwater/conserved water, groundwater pumping, and fallowing water would occur during the months of January through December of each year beginning in 2005. The amount of water that the Exchange Contractors would develop can vary by year, and its pattern would depend upon the sources of water developed. For the maximum transfer of 130,000 acre-feet, it is estimated that the Exchange Contractors would develop this water in accordance with the range of values listed in Table 2-2.

[4] Tailwater recovery is defined as the reuse of tailwater flows in the act or act(s) of reclaiming surface water from irrigated lands into a surface supply system. This reclamation can be achieved either by gravity or by low lift pumps. The water is reused within the political boundaries of the agency or agencies from which it originated. The tailwater recovery effort by the Exchange Contractors is their tailwater recapture program.

[5] Conserved water is defined as water made available from canal lining, changes in irrigation practices (such as drip irrigation rather than furrow), spill reductions, reductions in percolation to saline sinks, and other water management practices excluding land fallowing. It does not result from land fallowing above normal practices or longer than 1.5 years beginning with no irrigation from January until spring of the following year. Land fallowing that normally occurs is the nonapplication of irrigation water for 1 year on selected areas.

[6] Crop idling/land fallowing beyond normal practices is for the purpose of developing water. Lands to be fallowed would be temporary, i.e., for no more than 3 consecutive years.

Table 2-2
Estimated Quantity of Water Developed/Transferred from the Exchange Contractors, All Sources, Noncritical Years

Month	Acre-Feet Developed for Transfer
January	1,278–1,678
February	5,961–8,961
March	7,863–10,863
April	8,358–9,358
May	11,566–11,666
June	22,967–24,067
July	27,746–30,246
August	25,222–25,722
September	7,261
October	4,051–5,451
November	607–1,407
December	220
Total	**130,000**

Source: Appendix B, Hydrologic Effects of Water Transfers, Studies 1.1 and 1.5, Water Development and Disposition Assumptions.

For the Exchange Contractors transfer program, up to 20,000 acre-feet per year of groundwater pumping could occur in noncritical years, resulting in a like amount of surface water being available for direct transfer. Reclamation would not purchase groundwater directly for transfer; they would purchase "substitution" groundwater. Groundwater substitution transfers involve additional pumping of groundwater with a one-for-one reduction in surface water diversions that would have occurred absent the additional groundwater pumping (DWR 2002). The "substitution" groundwater pumped by the Exchange Contractors would be used to meet consumptive use demands.

Acquisitions involving groundwater would be evaluated using *Guidelines for the Technical Evaluation of Wells in Water Transfers Involving Groundwater Substitution* (as stated in the *Interim Water Acquisition Program Environmental Assessment* [Reclamation 1995b] and *Groundwater Substitution Transfers, How to Make Them Work in the Sacramento Valley in 2002* (DWR 2002). Groundwater would not be accepted if the wells are (1) located in areas of current groundwater overdraft, (2) perforated in areas of poor groundwater quality, or (3) perforated at shallow depths and located within the groundwater influence area of rivers or major distribution conveyance canals (unlined). Further, any acquisition involving groundwater would be accompanied by groundwater monitoring to evaluate any impacts of the program on a local groundwater aquifer. Agreements involving groundwater would require that pumping be reduced or curtailed to the extent that the pumping is identified as a source of significant degradation of groundwater levels or quality, is identified as a cause of subsidence, or is identified as reducing stream flows at a time when the water is used by downstream users.

The additional tailwater/conserved water, temporary crop idling water, and groundwater would be commingled with the Exchange Contractors surface water supply system and used to meet their own needs, thus temporarily reducing their demand for water made available under their Contract. For each acre-foot of tailwater/conserved water/reductions in consumptive use/groundwater (subject to the limitations agreed to in this document) recovered by the Exchange Contractors for their own reuse, an equal amount of water will be considered acquired and available in the CVP for delivery to the wetlands, CVP water users as replacement supplies to facilitate EWA actions, agriculture, or M&I uses. The transfer is CVP substitute water that would have been provided by the United States to the Exchange Contractors; it does not represent direct inflows to the San Joaquin River system. The availability of this water for delivery would be constrained by the same monthly limitations that apply to the Exchange Contractors under their Contract.

There are three action alternatives based on the quantity of water and sources of supply. Each action alternative has a range of subalternatives or scenarios based not only on the source of supply but also on potential water users and whether these users are hydraulically connected to the San Joaquin River. A range of scenarios is evaluated and described in Appendix B, Hydrologic Effects of Water Transfers.

2.3.1.1 Alternative A: 80,000 Acre-Feet

Alternative A represents an intermediate level of program implementation, and is similar to the level of implementation currently underway for noncritical years. For this action alternative, the Exchange Contractors would provide up to 80,000 acre-feet of water during noncritical years through a combination of conservation, groundwater, and crop idling/land fallowing sources; and during critical years, up to 50,000 acre-feet of water may be made available through crop idling/land fallowing only. Conservation measures are defined as tailwater recapture, recovery of irretrievable losses, and reductions in operational spills.

The maximum amount of water, up to 80,000 acre-feet, would be developed only in noncritical years. It is similar to the program previously implemented in recent calendar years 2000–2003 (64,500–71,637 acre-feet), none of which were critical years.

Flexibility exists in the development of 80,000 acre-feet of water for transfer during noncritical years. The Exchange Contractors have indicated the availability of up to 20,000 acre-feet of groundwater and the availability of up to 50,000 acre-feet of water from temporary crop idling/land fallowing during noncritical years. These sources of water in combination with tailwater and other conservation opportunities can provide flexibility in the decision of transfer water source. For example, if 50,000 acre-feet were developed through tailwater recovery, up to 30,000 acre-feet would be developed from the other measures.

Up to 50,000 acre-feet could be developed from crop idling/temporary land fallowing in both critical and noncritical years. In critical years, only water from crop idling/land fallowing would be available. This water from crop idling is a new component not included in previous annual water transfers. In critical years, no conservation or groundwater pumping (above No Action/No Project) would be available for transfers.

Any or all of the available water could be provided to the refuges, agriculture, and M&I users subject to the limitations identified in Section 2.3.2.

2.3.1.2 Alternative B: 50,000 Acre-Feet

The maximum available water for transfer is up to 50,000 acre-feet from crop idling/temporary land fallowing. Alternative B represents a unique transfer program of only utilizing crop idling/land fallowing as the source of transfer water supply. In any type of year, the Exchange Contractors would provide up to 50,000 acre-feet of water through crop idling/land fallowing on approximately 20,000 acres of land within the Exchange Contractors service area. Assuming a transferable quantity of 2.5 acre-feet per acre, the maximum amount of land to be temporarily idled/fallowed is approximately 20,000 acres, 8.3 percent of the irrigable land (240,000 acres) in the Exchange Contractors service area. The affected land would be rotated to avoid idling the same land year after year. Any or all of the available water could be provided to the refuges, agriculture, and M&I users subject to the limitations identified in Section 2.3.2.

2.3.1.3 Alternative C: 130,000 Acre-Feet

Alternative C evaluates the implementation of the maximum amount of water made available. The Exchange Contractors have identified the potential availability of up to 130,000 acre-feet of water during noncritical years, with up to 80,000 acre-feet of water made available through conservation (up to 80,000 acre-feet, including tailwater recovery) and groundwater (up to 20,000 acre-feet), and up to 50,000 acre-feet of water made available through crop idling/temporary land fallowing. During critical years, up to 50,000 acre-feet of water may be made available through crop fallowing, and no water is to be made available from conservation/tailwater recovery and groundwater measures. Any or all of the available water could be provided to the refuges, agriculture, and M&I users subject to the limitations identified in Sections 2.3.2 and 2.4 below.

2.3.2 Water Acquisition Scenarios

The action alternatives also consist of a range of acquisitions by the WAP, the CVP contractors, and the EWA agencies in any year. A multiple year agreement with any of the transferees is possible, including the option of a specific quantity of water in each year of the agreement. The transfers would be monitored and annually reported by Reclamation to calculate the cumulative transfer activity authorized under this EIS/EIR. They would be subject to the approvals and permits discussed in Section 2.4.

Each action alternative has numerous potential options for how and where the water would be used. The action alternatives are composed of the following scenarios for acquisition, transfer, and/or exchange of waters between the Exchange Contractors and other parties to bracket the extremes of water development and delivery within an environmental impact analysis:

- **Water to Refuges:** The WAP may acquire from the Exchange Contractors up to 80,000 acre-feet of water for delivery to wetland habitat areas under CVPIA Section 3406(d)(2) to meet a portion of the Incremental Level 4 refuge water requirements. The total Incremental Level 4 requirement is 128,767 acre-feet annually (including conveyance losses of 20 percent). For each acre-foot of water developed by the Exchange Contractors for their own use, an equal amount of water would be considered available for delivery to the wetlands. CVP water from the Delta-Mendota Canal would be delivered to the refuges instead of delivering the same amounts of substitute to the Exchange Contractors. Transfers to the refuges in the Delta-Mendota Canal/San Luis Canal service area are deemed to meet

the consumptive use criteria of the CVPIA. Transfers to the Kern and Pixley refuges must comply with the consumptive use requirements of the CVPIA.

- **Water to Agriculture and M&I Uses:** Agricultural and M&I (CVP) water users may obtain up to 100 percent of the available water (50,000 to 130,000 acre-feet, depending on the alternative and year type) subject to operation limitations. Recipients may include any or all of the following:
  - The transfer of up to 130,000 acre-feet of temporary water supplies to "in-basin" CVP water service contractors in the Delta export service area[7]
  - The transfer and exchange of up to 70,000 acre-feet of temporary water supplies from reductions in consumptive use and groundwater substitution plus the quantifiable decrease in irretrievable losses to "out-of-basin" CVP contractors in the Friant Division on the east side of the San Joaquin Valley[8]
  - The transfer of a portion of the temporary water supplies (up to the amount of shortages incurred by SCVWD in its CVP supply[9]) to SCVWD for agricultural, municipal, and/or industrial uses
  - The transfer of all or a portion of the temporary water supplies to Reclamation and/or DWR for delivery to CVP water users to facilitate EWA actions (replacement water for CVP water users in the San Luis Unit, Delta-Mendota Canal Unit, and San Felipe Division)

A combination of the above water transfers/exchanges could occur in any year. Part of the available water supply could go to the refuges, and the remaining amount could be used for CVP agriculture and M&I uses, including the EWA. The numerous combinations of uses are not evaluated herein, but their potential impacts would lie within the range of potential impacts disclosed by the action alternatives and scenarios. In application, the potential impacts associated with a specific combination of transfers/exchanges would be determined on an annual basis during the transfer approval process, similar to the 2000–2004 transfer program.

The water transferred or exchanged would not result in land use changes or provide irrigation service to lands not previously cultivated. CVP water deliveries would not exceed quantities contained in long-term supply agreements with Reclamation.

The potential scenarios are explained in greater detail in the following sections.

2.3.2.1 Water to Wetland Habitat

One potential scenario for the water acquisitions would be for Interior's WAP to acquire up to 80,000 acre-feet of the available water in any year, to meet a portion of the annual Incremental Level 4 need of 128,768 acre-feet (103,014 acre-feet at the refuge boundary plus approximately

[7] Up to contract totals.

[8] See footnote 6.

[9] Contract supply of 152,500 acre-feet per year, 119,400 acre-feet for M&I and 33,100 acre-feet for agriculture. The M&I component may be shorted by up to 25 percent (29,850 acre-feet), and the agriculture component may be shorted entirely. The Exchange Contractors' transfer to SCVWD will not exceed the amount of shortage anticipated to occur, 62,950 acre-feet total.

20 percent for conveyance losses), from the Exchange Contractors for the wetland habitat areas in the San Joaquin Valley. The approximate locations of the wetland habitat areas are shown on Figure 2-3.

Reclamation would make the acquired water available to the wetlands in accordance with Table 2-3 and pursuant to the following agreements: *Cooperative Agreement Between the United States of America and the San Luis Canal Company for Conveyance of Wildlife Refuge Water Supplies* (Reclamation 1998a)*, Cooperative Agreement Between the United States of America and the Central California Irrigation District for the Conveyance of Wildlife Refuge Water Supplies* (Reclamation 1998b), and *Cooperative Agreement Between the United States of America and the Grasslands Water District for Conveyance of Wildlife Refuge Water Supplies* (Reclamation 1998c). Under Alternative C, if all of the available Incremental Level 4 water is acquired by Reclamation and applied to the wetlands (80,000 acre-feet), the remaining up to 50,000 acre-feet would be available for transfer to agricultural users, M&I (SCVWD only), or the EWA during that particular year.

Table 2-3
San Joaquin Valley Refuge Incremental Water Supply Needs, Water Service Years 2005–2014

San Joaquin Valley Wetlands	Level 4 Increments (Acre-Feet) at Point of Delivery
San Luis*	0
Freitas*	0
Kesterson*	0
E. Bear Creek	4,432
W. Bear Creek	3,603
Volta	3,000
China Island	3,483
Salt Slough	3,340
Los Banos	8,330
Mendota	2,056
Grassland	55,000
Kern	15,050
Pixley	4,720
Total	103,014

Source: S. Carter, pers. comm., 2003a.
Note:
*The Memorandum of Understanding with the Service clarifies the Level 4 increment for these refuges. In accordance with a Reclamation commitment prior to CVPIA, a total of 18,550 acre-feet of full habitat development water supplies will be provided. The 18,550 acre-feet includes conveyance losses for delivery of the full habitat water supplies.

To deliver water to refuges outside of the San Joaquin River Basin, specifically to Pixley and Kern NWRs, exchanges may involve facilities referenced and described in the *Draft Finding of No Significant Impact, Conveyance of Refuge Water Supply, South San Joaquin Valley Study Area* (Reclamation 2003b).

2.3.2.2 Water to Agriculture

Under this scenario, potentially all of the available water in any year, up to 50,000–130,000 acre-feet, would be available to in-basin westside (nine districts) and no more than 70,000 acre-feet of this water would be available to the out-of-basin eastside (Friant) CVP water service contractors that need additional irrigation water. Several of the districts could obtain some portion of the available water in each water service year, 2005–2014. Friant Division districts most likely to be involved in a transfer or exchange with the Exchange Contractors are Arvin-Edison Water Storage District, Chowchilla WD, and Madera Irrigation District (ID). Kern-Tulare WD and Rag Gulch WD are Cross Valley Canal contractors who could participate in an exchange with Friant Division districts. The scheduling of deliveries to the districts would be consistent with the typical agricultural cycle that has the greatest deliveries during the growing season.

Figure 2-2 shows the Exchange Contractors service area composed of four member districts: Central California Irrigation District (CCID), Columbia Canal Company, Firebaugh Canal WD, and San Luis Canal Company. Along with the Exchange Contractors member districts and the refuges, Figure 2-4 indicates the location of the nine westside CVP contractors that may receive the transferred water for agricultural uses: Del Puerto, Pacheco, Panoche, Patterson, Plainview, San Benito County, San Luis, Santa Clara Valley, and Westlands WDs. The eastside Friant Division contractors agricultural service area comprises 23 districts.

The westside IDs could receive the transfer water through facilities currently providing their CVP supplies, the Delta-Mendota Canal, and San Luis Unit facilities. Friant Division contractors could receive the transfer water through wheeling arrangements utilizing CVP and SWP (California Aqueduct) facilities and other third-party facilities (e.g., Cross-Valley Canal contractors). Water exchange arrangements will be necessary to provide deliveries to specific Friant Division contractors, and it would be the responsibility of the potential water user to make those arrangements with all involved parties for conveyance.

2.3.2.3 Partial Allocations to Both Wetlands and Agriculture

Of the water available from the Exchange Contractors, part would be acquired by the WAP for the refuges and part would be acquired by other CVP agricultural service contractors as described above. Other assumptions on the sources of the additional water described in Section 2.3 also apply to both.

2.3.2.4 Partial Allocations to Environmental Water Account

This scenario is a potential component of the water to agricultural and/or M&I water uses previously described. In particular, a portion of the available water would be transferred to the CALFED EWA for use by contractors south of the Delta (West San Joaquin and San Felipe divisions) to the extent that CVP operations would benefit. In other words, changes in SWP/CVP operations to protect fisheries, including changes in Delta pumping operations that would require water supplies that would have been exported otherwise, would be addressed by replacement water to the affected CVP water users. A Final EIS/EIR on the EWA was available in January 2004 (Reclamation and DWR 2004), and Reclamation signed the Record of Decision in March 2004. This EWA document evaluates potential acquisitions in the EWA's Export Service Area (defined broadly as south of Delta, which includes the San Joaquin and Santa Clara valleys), but it does not analyze acquisitions specifically from the Exchange Contractors.

As described in Section 1.1.3, the EWA is a cooperative water management program. The EWA program replaces any regular water supply interrupted by the environmentally beneficial operation changes to CVP and SWP operations. Replacement water (EWA assets) is obtained by acquiring it through voluntary purchases in the water transfer market or through operational flexibility of the CVP and SWP pumping plants. The EWA could participate as a wheeler, seller, and buyer of water used directly for fishery enhancement or indirectly to replace lost supplies. Existing CVP and SWP storage and conveyance facilities, including San Luis Reservoir, Millerton Lake, Delta-Mendota Canal, California Aqueduct, and Cross Valley Canal, could be used to complete a transfer or exchange of available water from the Exchange Contractors to the EWA and subsequently to south of Delta CVP contractors. Reclamation, DWR, and the affected contractor would be responsible for development and implementation of the water transfer/exchange arrangements.

2.3.2.5 Partial Allocations to Municipal and Industrial Uses

This scenario involves a transfer to SCVWD for M&I and/or agricultural uses. The transferred water would be made available in the Delta-Mendota Canal as a temporarily reduced delivery to the Exchange Contractors. The water becomes a component of the CVP water supply existing south of the Delta. SCVWD would schedule with Reclamation the delivery of the transfer water, which may include temporary storage in San Luis Reservoir. The transfers would be structured to meet anticipated shortages in CVP supply and would not result in exceedances of supplies identified in the long-term contract with Reclamation.

2.4 REQUIRED APPROVALS AND PERMITS

Reclamation must approve all transfers or exchanges. Reclamation will review the proposed action for compliance with its *Interim Guidelines for Implementation of Water Transfers Under Title XXXIV of Public Law 102-575 (Water Transfer)*, Sections V(H) and V(J) (Reclamation 1993). The guidelines are based on Section 3405(a)(1)(I) of the CVPIA: "The water subject to any transfer undertaken pursuant to this subsection shall be limited to water that would have been consumptively used or irretrievably lost to beneficial use during the year or years of the transfer."

In compliance with applicable Reclamation guidelines and policies, Federal statutes, and State law, the Exchange Contractors have proposed that any or all of the available water from the alternatives could be provided to the refuges, agriculture, EWA, and M&I users subject to the limitations identified as follows:

1. Water transfers made available by conservation measures such as additional reuse of tailwater may be only transferred by the Exchange Contractors to CVP contractors in the Delta-Mendota Canal service area, San Luis Unit, San Felipe Unit, San Joaquin Valley refuges (excluding the Tulare Lake Basin wildlife areas), all of Westlands, and transfers to DWR for EWA replacement water for CVP contractors. These transfers are referred to herein as "in-basin" transfers and are deemed to meet the reduction in consumptive use/irretrievable loss criteria of CVPIA.
2. Water transfers (out-of-basin) to the Friant Unit, including Madera ID, Cross Valley Contractors, Kern County, and Tulare Lake Basin wildlife areas are limited to water that can be made available by a reduction in consumptive use or irretrievable loss as set forth in Section 3405 of the CVPIA, the 1993 Transfer Guidelines, and State law. In addition,

groundwater substitution meeting the requirements outlined in Section 3.2.1 can be used to support an out-of-basin transfer.

This use of the terms "in-basin" and "out-of-basin" transfers is not to be confused with the out-of-basin definition used in the hydrologic analysis (Section 4 and Appendix B), which is a transfer occurring outside of the drainage of the San Joaquin River, i.e., not hydraulically connected to the San Joaquin River.

Reclamation policy is that for the proposed 10-Year Transfer Program, transfers based on conservation measures such as reuse of tailwater can be deemed to meet the CVPIA criteria of reduction in consumptive use/irretrievable loss for transfers to the Delta-Mendota Canal service area, San Luis Unit, and the San Felipe Unit. The rationale is that these areas are all served by Delta water pumped at Tracy, and transfers within those areas have no effect on total Delta demand. In addition, CVP water provided to the Exchange Contractors and the contractors in the Delta export service area has generally been fully used, and transfers within the Delta export service area do not affect the amount of water delivered or the return flows available to any of these contractors. Consequently, tailwater (in addition to mechanisms that actually result in a reduction in consumptive use) can be reused by the Exchange Contractors and generate a credit for substitute water to be transferred within the Delta export service area. However, transfers to the Friant Unit, including Madera ID, Cross Valley Contractors, Kern County, or anywhere outside of the Delta export service area , and transfers to EWA are subject to the requirement to demonstrate a reduction in consumptive use/irretrievable loss. For out-of-basin transfers based on land fallowing, annual crops and alfalfa may be considered for water transfer; while permanent crops are not eligible. The test is whether the fallowed acres are over and above normal fallowing rotation. Fallowing that does not exceed the historical baseline does not generate transferable water.

Reclamation is required to consult with the Service and to provide the Service a Biological Assessment or its equivalent because of the potential to affect fish and wildlife species under the Endangered Species Act. The biological resources section of this EIS/EIR (Section 6) will serve as the biological evaluation to determine any effects on listed species and their habitats. The Service's responses will be included in the Record of Decision (ROD) for this EIS/EIR.

State agencies likely to be interested in the potential transfers/exchanges are DWR, Regional Board, and DFG. Reclamation and DWR, through the CALFED Program, would be involved in any acquisitions for the EWA. Alternatives involving SWP facilities would require approval from DWR. None of the transfers or exchanges would involve a change of place and purpose of use under Water Code Sections 1707 and 1735.

Some of the counties are especially interested in the movement of water resources across county boundaries. Madera and Fresno counties have groundwater ordinances that require obtaining a permit or an exemption to move groundwater out of the county.

2.5 ALTERNATIVES CONSIDERED BUT NOT EVALUATED IN DETAIL

A broad range of transfers is evaluated in this EIS/EIR, from no transfer to a maximum of 130,000 acre-feet in noncritical years and 50,000 acre-feet in critical years. The three action alternatives have a wide variety of options based on the three primary sources of water (conservation including tailwater recovery, groundwater, and crop idling/temporary land fallowing) and three broad types of water users (wildlife refuges, agricultural, and M&I users).

The hydrologic analysis (Appendix B) evaluates 28 possible types of water transfer, including transfers in critical and noncritical years and transfers to uses that are or are not hydraulically connected to the San Joaquin River.

Both NEPA and CEQA require that an EIS or EIR identify and analyze only reasonable alternatives, i.e., those that are feasible based on current information. "Feasible" means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors. For CEQA, reasonable alternatives are to be limited to those that would avoid or substantially lessen at least one of the significant environmental impacts of the proposed project. Other alternatives and options considered, but eliminated from detailed analysis in this EIS/EIR (for technical feasibility or other reasons), include the following:

Water Development

- Additional groundwater pumping: The action alternatives propose pumping of up to 20,000 acre-feet in the unconfined aquifer above the Corcoran Clay specifically for transfer and in addition to what is normally pumped for use within the Exchange Contractors service area. Additional pumping greater than 20,000 acre-feet was unnecessary to meet project objectives.
- Additional conservation: Up to 80,000 acre-feet is included in two of the action alternatives. Additional conservation was determined to be impractical due to limits set forth in the Exchange Contractors' water transfer policy.
- Additional crop idling/temporary land fallowing: Up to 50,000 acre-feet is assumed under the action alternatives. A greater amount was eliminated from consideration as impractical and undesirable because of potential effects on the local and regional economies, desire of district farmers to continue farming, and existing district policy.

Water Uses

- Restoration flows to the San Joaquin River: Use of transfer water for restoration flows for anadromous fish and water quality on the upper San Joaquin River was eliminated from consideration at this time because it does not help to meet the purpose and need/project objectives described in Section 1.2. Water released for San Joaquin River restoration is a different purpose than water released for specific state and federal wildlife refuges. Reclamation is currently obligated under the CVPIA to purchase water to enhance the refuges. Water for river restoration is not a project objective at this time due in part to the lack of a long-term restoration plan for the river and a full and complete environmental impact analysis of that plan. The Exchange Contractors have expressed concerns about pilot or experimental projects in recent years that could constrain long-term restoration strategies through the establishment of plants and animals in the short term.
- Additional M&I uses: To avoid population growth inducement and to minimize economic impacts, additional M&I uses beyond SCVWD and the maximum of 29,850 acre-feet were not considered. Additional water to go beyond current CVP water shortages is inconsistent with the project's purpose and need.

By limiting the water uses to those (1) consistent with current CVP contracts and quantities, to assist in alleviating water shortages associated with those contracts; (2) consistent with Incremental Level 4 deliveries to the state and federal wildlife refuges; and (3) consistent with EWA replacement water policy, the Exchange Contractors proposed water transfer program would help to implement existing agreements and programs, as described in Section 1.2.

2.6 AGENCY PREFERRED ALTERNATIVE

Alternative C has been selected as the Preferred Alternative because it assumes maximum flexibility in water developed and water transferred and the greatest potential for alleviating water supply shortages while minimizing environmental impacts. Based on a comparison of impacts and proposed mitigation, the preferred scenarios included under Alternative C will be determined following public review of this EIS/EIR in order to take public comments into consideration.

2.7 SUMMARY COMPARISON OF ALTERNATIVES

Table 2-4 provides a comparison of the alternatives to the purposes/objectives of the proposed transfer program.

Comprehensive summaries of environmental effects are contained in the text of the EIS/EIR, at the end of each section for resources potentially affected by any of the alternatives. Table 2-5 summarizes the net effects of the action alternatives on selected resources, focusing on the quantitative results for combined water development and transfer. The selected resources are surface water, groundwater, biological resources, and socioeconomics.

No one alternative is clearly environmentally preferred or superior. Rather, the environmentally preferred alternative depends upon the particular resource under evaluation. For the key resource issues of water quality at Vernalis and New Melones Reservoir operation/storage, Alternative C is environmentally preferred because it has the fewest adverse impacts combined with benefits under some scenarios.

Table 2-4
Comparison of Alternatives with Project Purposes

Purpose & Need/Objective Statements	No Action Alternative	Alternative A: 80,000 acre-feet	Alternative B: 50,000 acre-feet	Alternative C: 130,000 acre-feet
Develop supplemental water supplies from willing sellers in the Exchange Contractors service area through water conservation/tailwater recovery, groundwater pumping, and crop idling/fallowing activities consistent with district policies.	No – No supplemental supplies would be developed. Reclamation would have less flexibility to maximize use of limited CVP water resources.	Yes – 80,000-acre-foot transfer program similar to previous program but includes 50,000 acre-feet in a critical year from temporary land fallowing.	Yes – 50,000-acre-foot transfer program smaller than previous years but includes 50,000 acre-feet in a critical year and only from temporary land fallowing.	Yes – 130,000-acre-foot transfer program larger than previous years overall. Refuges limited to 80,000 acre-feet. Greater potential to maximize water development from all sources and use by all transferees.
Provide water supplies to the refuges consistent with the Incremental Level 4 water quantities for wildlife habitat development.	Yes – Water deliveries to refuges would be 75,694 acre-feet, but would have to be obtained from other sources (not from the Exchange Contractors).	Yes – Under the All Water to Refuges scenario, the managed seasonal wetlands and aquatic habitat could continue to receive approximately 65 percent of the full Incremental Level 4 supply of 103,014 acre-feet for each water service year.	Yes – Under the All Water to Refuges scenario, the refuges, special-status species, and aquatic habitat would receive all of the available water in any year to reach 40 percent of full Level 4 increment for each water service year. This amount of water is slightly lower than the average amount of water that refuges have received under the current transfer program.	Yes – Under the All Water to Refuges scenario (maximum of 80,000 acre-feet), improvements in wetland habitat quality would occur similar to Alternative A.

Table 2-4 (concluded)

Purpose & Need Statement	No Action Alternative	Alternative A: 80,000 acre-feet	Alternative B: 50,000 acre-feet	Alternative C: 130,000 acre-feet
Assist CVP agricultural service contractors to obtain CVP water for the production of agricultural crops or livestock because of water supply shortages when full contract deliveries cannot otherwise be made.	No – Contractors would have to obtain temporary supplies from other sources or idle land. Crop idling that occurs under the No Action Alternative, in either noncritical or critical years, would be temporary. Land farmed in the study areas varies between years because of crop rotations and other factors.	Yes – Some of the districts' water deficits could be met.	Yes – Some of the districts' water deficits could be met.	Yes – Some of the districts' water deficits could be met.
Provide SCVWD with short-term water supplies to support agriculture and/or M&I uses in Santa Clara County when full contract deliveries cannot otherwise be made.	No – SCVWD would not obtain any water from the Exchange Contractors.	Yes – Needs could be met, up to 31,100 acre-feet for agriculture and 29,850 acre-feet for M&I.	Yes – Needs could be met, up to 31,100 acre-feet for agriculture and 29,850 acre-feet for M&I.	Yes – Needs could be met, up to 31,100 acre-feet for agriculture and 29,850 acre-feet for M&I.
Annual transfer and/or exchange of CVP water from the Exchange Contractors to EWA to the extent that this would benefit CVP operations by improving water supply reliability for CVP water users south of the Delta.	No	Yes – Results are similar to those of water transferred or exchanged for agricultural or M&I uses.	Yes – Results are similar to those of water transferred or exchanged for agricultural or M&I uses.	Yes – Results are similar to those of water transferred or exchanged for agricultural or M&I uses.

Table 2-5
Comparison of Potential Net Impacts to Selected Resources by Action Alternative

Resource	Year Type	Alternative A	Alternative B	Alternative C
SURFACE WATER SUPPLY				
Flows at Vernalis (cubic feet per second)				
All Water to Refuges	noncritical	-54	-23	-64
	critical	200	200	200
All Water to Agriculture	noncritical	-46	-16	-55
	critical	-21	-21	-21
All Water Transferred Out of Basin[a]	noncritical	-57	-24	-74
	critical	-21	-21	-21
Water Quality at Vernalis (micromhos)				
All Water to Refuges	noncritical	19	17	16
	critical	3	3	3
All Water to Agriculture	noncritical	-11	-8	-18
	critical	-2	-2	-2
All Water Transferred Out of Basin[a]	noncritical	-14	-8	-18
	critical	-2	-2	-2
New Melones Reservoir Operation (acre-feet per year)				
All Water to Refuges	noncritical	-3,000	-3,200	-2,500
	critical	-5,700	-5,700	-5,700
All Water to Agriculture	noncritical	3,800	-400	4,700
	critical	1,300	1,300	1,300
All Water Transferred Out of Basin[a]	noncritical	-2,700	-1,000	-3,300
	critical	1,200	1,200	1,200
Delta Supply (acre-feet per year)				
All Water to Refuges	noncritical	-10,400	2,200	-10,500
	critical	10,700	10,700	10,700
All Water to Agriculture	noncritical	-12,700	-2,500	-12,900
	critical	-350	-350	-350
All Water Transferred Out of Basin[a]	noncritical	-17,500	-5,200	-20,700
	critical	-4,600	-4,600	-4,600
GROUNDWATER SUPPLY (acre-feet per year)				
All Water to Refuges	noncritical	-10,365	2,500	-7,865
	critical	2,500	2,500	2,500
All Water to Agriculture	noncritical	-24,000	-10,000	-24,000
	critical	-10,000	-10,000	-10,000
All Water Transferred Out of Basin[a]	noncritical	-24,000	-10,000	-24,000
	critical	-10,000	-10,000	-10,000

Table 2-5 (concluded)

Resource	Year Type	Alternative A	Alternative B	Alternative C
BIOLOGICAL RESOURCES				
Wetland Habitat (change in acre-feet per year)				
All Water to Refuges	All	Increase slightly	Maintain	Increase
All Water to Agriculture	All	Maintain	Decrease slightly	Maintain
All Water Transferred Out of Basin[a]	All	Maintain	Decrease slightly	Maintain
Special-Status Species and Aquatic Resources (change in flows to Mud and Salt Sloughs in acre-feet per year)				
All Water to Refuges	noncritical	-15,466	Decrease slightly	-30,930
	critical	0		Decrease slightly
All Water to Agriculture	noncritical	-15,466	Decrease slightly	-30,930
	critical	0		Decrease slightly
All Water Transferred Out of Basin[a]	noncritical	-15,466	Decrease slightly	-30,930
	critical	0		Decrease slightly
SOCIOECONOMICS				
Output ($ Millions), Total All Areas				
All Water to Refuges	noncritical	15.9	-30.9	4.0
	critical	-25.8	-25.8	-25.8
All Water to Agriculture	noncritical	48.2	-12.0	36.3
	critical	-3.7	-3.7	-7.7
All Water Transferred Out of Basin[a]	noncritical	27.7	-27.9	7.7
	critical	-22.0	-24.7	-26.2
Income ($ Millions), Total All Areas				
All Water to Refuges	noncritical	4.5	-7.7	0.9
	critical	-6.4	-6.4	-6.4
All Water to Agriculture	noncritical	11.8	-3.7	8.1
	critical	-1.7	-1.7	-2.6
All Water Transferred Out of Basin[a]	noncritical	7.1	-7.2	1.4
	critical	-5.7	-6.4	-6.8
Employment (Jobs), Total All Areas				
All Water to Refuges	noncritical	161	-403	-124
	critical	-362	-362	-362
All Water to Agriculture	noncritical	386	-285	102
	critical	-218	-218	-250
All Water Transferred Out of Basin[a]	noncritical	207	-428	-143
	critical	-374	-396	-398

[a] Conserved water for Alternatives A and C, up to 80,000 acre-feet, is subject to the limitations set forth in Section 2.3.2.

Surface Water

Water quality improvement in the San Joaquin River is greatest with delivery of water to agriculture with hydraulic connectivity to the San Joaquin River and to those not hydraulically connected. The greatest benefits are associated with Alternative C, followed by Alternative A.

Because flows and water quality at Vernalis are regulated by New Melones Reservoir operations, the primary effect of the action alternatives is on storage in New Melones with its implications for water allocations. Positive values indicate an increase in storage (and decrease in flow to the lower Stanislaus River). The greatest potential negative effects to New Melones occur when all of the available water is transferred to refuges in the San Joaquin River Basin. Alternative B has the greatest impact (-3,200 acre-feet per year), and Alternative C has the smallest impact (-2,500 acre-feet per year).

The greatest potential negative effects to the CVP/SWP's Delta water supply occur when all of the available water is transferred to entities without hydraulic connectivity to the San Joaquin River. Alternative B has the smallest impact (-5,200 acre-feet), and Alternative C has the greatest impact.

Groundwater

The loss of groundwater due to pumping is offset by recharge when the water is transferred to the refuges. Alternative B's loss of 10,000 acre-feet of recharge from fallowed lands is offset by up to 12,500 acre-feet of recharge from the wetlands.

Biological Resources

Alternative C has the greatest potential for beneficial improvements in wetland habitat quality and the creation of new habitat in the existing wildlife refuges, if water is transferred to the refuges. Alternative B has the smallest effect on Mud and Salt sloughs, where the giant garter snake is known to occur.

Socioeconomics

The physical change of temporary crop idling/land fallowing is evaluated for its effects on regional economic output, income, and employment. All scenarios for Alternative A and one scenario for Alternative C in a noncritical year would result in uniformly positive aggregate output, income, and employment impacts across all affected regions. The largest negative impacts in noncritical years are for scenarios that involve temporary land fallowing as the exclusive source of transferred water (Alternative B). The largest negative impacts during critical years would occur with Alternative C, especially for the out-of-basin scenario.

This section provides an introduction to Sections 4 through 11, which discuss the affected environment and environmental consequences for specific resources and other environmental concerns. This section also identifies the resources not evaluated and explains why they are not evaluated. For each section in which resources are evaluated, a regulatory setting is summarized for key requirements that affect the determination of environmental effect/impact. Additional regulatory information pertinent to the proposed water transfer program is included in Section 14, Compliance Requirements.

3.1 RESOURCES TO BE EVALUATED

Sections 4 through 11 present analyses of the resources or environmental concerns that could be affected by the No Action/No Project Alternative and the transfer program's three action alternatives: annual transfer of up to 80,000 acre-feet, 50,000 acre-feet, and 130,000 acre-feet per year of water over a 10-year period. The resources listed below were determined to require analysis based on public scoping comments and the judgment of the Exchange Contractors and Reclamation's NEPA/CEQA practitioners. Their location in the EIS/EIR is as follows:

- Surface Water Resources Section 4
- Groundwater Resources Section 5
- Biological Resources Section 6
- Land Use and Recreation Section 7
- Socioeconomics Section 8
- Environmental Justice Section 9
- Indian Trust Assets Section 10
- Air Quality Section 11

3.2 RESOURCES NOT EVALUATED

The following resources were determined to be unlikely to be affected by the Exchange Contractors' proposed 10-Year Water Transfer Program and are not evaluated in detail in this EIS/EIR.

3.2.1 Cultural Resources

The proposed water transfer program would not result in any construction or land-altering/ground-disturbing activities beyond normal agricultural and refuge management practices or in any significant changes in reservoir operations that would expose buried resources, if present. Changes in water levels due to water quality releases from New Melones Reservoir (to mitigate for potential effects on water quality at Vernalis) would be within the range of drawdowns experienced in recent years.

3.2.2 Energy

The proposed water development and conveyance activities would not result in substantial use of energy resources. Groundwater development and surface water distribution rely on existing electric pumps. The greatest net change in tailwater recovery under any action alternative is 15,465 acre-feet per year, while the net change in groundwater pumping is 10,365 acre-feet per year. Temporary crop idling (approximately 20,000 acres in any year) would require soil management practices (such as disking) with similar farm equipment used for crop planting and harvesting.

3.2.3 Geology and Soils

Implementation of the temporary water transfer program would not involve construction or operation of new facilities that could be located on unstable soils or subject to geologic or seismic hazards. The development and conveyance of water in existing facilities would not increase the exposure of people or structures to geologic or seismic hazards. For the Exchange Contractors' water development component of crop idling on approximately 20,000 acres of land, substantial soil erosion would be avoided with disking and/or planting of a cover crop. However, cover crops would not be irrigated during the year of the transfer. Idled lands would be rotated and brought back into production.

3.2.4 Hazardous Materials

The water transfer program would not increase the use of hazardous materials or create a significant hazard to the public or the environment. Existing agricultural operations may involve the use of pesticides regulated by the California Department of Pesticide Regulation. No new lands would be brought into production, and the use of pesticides would occur commensurate with existing levels of agricultural production in the source and receiving areas for the transfer water. Reductions in agricultural production could result in reductions in pesticide applications.

3.2.5 Noise

Noise impacts are assessed when a proposed action has the potential to generate new or exacerbate existing sources of noise as measured at sensitive receptors (such as residential areas, hospitals, and schools) in the project vicinity. None of the water development measures or water applications by potential users would introduce new or worsen existing noise-generating activities beyond existing refuge and farming operations. No new lands would be brought into agricultural production. Pumps associated with the tailwater recovery, groundwater, and water conveyance facilities are existing facilities and are located primarily in agricultural areas or along existing road right-of-ways.

3.2.6 Mineral Resources

The development of the transfer water and its use in the refuges or by agriculture would not result in the loss of availability of a known mineral resource. Agricultural lands would remain in agricultural use, even lands with crop idling. Agricultural lands in the Exchange Contractors service area would not be converted to other land uses.

3.2.7 Utilities and Public Services

The management of refuge and irrigation water occurs separately from M&I water supply, wastewater, solid waste, and other public services and utilities. A maximum of 29,850 acre-feet annually could be transferred and used for M&I purposes in SCVWD. Consequently, the action alternatives do not have the potential to place additional demand on existing infrastructure other than CVP and SWP facilities and district conveyance systems. It is the potential water user's responsibility to arrange for use of existing water conveyance and storage facilities from the Exchange Contractors to the point of delivery. Development, conveyance, and use of the water to be transferred does not introduce sufficient new jobs as to attract permanent residents to an area and indirectly affect other public services or the need for services in local communities.

3.2.8 Traffic and Transportation

Transportation/circulation system effects are related primarily to construction of facilities rather than to the ongoing operation of those facilities. No new construction of facilities would occur for the water transfer. No long-term potential exists for significant changes in traffic within the source area due to tailwater recovery or any other component of water development, as none of the operations are sufficiently labor intensive as to affect local or county roads and highways.

3.3 EFFECT AND IMPACT SIGNIFICANCE DETERMINATIONS

For the environmental consequences evaluations, **criteria for determining the significance of the effects** are presented. Significance determinations are made for comparisons of the action alternatives to existing conditions as required for an EIR prepared under CEQA. Comparisons to No Action/No Project explain the impact without making a significance determination, consistent with Reclamation's implementation of NEPA. For most of the affected resources, the No Action/No Project baseline is equivalent to existing conditions.

Each environmental consequences section begins with an **analysis of the No Action and No Project Alternatives**, which are essentially the same and are referred to as No Action/No Project. The No Action/No Project analysis compares this alternative against the existing condition for that resource or concern. Existing condition is defined in the affected environment/environmental setting section for each resource and may represent the state of the environment over more than one year, including conditions prior to October 2003, in order to reflect best available information. In most cases, No Action/No Project reflects the existing condition; however, small differences are explained.

The analysis of the **three action alternatives** includes analyses of **three major use or disposition scenarios** to ensure that a "worst case" or consideration of a full range of effects is presented: all water to the refuges (refuge focus), all water to agriculture (agriculture focus, limited to agriculture in the San Joaquin River Basin), and all water to non-San Joaquin River Basin users (hydrologic out-of-basin focus). The analysis also identifies the effects of **three methods of water development** by the Exchange Contractors: conservation/tailwater recovery, groundwater pumping, and temporary land fallowing (e.g., crop idling). For surface water resources, the effects of water development by the Exchange Contractors are identified separately, followed by the combined effects of water development and water use.

Each section concludes with a **summary of environmental effects and impacts**. The summary contains both abbreviated findings (or statements of the effect) and summary tables. Language used in the table (and in the text) for CEQA determinations of impact (including beneficial impacts) is:

- Significant adverse impact
- Significant unavoidable adverse impact
- Potentially significant adverse impact
- Potentially significant unavoidable adverse impact
- Less-than-significant adverse impact
- No adverse impact
- Beneficial impact (either significant or less than significant)

Corresponding language used for NEPA determinations of effect is:

- Negative effect, either mitigatable or unavoidable
- Minimal effect
- Neutral effect
- Positive effect

Significance thresholds for CEQA are more restrictive than for NEPA and are controlling for this document. With regard to environmental consequences, CEQA requires that impacts that are regarded as "significant" be identified as such. In this EIS/EIR, for CEQA purposes, "CEQA significance criteria" are set forth by resource area. For all impacts that are identified as significant, appropriate mitigation measures are identified to reduce the impacts to a less-than-significant level. NEPA significance criteria (as listed in 40 Code of Federal Regulations [CFR] 1508.27) are broader and generally less stringent than CEQA significance criteria. For these reasons, identification of impacts as potentially significant under CEQA will identify all potentially significant/negative effects under NEPA, and the mitigation measures set forth to address potentially significant impacts for CEQA will also mitigate potentially significant/negative effects for NEPA.

Where potentially significant impacts may occur (to surface water resources), mitigation measures that could reduce the impacts to either no impact or a less-than-significant impact are identified. A thorough discussion of these measures is provided in Section 13.

This section identifies the surface water resources that could be affected by the 10-Year Water Transfer Program. The impact analysis focuses on water supplies and relevant water operations. Much of the information is highly technical. Consequently, key findings are summarized at the end of the section (Section 4.2.4, Impact and Mitigation Summary).

4.1 AFFECTED ENVIRONMENT/ENVIRONMENTAL SETTING

This section describes the project area hydrology, the Exchange Contractors service area, and the regulatory setting regarding surface water resources and water quality.

4.1.1 Resources

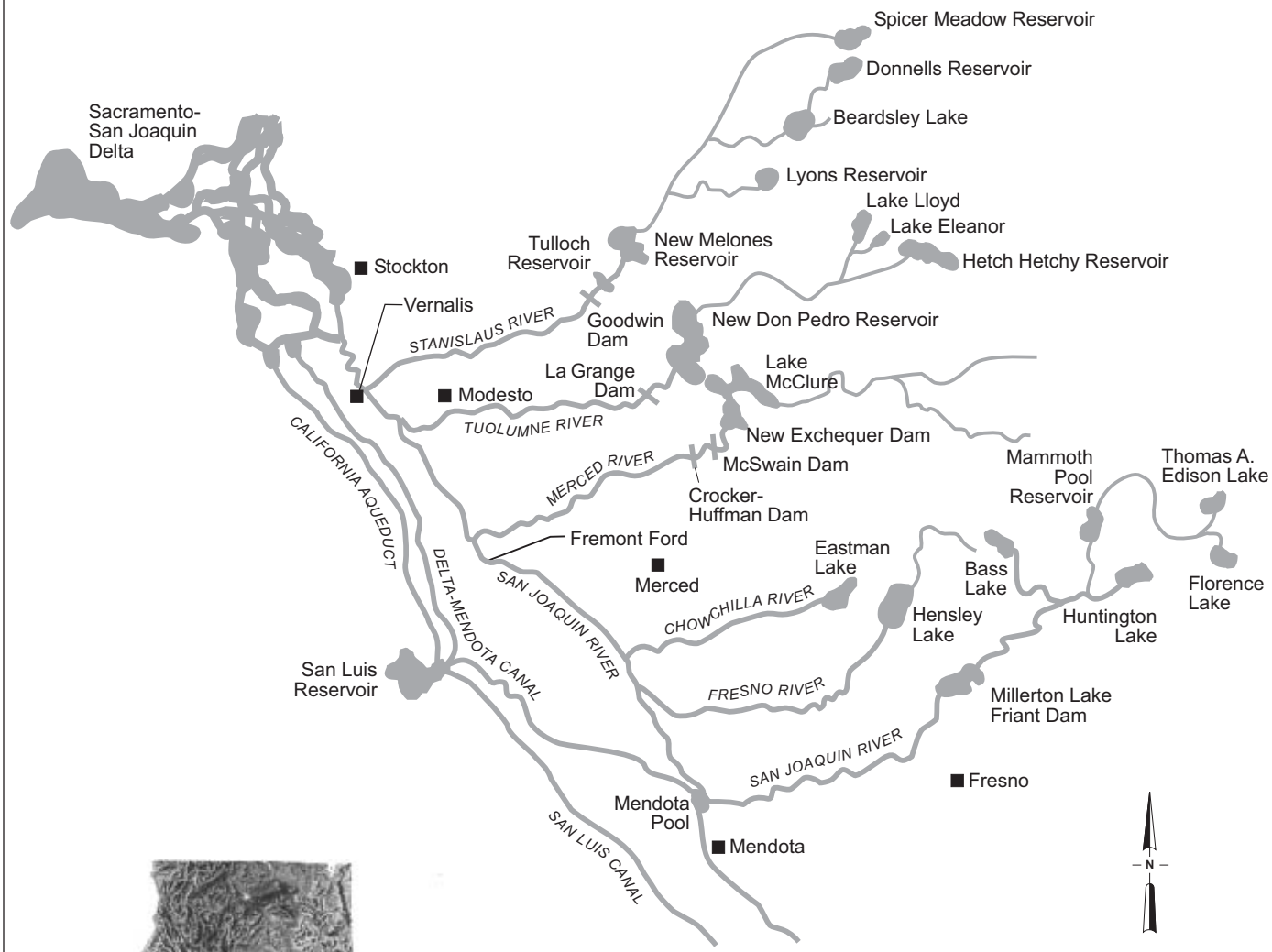
4.1.1.1 Overview of Project Area Hydrology

Figure 4-1 (and previously Figure 2-1) shows the San Joaquin River drainage and vicinity. Excluding the Delta, the area shown on the map comprises the San Joaquin River Basin Hydrologic Unit. The San Joaquin River is the primary drainage for the San Joaquin Valley, dividing it into eastern and western subregions. Primary eastside tributaries to the San Joaquin River are the Mokelumne, Stanislaus, Tuolumne, and Merced rivers. The major streams located on the west side of the San Joaquin River Basin are Orestimba, Los Banos, and Garzas creeks and Salt and Mud sloughs. San Joaquin River flows are regulated by Friant Dam and the diversion of water to the Madera and Friant-Kern canals. Releases from Friant Dam to the San Joaquin River are generally limited to those necessary to satisfy instream flow and diversion requirements between Friant Dam and Gravelly Ford. Stretches of the San Joaquin River between Mendota Pool and Fremont Ford periodically run dry.

The Exchange Contractors hold historic water rights to water in the San Joaquin River. Their service area is located on the west side of the San Joaquin Valley (see Figure 2-2). In exchange for the regulation and diversion of the San Joaquin River at Millerton Lake (Friant Division), Reclamation agreed to supply water to the Exchange Contractors from the CVP's Delta supply.

Reclamation's CVP is a multipurpose water supply, flood control, and power generation project. The CVP has a total storage capacity of about 11 million acre-feet. The CVP's major water supply reservoir is Shasta Lake in Northern California, with a storage volume of over 4 million acre-feet. CVP's main storage facilities south of the Delta include New Melones Reservoir on the Stanislaus River with a storage volume of 2.4 million acre-feet, Millerton Lake on the San Joaquin River with a storage volume of 520,000 acre-feet, and San Luis Reservoir. San Luis Reservoir, on the western side of the San Joaquin Valley with a storage capacity of 2 million acre-feet, is shared with the SWP. The CVP's portion of the storage capacity is about 966,000 acre-feet.

A number of conveyance and pumping facilities are used to distribute water to and within the project area. Tracy Pumping Plant, located in the southern portion of the Delta near Tracy, is operated by Reclamation as part of the CVP system and discharges to the Delta-Mendota Canal. Banks Pumping Plant, also located in the southern Delta, at Clifton Court Forebay, is operated by the SWP and discharges to the California Aqueduct. Both canals are linked to the San Luis Unit. The Delta-Mendota Canal continues on to the Mendota Pool. Water exported from the Delta at



Source: DWR 1987

URS	Project No. 26814274 Exchange Contractors Water Transfer EIS/EIR	MAP OF SAN JOAQUIN VALLEY PROJECT AREA AND VICINITY	Figure 4-1

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the Tracy Pumping Plant into the Delta-Mendota Canal is either delivered directly to water users or stored in San Luis Reservoir for release at a later date.

The Delta-Mendota Canal service area includes the Exchange Contractors, CVP agricultural and municipal service contractors, and wildlife habitat areas. Deliveries to these contractors vary depending on hydrologic conditions and other factors that can affect pumping from the Delta. Many CVP contractors also pump groundwater to supplement their surface water supplies.

The quality of water in the lower San Joaquin River system is of concern, with the principal problems being periodic low dissolved oxygen near Stockton and high salinity levels in the mainstem of the river. In the lower San Joaquin River, low dissolved oxygen levels occur mainly in the late summer and coincide with low river flows and high water temperatures. In the fall, these conditions, together with disruption of natural flow patterns by export pumping, have created environmental conditions that are less than desirable for the migration of anadromous fish (salmon) from the Delta to spawning areas in the San Joaquin Valley. Salinity problems are associated with high concentrations of salts carried by the San Joaquin River into the eastern Delta during the summer and early spring, and more often during years of below normal runoff. Mud and Salt sloughs primarily convey agricultural and wildlife area drainage to the San Joaquin River. Generally, on a year-round basis, agricultural flows and other discharges from the wildlife areas degrade water quality conditions (salt) in the San Joaquin River.

4.1.1.2 Overview of Exchange Contractors Service Area

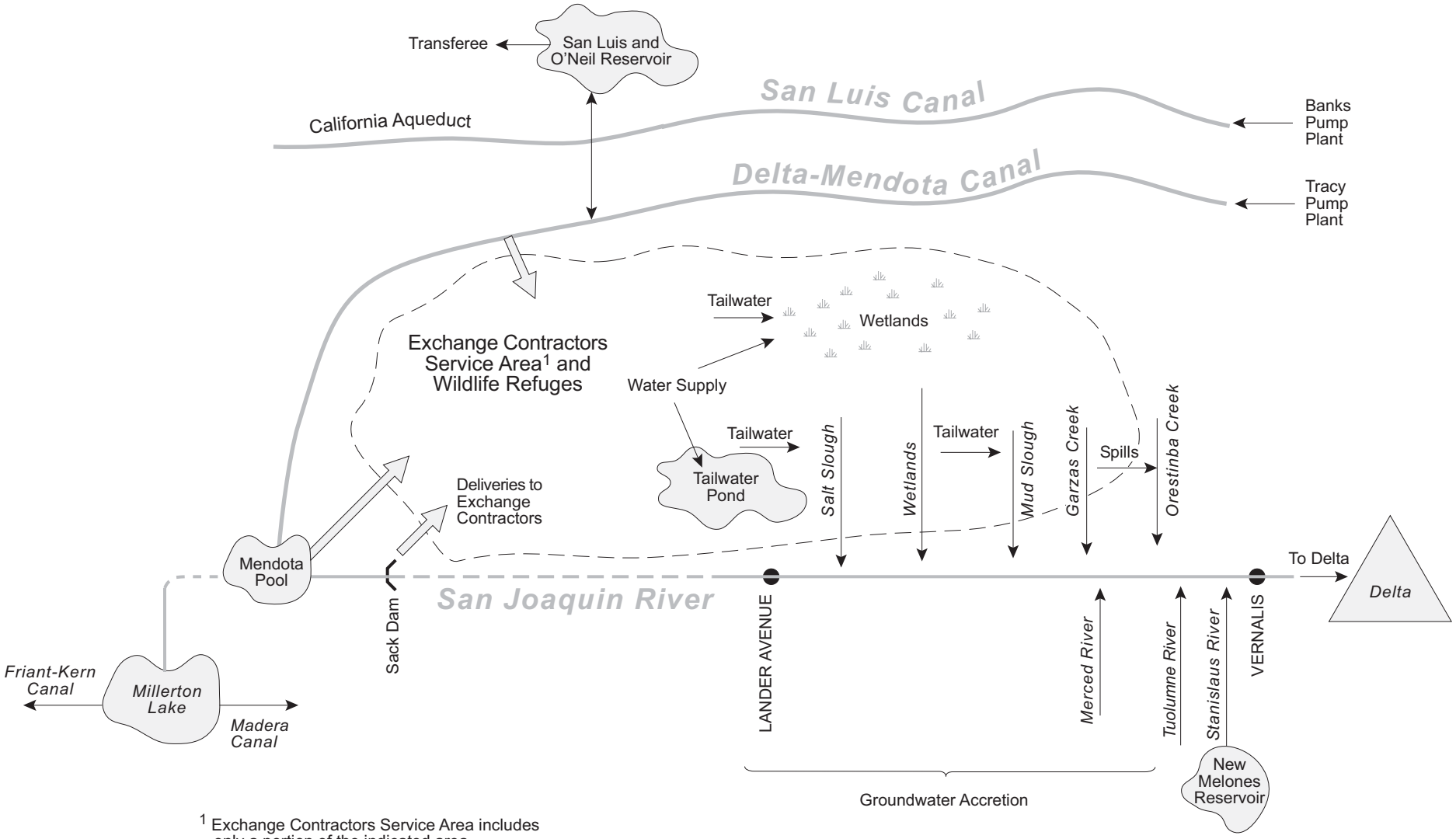
This discussion of the Exchange Contractors existing operations is summarized from Appendix B, Hydrologic Effects of Water Transfers.

The Exchange Contractors provide water deliveries to over 240,000 acres of irrigable land on the west side of the San Joaquin Valley, spanning a distance roughly from the town of Mendota in the south to the town of Crows Landing in the north. The four entities of the Exchange Contractors each have separate conveyance and delivery systems operated independently although integrated within a single operation for performance under the exchange contract. These conveyance and delivery systems generally divert water from CVP's Delta-Mendota Canal and Mendota Pool, convey water to customer delivery turnouts, and at times discharge to tributaries of the San Joaquin River. Deliveries include the conveyance of water to wildlife areas.

In certain circumstances, groundwater is used to supplement the Exchange Contractors' CVP substitute water supply and to provide delivery capacity. Groundwater is also being used to improve the operational control of the distribution systems. Currently, the Exchange Contractors have an active program to capture tailwater and redirect it to distribution canals.

Figure 4-2 shows a schematic of the water movement in the project area. Flows shown on the figure consist of CVP deliveries to the Exchange Contractors, tailwater releases to westside San Joaquin River tributaries, wildlife area releases, and flows from eastside tributaries to the San Joaquin River. The flow at Vernalis is affected by the flows shown on Figure 4-2.

Deliveries are made to the Exchange Contractors from the Delta-Mendota Canal, Mendota Pool, or from releases from Mendota Pool into the San Joaquin River and diverted into the Exchange Contractors delivery system at Sack Dam. Depending on the Exchange Contractor entity, water is either directly delivered to community ditch systems of the customers from the main canal



[1] Exchange Contractors Service Area includes only a portion of the indicated area.

URS	Project No. 26814274 Exchange Contractors Water Transfer EIS/EIR	SCHEMATIC OF WATER DISTRIBUTION AND FLOW IN PROJECT AREA	Figure 4-2

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systems or water is further conveyed through entity-owned (e.g., Firebaugh ID, CCID, etc.) and maintained community ditch systems to ultimate points of delivery. Once delivered, the entities lose control of the water until the farmers' drainage, if any, is intercepted by district facilities.

Individual farmers may operate tailwater recovery systems and recycle the water on their farms. The water that ultimately escapes the customers' on-farm systems is intercepted and reused by the Exchange Contractors tailwater recovery program. The water that exits from community ditches and drainage systems, whether intercepted by the Exchange Contractors facilities or not, is a function of on-farm and community system water use practices.

Some drainage exits the Exchange Contractors service area to Salt and Mud sloughs. Prior to reaching the San Joaquin River, flows can be diverted by wildlife area water users with appropriative rights, who also at times discharge to Mud and Salt sloughs. The flows contribute to the measured flows at Vernalis. If they were reduced due to a tailwater recovery program or are affected by other elements utilized by the Exchange Contractors to develop transfer water, a corresponding change in flow would occur at Vernalis.

4.1.2 Regulatory Setting

Vernalis on the San Joaquin River is the primary regulatory compliance point for the San Joaquin River and represents the location where the San Joaquin River enters the Delta. Flows at Vernalis are periodically controlled according to State Water Resources Control Board (State Board) Decision 1641, inclusive of the Vernalis Adaptive Management Plan (VAMP). During the VAMP period, the flows on the San Joaquin River at Vernalis are maintained at levels up to 7,000 cubic feet per second (cfs) depending on several hydrologic circumstances. During other periods during February through June, other flow requirements apply.

Table 4-1 shows the statistics for daily average flows, by month, measured in the San Joaquin River at Vernalis for the period January 1970 to September 2002. The average flow at Vernalis is about 4,600 cfs. The smallest flows occur during late summer and average about 2,000 cfs (see August and September in Table 4-1). The largest flows occur during late winter and spring and average about 8,000 cfs (see February and March in Table 4-1).

Table 4-1
Statistics for Monthly Flows in the San Joaquin River at Vernalis (cfs)

Month	Average	Standard Deviation	Minimum	Maximum
January	5,678	6,913	816	30,380
February	7,731	8,686	758	35,060
March	8,218	8,764	524	40,030
April	6,955	8,562	212	36,450
May	6,063	7,450	400	31,770
June	4,138	5,434	118	26,079
July	2,768	3,971	93	19,230
August	1,948	1,684	124	9,035
September	2,424	2,134	179	11,310
October	3,002	2,541	246	13,320
November	2,520	1,923	430	10,670
December	3,623	4,287	506	19,130

Source: U.S. Geological Survey Stream Gage No. 11303500, San Joaquin River northeast of Vernalis obtained from http://NWIS.watercharts.USGS.gov/USA/NWIS.

Development and operations within the San Joaquin River basin have changed throughout history, particularly in recent years. Therefore, the long-term record of San Joaquin River flow as shown in Table 4-1 does not provide a consistent hydrologic basis to directly develop hydrologic conditions to use in the alternatives analysis. A depiction of flow and quality conditions for the San Joaquin River at Vernalis, by year type, was synthesized by review of historical records and several computer-generated simulations of San Joaquin River operations. The synthesized data were used to represent hydrologic conditions for the analysis of alternatives.

Table 4-2 depicts the synthesized flow conditions for the San Joaquin River at Vernalis for each year-type used in the analysis: wet, above normal, below normal, dry, and critical.

Table 4-2
Assumed Existing Flow Conditions at Vernalis

	Average Monthly Flow (cfs)											
Year Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500

Source: Appendix B.

Water quality objectives on the San Joaquin River at Vernalis are 700 microSiemens per centimeter (µS/cm) electrical conductivity (EC) during April through August and 1,000 µS/cm EC in other months. If problematic, the water quality and flow requirements at Vernalis are maintained primarily by releasing additional water from New Melones Reservoir. However, salinity objectives might be violated during some years due to water supply shortage at New Melones Reservoir.

A long-term record of water quality conditions at Vernalis reflecting current San Joaquin River operation also does not exist. To develop data to use in the analysis presented in Appendix B, recent historical records were reviewed and analyzed to develop a regression between monthly flow and quality at Vernalis. Table 4-3 shows the results of that analysis and includes the use of the water quality objective at Vernalis during times when the regression indicated a quality that

Table 4-3
Assumed Existing Water Quality Conditions at Vernalis

	Average Monthly Quality (µS/cm)											
Year Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	352	286	310	269	212	310	341	460	442	359	497	432
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657
Dry	880	736	1000	700	700	700	700	700	772	547	708	678
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859

Note: 700 µS/cm during April and May is representative of the assumed water quality during the nonpulse flow period.
Source: Appendix B.

was in excess of the objective, or when it is assumed that water quality objectives at Vernalis were being met with specific releases from New Melones Reservoir (further discussed in Appendix B).

The quality of agricultural tailwater (from the Exchange Contractors) and wildlife area releases (shown in Tables 4-4 and 4-5) affected by the proposed transfer program and assumed in the analysis generally exceeds the water quality standards at Vernalis. Therefore, the more tailwater and wildlife area water discharged to the San Joaquin River, the lower the water quality will be in the San Joaquin River. This situation could have an effect on releases from the New Melones Reservoir if the tailwater and wildlife area releases would cause the quality at Vernalis to exceed the standards at Vernalis. On the other hand, if the volume of tailwater and wildlife area releases decreases, the water quality in the San Joaquin River could improve, which could result in decreased dilution releases from New Melones Reservoir. The change in dilution releases from New Melones Reservoir may be limited by the need to maintain releases for other purposes.

Table 4-4
Assumed Water Quality Associated with Wildlife Area Runoff

	Average Monthly Quality (µS/cm)											
Year Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All	1163	1448	2713	3018	0	0	0	1315	1065	1029	1118	1118

Note: Assumes no discharge during May through July.
Source: Appendix B.

Table 4-5
Assumed Water Quality Associated with Tailwater Recovery

	Average Monthly Quality (µS/cm)											
Year Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All	1748	1470	1121	1231	1197	931	928	885	1048	893	899	1195

Source: Appendix B.

Reclamation operates New Melones Reservoir generally in accordance with the Interim Plan of Operations. Based on a forecast of annual water supply Reclamation allocates deliveries to water rights settlement holders, and upon a forecast using storage and anticipated runoff, water to CVP contractors and fish and water quality objectives. Included in the procedure are releases for water quality and flow objectives at Vernalis. The allocation of annual water supplies to fishery uses (assumes this plan represents CVPIA b(2) priorities), Vernalis water quality, Bay-Delta, and CVP contractors was assumed as follows (Table 4-6), dependent on the water supply of New Melones.

Table 4-6
New Melones Allocation of Supplies (1,000 acre-feet)

New Melones Storage Plus Inflow		Fishery		Vernalis Water Quality		Bay-Delta		CVP Contractors	
From	To	From	To	From	To	From	To	From	To
0	1,400	0	98	0	70	0	0	0	0
1,400	2,000	98	125	70	80	0	0	0	0
2,000	2,500	125	345	80	175	0	0	0	59
2,500	3,000	345	467	175	250	75	75	90	90
3,000	6,000	467	467	250	250	75	75	90	90

Source: *New Melones Interim Plan of Operation* (Reclamation 1997b).

Long-term simulation studies (prepared for *Meeting Flow Objectives for the San Joaquin River Agreement EIS/EIR* [Reclamation and San Joaquin River Group Authority 1999]) that evaluate the current operation of New Melones Reservoir estimate that water allocations under the Interim Plan of Operations will generally have a New Melones year-type distribution as shown in Table 4-7.

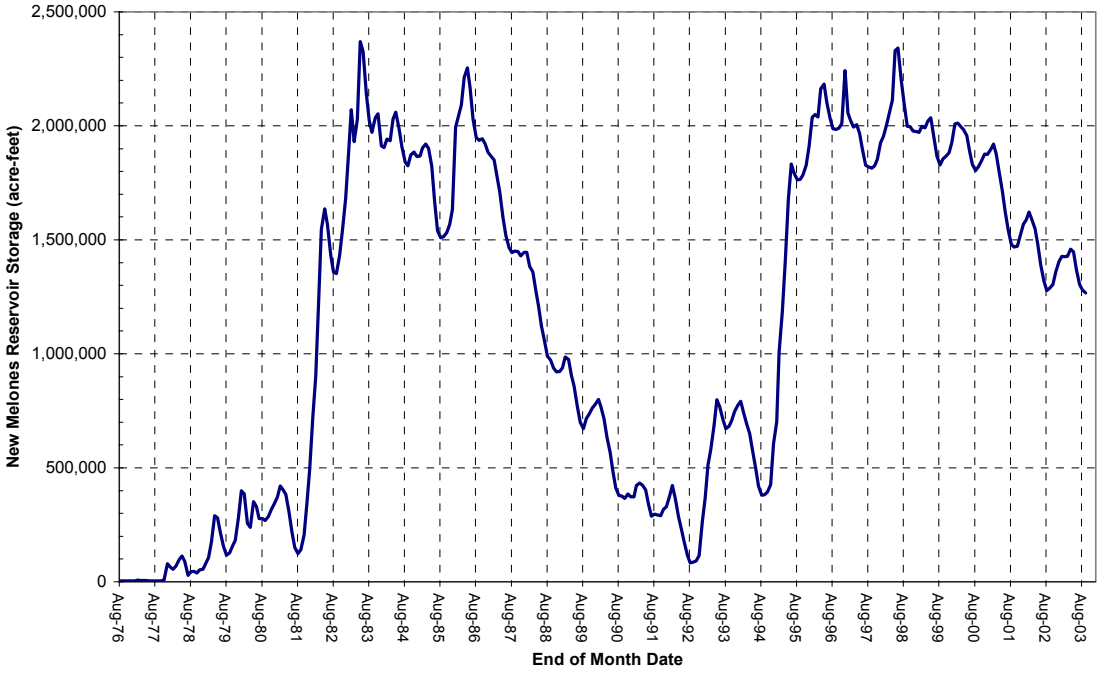
Table 4-7
New Melones Interim Plan of Operations Water Supply Allocations
Estimated Year-Type Distribution

New Melones Storage Plus Inflow		Category	Occurrence Count (Number of years within study)	Percentage Occurrence
From	To			
0	1,400	Low	5	7
1,400	2,000	Medium-Low	19	27
2,000	2,500	Medium	22	31
2,500	3,000	Medium-High	14	20
3,000	6,000	High	11	15
		Total	**71**	**100**

Source: Reclamation and San Joaquin River Group Authority 1999.

Figure 4-3 shows the historic storage in New Melones Reservoir from the mid-1970s when construction was complete through October 2003. The period of low reservoir levels in the late 1980s and early 1990s corresponds to a prolonged period of below-normal precipitation.

Figure 4-3 Historic Storage in New Melones Reservoir



In addition to SWRCB Decision 1641, the New Melones Interim Operation Plan, a portion of Level 4 wildlife area deliveries, and the San Joaquin River Agreement (inclusive of VAMP), several other projects and programs are currently affecting the environmental conditions in the San Joaquin River or will have an effect in the future. The Grassland Bypass Project is currently being implemented. The effects of these projects are incorporated into the existing water quality and flow conditions of the river. As described in Section 1.3, several other programs or actions are currently underway but have not been implemented or have not developed identifiable effects in the river environment. These programs or actions include the salt and boron TMDLs, the TMDL for dissolved oxygen in the Stockton Deep Water Ship Channel, the Regional Board irrigated lands conditional waiver, the Westside regional drainage plan, the San Luis Drainage Feature Re-evaluation, the San Joaquin River habitat restoration program, and the Upper San Joaquin River conceptual restoration plan.

4.2 ENVIRONMENTAL CONSEQUENCES

Two areas of potential effects on surface water resources are relevant to this EIS/EIR: effects resulting from how the transfer water is developed in the Exchange Contractors service area (source area) and effects resulting from the use of the water outside of the source area, by wildlife area, agriculture, and urban water users (transfer area). This section evaluates impacts to water supplies and relevant water operations in all of these areas. Key issues discussed below are impacts to San Joaquin River water quality and quantity of flow, including wildlife area and agricultural area runoff, tailwater recovery, and operation of New Melones Reservoir. Also, effects on surface drainage, changes to Delta water supply, and changes in consumptive use are identified.

The results presented in this section are based primarily on the analyses provided in Appendix B, Hydrologic Effects of Water Transfers. A summary of potential impacts and mitigation is provided at the end, with a more complete discussion of mitigation provided in Section 13.

Appendix B provides a detailed analysis of changes in the flow and quality in the San Joaquin River at Vernalis for 28 different scenarios. Seven of these scenarios identify the potential hydrologic differences in San Joaquin River hydrology caused by the direct actions of the Exchange Contractors in developing transfer water (direct effects). The other 21 scenarios identify the potential hydrologic differences due to the direct actions of the Exchange Contractors in combination with the hydrologic outcome associated with the delivery of transfer water (indirect effects). Various source and transferee combinations are analyzed. The analysis evaluates the scenarios with hydrology for 5 different water year types. The model results presented in Appendix B quantify the magnitude of the changes in flow and quality in the San Joaquin River as well as potential changes in the storage in New Melones Reservoir due to the different source and transferee options. Results are also developed to identify the potential changes in Delta supply to the CVP and SWP. This section of the report summarizes the analysis presented in Appendix B to meet NEPA and CEQA requirements. The reader is referred to Appendix B for additional details.

4.2.1 Key Impact and Evaluation Criteria

Criteria to determine the significance or severity of any impact to surface water that could occur due to any of the water transfer program action alternatives are a CEQA requirement. They are based on whether the transfers could affect the quantity and quality of water delivered to other water users that are not part of the transfer program. Consequently, the following criteria/issues were used to determine significance of an impact:

- Would the alternative alter the flow and quality in the San Joaquin River at Vernalis such that the Vernalis standard would not be met?
- Would the alternative result in a change in release from New Melones Reservoir and subsequently affect Stanislaus River water users?
- Would the alternative affect the CVP/SWP's Delta water supply?
- Would the alternative result in a net increase in consumptive use?

With the exception of the Vernalis standard, the other criteria are broadly stated and result in a conservative approach to the impact and effects determinations contained in this section. Section 4.2.2 presents the discussion of direct and indirect effects. The determinations of significance are provided in Section 4.2.4, Impact and Mitigation Summary. Only the first criterion is a standard for measurement. The other criteria are really issues, and there are no specific standards. Any change, even small or minor changes, can be interpreted as significant.

4.2.2 Environmental Impacts and Mitigation

The environmental consequences of the action alternatives plus the No Action Alternative are described below. Since three methods are proposed to develop water for transfer (e.g., conservation including tailwater recovery, groundwater substitution, and crop idling/temporary land fallowing) and many possible transferees (CVP agricultural, wildlife areas, EWA agencies,

Table 4-8 Summary of Water Development and Delivery Scenarios Analyzed for Hydrologic Impacts

				Developed Water									Water Deliveries										
						Exchange Contractors						Interior						Interior					
Scenario Description	Water Source	Year Type	Scenario Number[1]	Evap/Seeps	Spills	Discharge to Mud/Salt slough	Upstream of Sack Dam	Groundwater	Fallowing	Total	Total	Total Developed Water	SJR - Wildlife	Non-SJR Wildlife	SJR- Ag	non-SJR Entities	Total Deliveries	Total Deliveries to Wildlife	SJR - Wildlife	Non-SJR Wildlife	Total Deliveries to Wildlife	Total Deliveries to Wildlife	Total Deliveries to SJR Wildlife	Total Deliveries
Baseline		Noncritical	Baseline	15,000	14,000	28,535	6,100	6,000	-	69,635	17,713	87,348	62,250	0	0	7,385	69,635	62,250	1,115	12,329	13,444	75,694	63,365	83,079
Baseline		Critical	Baseline	15000	14000	28535	6100	0	0	63635	17713	81348	0	0	0	0	0	0	1115	12329	13444	13444	1115	13444
Future No Action		Noncritical	Future No Action	15000	14000	28535	6100	0	0	63635	90000	153635	0	0	0	0	0	0	63365	12329	75694	75694	63365	75694
Future No Action		Critical	Future No Action	15000	14000	28535	6100	0	0	63635	17713	81348	0	0	0	0	0	0	1115	12329	13444	13444	1115	13444
Alternative A 80,000 Acre-feet Delivery																								
Refuge Focus	tailwater	Noncritical	A-1-1-C	-	-	15,465	900	(6,000)	-	10,365	31,054	41,419	1,750	-	-	(7,385)	(5,635)	1,750	16,073	9,497	25,570	27,320	17,823	19,935
Refuge Focus	tailwater	Critical	A-1-0-S	-	-	-	-	-	50,000	50,000	-	50,000	40,000	-	-	-	40,000	40,000	-	-	-	40,000	40,000	40,000
Agriculture Focus	tailwater	Noncritical	A-1-2-C	-	-	15,465	900	(6,000)	-	10,365	72,287	82,652	(62,250)	-	80,000	(7,385)	10,365	(62,250)	62,250	-	62,250	-	-	72,615
Agriculture Focus	tailwater	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	50,000	-	50,000	-	-	-	-	-	-	50,000
Non-SJR Focus	tailwater	Noncritical	A-1-3-C	-	-	15,465	900	(6,000)	-	10,365	72,287	82,652	(62,250)	-	-	72,615	10,365	(62,250)	62,250	-	62,250	-	-	72,615
Non-SJR Focus	tailwater	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	-	50,000	50,000	-	-	-	-	-	-	50,000
Refuge Focus	groundwater	Noncritical	A-1-1-C	-	-	-	-	10,365	-	10,365	31,054	41,419	1,750	-	-	(7,385)	(5,635)	1,750	16,073	9,497	25,570	27,320	17,823	19,935
Refuge Focus	groundwater	Critical	A-1-0-S	-	-	-	-	-	50,000	50,000	-	50,000	40,000	-	-	-	40,000	40,000	-	-	-	40,000	40,000	40,000
Agriculture Focus	groundwater	Noncritical	A-2-2-C	-	-	-	-	10,365	-	10,365	72,287	82,652	(62,250)	-	80,000	(7,385)	10,365	(62,250)	62,250	-	62,250	-	-	72,615
Agriculture Focus	groundwater	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	50,000	-	50,000	-	-	-	-	-	-	50,000
Non-SJR Focus	groundwater	Noncritical	A-2-3-C	-	-	-	-	10,365	-	10,365	72,287	82,652	(62,250)	-	-	72,615	10,365	(62,250)	62,250	-	62,250	-	-	72,615
Non-SJR Focus	groundwater	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	-	50,000	50,000	-	-	-	-	-	-	50,000
Refuge Focus	fallowing	Noncritical	A-3-1-C	-	-	-	-	(6,000)	16,365	10,365	31,054	41,419	1,750	-	-	(7,385)	(5,635)	1,750	16,073	9,497	25,570	27,320	17,823	19,935
Refuge Focus	fallowing	Critical	A-3-0-S	-	-	-	-	-	50,000	50,000	-	50,000	40,000	-	-	-	40,000	40,000	-	-	-	40,000	40,000	40,000
Agriculture Focus	fallowing	Noncritical	A-3-2-C	-	-	-	-	(6,000)	16,365	10,365	72,287	82,652	(62,250)	-	80,000	(7,385)	10,365	(62,250)	62,250	-	62,250	-	-	72,615
Agriculture Focus	fallowing	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	50,000	-	50,000	-	-	-	-	-	-	50,000
Non-SJR Focus	fallowing	Noncritical	A-3-3-C	-	-	-	-	(6,000)	16,365	10,365	72,287	82,652	(62,250)	-	-	72,615	10,365	(62,250)	62,250	-	62,250	-	-	72,615
Non-SJR Focus	fallowing	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	-	50,000	50,000	-	-	-	-	-	-	50,000
Alternative B 50,000 Acre-feet Delivery																								
Refuge Focus	fallowing	Noncritical	B-3-1-C	-	-	-	-	(6,000)	50,000	44,000	61,055	105,055	(22,250)	-	-	(7,385)	(29,635)	(22,250)	40,073	9,497	49,570	27,320	17,823	19,935
Refuge Focus	fallowing	Critical	B-3-0-S	-	-	-	-	-	50,000	50,000	-	50,000	40,000	-	-	-	40,000	40,000	-	-	-	40,000	40,000	40,000
Agriculture Focus	fallowing	Noncritical	B-3-2-C	-	-	-	-	(6,000)	50,000	44,000	72,287	116,287	(62,250)	-	50,000	(7,385)	(19,635)	(62,250)	62,250	-	62,250	-	-	42,615
Agriculture Focus	fallowing	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	50,000	-	50,000	-	-	-	-	-	-	50,000
Non-SJR Focus	fallowing	Noncritical	B-3-3-C	-	-	-	-	(6,000)	50,000	44,000	72,287	116,287	(62,250)	-	-	42,615	(19,635)	(62,250)	62,250	-	62,250	-	-	42,615
Non-SJR Focus	fallowing	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	-	50,000	50,000	-	-	-	-	-	-	50,000
Alternative C 130,000 Acre-feet Delivery																								
Refuge Focus	tailwater	Noncritical	A-1-1-C	-	-	15,465	900	(6,000)	50,000	60,365	31,054	91,419	1,750	-	50,000	(7,385)	44,365	1,750	16,073	9,497	25,570	27,320	17,823	69,935
Refuge Focus	tailwater	Critical	A-1-0-S	-	-	-	-	-	50,000	50,000	-	50,000	40,000	-	-	-	40,000	40,000	-	-	-	40,000	40,000	40,000
Agriculture Focus	tailwater	Noncritical	A-1-2-C	-	-	15,465	900	(6,000)	50,000	60,365	72,287	132,652	(62,250)	-	130,000	(7,385)	60,365	(62,250)	62,250	-	62,250	-	-	122,615
Agriculture Focus	tailwater	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	50,000	-	50,000	-	-	-	-	-	-	50,000
Non-SJR Focus	tailwater	Noncritical	C-1-3-C	-	-	15,465	900	(6,000)	50,000	60,365	72,287	132,652	(62,250)	-	-	122,615	60,365	(62,250)	62,250	-	62,250	-	-	122,615
Non-SJR Focus	tailwater	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	-	50,000	50,000	-	-	-	-	-	-	50,000
Refuge Focus	groundwater	Noncritical	C-1-1-C	-	-	-	-	10,365	50,000	60,365	31,054	91,419	1,750	-	50,000	(7,385)	44,365	1,750	16,073	9,497	25,570	27,320	17,823	69,935
Refuge Focus	groundwater	Critical	C-1-0-S	-	-	-	-	-	50,000	50,000	-	50,000	40,000	-	-	-	40,000	40,000	-	-	-	40,000	40,000	40,000
Agriculture Focus	groundwater	Noncritical	C-2-2-C	-	-	-	-	10,365	50,000	60,365	72,287	132,652	(62,250)	-	130,000	(7,385)	60,365	(62,250)	62,250	-	62,250	-	-	122,615
Agriculture Focus	groundwater	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	50,000	-	50,000	-	-	-	-	-	-	50,000
Non-SJR Focus	groundwater	Noncritical	C-2-3-C	-	-	-	-	10,365	50,000	60,365	72,287	132,652	(62,250)	-	-	122,615	60,365	(62,250)	62,250	-	62,250	-	-	122,615
Non-SJR Focus	groundwater	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	-	50,000	50,000	-	-	-	-	-	-	50,000
Refuge Focus	fallowing	Noncritical	C-3-1-C	-	-	15,465	900	(6,000)	50,000	60,365	31,054	91,419	1,750	-	50,000	(7,385)	44,365	1,750	16,073	9,497	25,570	27,320	17,823	69,935
Refuge Focus	fallowing	Critical	C-3-0-S	-	-	-	-	-	50,000	50,000	-	50,000	40,000	-	-	-	40,000	40,000	-	-	-	40,000	40,000	40,000
Agriculture Focus	fallowing	Noncritical	C-3-2-C	-	-	15,465	900	(6,000)	50,000	60,365	72,287	132,652	(62,250)	-	130,000	(7,385)	60,365	(62,250)	62,250	-	62,250	-	-	122,615
Agriculture Focus	fallowing	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	50,000	-	50,000	-	-	-	-	-	-	50,000
Non-SJR Focus	fallowing	Noncritical	C-3-3-C	-	-	15,465	900	(6,000)	50,000	60,365	72,287	132,652	(62,250)	-	-	122,615	60,365	(62,250)	62,250	-	62,250	-	-	122,615
Non-SJR Focus	fallowing	Critical		-	-	-	-	-	50,000	50,000	-	50,000	-	-	-	50,000	50,000	-	-	-	-	-	-	50,000

[1] The letter S in scenario numbers indicates water development component only. C indicates combined development and transfer components.

and also a limited amount to M&I contractors), a multitude of combinations of supply and transferee scenarios are possible. Appendix B quantifies the effects of 28 scenarios of the three overall alternatives. A summary of the scenarios is shown in Table 4-8. This EIS/EIR presents the impacts associated with a range of options: all water to the wildlife areas, all water to other agricultural users, and all water to users outside of the San Joaquin River drainage basin. The preferred alternative would most likely be some combination of these. The water sources were focused on three emphases: tailwater recovery and other conservation, groundwater, and crop idling/temporary land fallowing. During critical years water would be developed exclusively through crop idling/temporary land fallowing.

Under the action alternatives, for each acre-foot of water recovered by the Exchange Contractors from tailwater recovery, conservation, crop idling/temporary land fallowing, or groundwater, an acre-foot of water would be considered acquired and available in the CVP for delivery to other users.

4.2.2.1 No Action/No Project Alternative

Because No Action and No Project are essentially the same, the analysis below uses the term "No Action" to refer to both.

In 2003, 60,000 acre-feet were transferred to the wildlife areas, and the remaining 11,637 acre-feet went to in- and out-of-basin water users (including 10,000 acre-feet to SCVWD).

Under the No Action Alternative no transfer or exchange of water would occur from the Exchange Contractors to either Interior or to any of the other potential CVP water users. This scenario differs from the recent past where the Exchange Contractors have been making water available for transfers intermittently since 1993. Table 4-9 illustrates the amount of water transfers that have occurred through previous Exchange Contractors transfer programs.

Table 4-9
Previous Exchange Contractor Annual Water Transfers

Calendar Year	Total (acre-feet)
1993	59,891
1995	27,596
1996	32,448
1997	52,160
1999	61,260
2000	65,860
2001	70,286
2002	72,048
2003	74,039

Source: Appendix B.

Note: Table 4-9 only represents Exchange Contractor transfer amounts associated with its recent recapture and conservation transfer program and transfers for the WAP. Table 4-9 (referencing Appendix B) represents total water transfer by the Exchange Contractors including district-to-district transfers on behalf of land owners who have lands in multiple districts. The values will be different from those in Table 1-1.

As described in Section 2.2, the Exchange Contractors have been the main suppliers of Level 4 water to the state and federal wildlife areas. Under the No Action Alternative this water would no longer be available and Interior would need to find other sources for supplemental supplies to the wildlife areas or not meet the desired Level 4 quantities. The same would be true for cases where the Exchange Contractors sold water to other agricultural water users. These users would need to find other sources or make changes in their farming practices (e.g., change crops, fallow fields). Key assumptions for the No Action Alternative are:

- Deliveries to the wildlife areas would continue at the recently achieved level, inclusive of Level 2, Replacement Water and some (75,694 acre-feet) Incremental Level 4 quantities. It is assumed that Reclamation can acquire water supplies for these deliveries from a combination of San Joaquin River drainage basin entities (other than the Exchange Contractors), entities south of the Delta but not draining to the San Joaquin River, and entities upstream of the Delta.
- The Exchange Contractors would recover and reuse for their own operations the same amount of tailwater flows that have recently been otherwise transferred. The reuse of this water by the Exchange Contractors would integrate into their water supply and likely reduce groundwater pumping that currently helps meet irrigation demands.
- Agricultural and M&I water users would get their CVP contractual supplies subject to the limitations in their contracts.

Wildlife area water acquisitions and deliveries for the last two years (2002 and 2003) serve as the assumption for the No Action Alternative Incremental Level 4 operation. Table 4-10 illustrates recent Incremental Level 4 acquisitions by Reclamation.

Table 4-10
Recent Incremental Level 4 Water Acquisitions and Sources

	2002	2003
San Joaquin River Exchange Contractors Water Authority	64,500	60,000
San Joaquin River Drainage Basin	12,825	0
Sacramento Valley	4,515	4,536
South of San Joaquin River Drainage Basin	3,550	10,000
Total	85,390	74,536

Source: D. Meier and G. Gregory, pers. comm., 2004.

Deliveries to the wildlife areas for 2002 and 2003, including Incremental Level 4 quantities, are shown in Table 2-1 (Section 2.2.1). Absent water available from the Exchange Contractors, Reclamation assumes it can acquire water from other willing sellers in sufficient quantity to maintain these deliveries.

During critical years, the Exchange Contractors will use the recovery and conservation programs primarily developed to establish the transfer program to offset reductions in their CVP substitute surface supply.

Without the proposed transfer program (the No Action Alternative), CVP contractors will continue to experience surface water supply shortages due to an uncertain CVP supply. Since 1999, the CVP agricultural allocation to south of Delta contractors has fluctuated between 49 and 75 percent of their contract amounts.

4.2.2.2 Alternative A: 80,000 Acre-Feet

Alternative A consists of transferring up to 80,000 acre-feet of water per year during noncritical years and up to 50,000 acre-feet during critical years. For this alternative the water would be developed through a combination of conservation (tailwater recovery and other conservation, up to 80,000 acre-feet), increased groundwater pumping (up to 20,000 acre-feet), and crop idling/temporary land fallowing (up to 50,000 acre-feet). The combination of conservation and groundwater will not exceed 80,000 acre-feet in a year. Water would be acquired from the Exchange Contractors, who would receive less substitution water from Reclamation.

Detailed results for this alternative are provided in Appendix B. Due to the numerous sources and transferees included in the proposed program, the analysis evaluated a range of potential combinations. Results are described as grouped below:

- All water to the wildlife areas within the San Joaquin River drainage basin (Refuge Focus)
- All water to agriculture within the San Joaquin River drainage basin (Agriculture Focus)
- All water to users (wildlife areas, agriculture, urban) outside of the San Joaquin River drainage basin (Non San Joaquin River or Out-of-Basin Focus)

Two separate hydrologic analyses are provided for each alternative. First reported are results of the analysis that identifies the potential hydrologic differences in San Joaquin River hydrology caused by the direct actions of the Exchange Contractors in developing transfer water, such as emphasizing conservation and tailwater recovery (Section 4.2.2.2.1). Secondly, results are reported concerning the potential hydrologic differences due to the direct actions of the Exchange Contractors and the hydrologic outcome associated with the delivery of transfer water, such as delivering water to wildlife areas that drain to the San Joaquin River (Section 4.2.2.2.2).

4.2.2.2.1 Hydrologic Effects Due to Water Development

The Exchange Contractors actions to develop water are reported herein in isolation from other actions of water purchasers. These actions are only one component of a multitude of actions, and are affected by subsequent actions. Consequently, the effects of water development must be evaluated in the context of the remaining components of the proposed water transfer program when determining the magnitude or significance of the potential effects.

Three methods are proposed to develop water for transfer: conservation including tailwater recovery, groundwater substitution, and crop idling/temporary land fallowing. Each of these methods would have different effects, although sometimes no effect, upon San Joaquin River flows. In this alternative, up to 80,000 acre-feet of transfer water would be developed by the Exchange Contractors. The hydrologic effect to the San Joaquin River for a portion of this water is included in the existing condition/No Action Alternative settings (i.e., baseline condition). Also, since impacts to hydrology are stated relative to the baseline, the impacts discussed below relate to the incremental amount of water above the baseline that is developed and delivered.

That is, in the existing condition/No Action Alternative setting, the Exchange Contractors are already developing water either for existing transfers (existing condition) or using the developed water for their own internal purposes (No Action Alternative).

For the conservation scenario, the Exchange Contractors would increase their water development by 10,365 acre-feet above baseline, including tailwater recapture of 16,365 acre-feet during noncritical years to achieve 80,000 acre-feet of transfer water (with a commensurate reduction from baseline of 6,000 acre-feet of groundwater pumping). For the groundwater scenario, the Exchange Contractors will increase their groundwater substitution efforts by 10,365 acre-feet. To develop the full amount of transfer through a crop idling/temporary land fallowing program, the Exchange Contractors would develop 16,365 acre-feet of water from crop idling. This occurs with a decrease in groundwater pumping of 6,000 acre-feet.

Effects at Vernalis

Simulated hydrologic effects at Vernalis resulting from each of these scenarios in each year type are shown in Table 4-11, which also illustrates the assumed existing condition/No Action Alternative Vernalis flows.

Table 4-11
Vernalis Flow Conditions – Alternative A Water Development

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

A-1-0-S: 80 CONSERVATION SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-2	-19	-17	-30	-37	-38	-37	-37	-24	-15	0	0	0	0
Above Normal	-2	-19	-17	-30	-37	0	-37	-37	-24	-15	0	0	0	0
Below Normal	-2	0	-17	-30	-37	-52	-50	-48	-24	-15	0	0	0	0
Dry	-2	0	-19	-42	-51	-52	-50	-48	-24	-15	0	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

A-2-0-S: 80 GROUNDWATER SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

A-3-0-S: 80 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-5	-2	0	0	-3	-5	-4	0	0	0	0	0	0
Above Normal	-1	-5	-2	0	0	0	-5	-4	0	0	0	0	0	0
Below Normal	-1	0	-2	0	0	-5	-6	-5	0	0	0	0	0	0
Dry	-1	0	-2	0	0	-5	-6	-5	0	0	0	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

Note: The letter S after scenario number indicates water development impacts only.

The effects of developing the water upon flows at Vernalis vary depending upon the source of the developed water and the year type. The **conservation scenario** exhibits the largest potential affect to Vernalis flows. The development of transfer water through tailwater recapture is assumed to have a direct 1-to-1 effect on river flow. For each acre-foot of water recaptured, an acre-foot of water is removed from the river. The monthly pattern exhibited in the effect is generally consistent with the delivery of water to the Exchange Contractors. Certain months

(e.g., June of an above normal year and February in below normal and dry years) show no change in flow. This circumstance is due to the required Vernalis flow condition being maintained by New Melones Reservoir operations. During these months any change in San Joaquin River flows upstream of the Stanislaus River are assumed to be counteracted by a change in New Melones Reservoir releases. During certain other months, when New Melones Reservoir operations are maintaining required water quality conditions at Vernalis, the flow change at Vernalis is the combination of both the effects of the Exchange Contractors developing the transfer water and the counteraction by New Melones Reservoir releases to maintain the water quality condition at Vernalis. During critical years, the effect is due to a crop idling/temporary land fallowing program. For each of the water development scenarios, only crop idling/temporary land fallowing is available during critical years. The impact to flows at Vernalis during dry periods when river flows are the smallest is on the order of 1 to 4 percent of the Vernalis flow rate.

For the **groundwater scenario**, no effect appears at Vernalis for noncritical years. This circumstance is due to the lack of hydrologic influence between the Exchange Contractors groundwater pumping and San Joaquin River flows. The only effect in this scenario is during critical years, again when the effect is due to crop idling/temporary land fallowing.

For the **crop idling/temporary land fallowing scenario**, a relatively small effect to Vernalis flows occurs. This effect has a pattern associated with the pattern of irrigation requirements for cotton, and an assumption for surface runoff from that irrigation. The effect during critical years is associated with the full employment of 50,000 acre-feet of crop idling/temporary land fallowing.

Water quality at Vernalis may also change due to the development of transfer water by the Exchange Contractors. Table 4-12 illustrates the change in water quality at Vernalis associated with the development of each of the sources of transfer water.

Water quality changes at Vernalis trend with the changes in flow at Vernalis. The water quality of tailwater is typically worse than the melded quality of water at Vernalis. Therefore, the removal of tailwater by the Exchange Contractors would improve water quality at Vernalis. The crop idling/temporary land fallowing program is assumed to affect the same flows that are available for tailwater recapture. There is no change in water quality for several months during below normal, dry and critical years although there would be a change in flow. These are periods when New Melones Reservoir releases are maintaining the water quality requirement at Vernalis. A change in upstream flows and associated quality will be counteracted by releases from New Melones Reservoir to maintain the water quality requirement at Vernalis.

Table 4-12
Vernalis Water Quality Conditions – Alternative A Water Development

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

A-1-0-S: 80 CONSERVATION SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	-2	-1	-2	-3	-3	-4	-5	-6	-2	0	0	0	0
Above Normal	-1	-3	-2	-4	-7	-13	-8	-7	-7	-3	0	0	0	0
Below Normal	-1	-8	-2	-6	-8	0	0	0	-7	-3	0	0	0	0
Dry	-1	-10	0	-	-	0	0	0	-7	-3	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

A-2-0-S: 80 GROUNDWATER SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	-	-	0	0	0	0	0	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

A-3-0-S: 80 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	-1	-1	0	0	0	0	0	0
Above Normal	0	-1	0	0	0	-1	-1	-1	0	0	0	0	0	0
Below Normal	0	-2	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	-3	0	-	-	0	0	0	0	0	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur. During the other portions of these months, water quality would only slightly change and within a magnitude shown for the month in the other year types.

Effects on New Melones Reservoir

New Melones Reservoir operations may be affected by the Exchange Contractors' development of transfer water due to the linkage between its operations and San Joaquin River conditions. State Board Decisions 1641 and 1422 require releases from New Melones Reservoir to maintain minimum levels of water quality and flow at Vernalis. The flow and quality effects of the transfer to the San Joaquin River upstream of the Stanislaus River can trigger a change in releases from New Melones Reservoir to counter such effects. The potential changes in the net releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are illustrated in Table 4-13. The values are depicted as a change in New Melones Reservoir storage, and are directly representative of flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-13
Storage Change in New Melones Reservoir – Alternative A Water Development

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

A-1-0-S: 80 CONSERVATION SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-2285	0	0	0	0	0	0	0	0	-2285
Below Normal	0	-1054	0	0	0	813	800	650	0	0	0	0	0	0	1208
Dry	0	-1054	135	718	845	813	800	650	0	0	0	0	0	0	2906
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

A-2-0-S: 80 GROUNDWATER SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

A-3-0-S: 80 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-205	0	0	0	0	0	0	0	0	-205
Below Normal	0	-255	0	0	0	73	97	70	0	0	0	0	0	0	-15
Dry	0	-255	13	3	5	73	97	70	0	0	0	0	0	0	5
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

The changes shown in Table 4-13 indicate the changes that would be required to counter the effect of developing the transfer water on maintaining Vernalis flow and quality conditions exactly at the Vernalis objective compliance level. However, when a reduction in flow is calculated, the reduction may not actually be allowed because another release objective may require the continuation of some level of that release. Modeling limitations did not allow the identification of such circumstances. Accumulated changes in New Melones Reservoir storage vary by year type and source option, but the change in storage within a year is less than 3,000 acre-feet, positive or negative.

Flows in the Lower Stanislaus River Storage would mirror changes in New Melones Reservoir but in the opposite direction. For instance, a decrease in New Melones Reservoir storage results in an increase in flows in the lower Stanislaus River. The potential change in flow to the lower Stanislaus River ranges from an increase of 38 cfs during June (during an above normal year, conservation emphasis) to a decrease of up to 14 cfs during May during a dry year with the conservation emphasis. An indirect impact that may result from a change in New Melones Reservoir operations is the allocation of water to uses within the Interim Plan of Operations, including impacts to water users and the use of water for fish and water quality purposes. As described in Section 4.1.2, the New Melones Project is generally operated according to the Interim Plan of Operations, which allocates water for various purposes according to formulae that relate to anticipated runoff and reservoir storage. A change in carry-over storage (as determined for the end of February) in comparison to the existing condition would lead to a change in allocations, higher or lower, or potentially lead to no change in allocations. The potential water supply effect to any particular use is dependent upon the magnitude of the change in storage (in a year, or accumulated over a number of years). However, given the very small changes in storage anticipated, on the order of 1,000 to 3,000 acre-feet in a year, the impact from water development alone is expected to be minor.

The effect of a change in New Melones Reservoir water supply (surrogated by a year's total change in reservoir storage) upon each non-water right purpose is illustrated in Table 4-14.

Table 4-14
New Melones Interim Plan of Operations Allocation Sensitivity

New Melones Allocation of Supplies (1,000 acre-feet)									
New Melones Storage Plus Inflow (Index)		Fishery		Vernalis Water Quality		Bay-Delta		CVP Contractors	
From	To	From	To	From	To	From	To	From	To
0	1,400	0	98	0	70	0	0	0	0
1,400	2,000	98	125	70	80	0	0	0	0
2,000	2,500	125	345	80	175	0	0	0	59
2,500	3,000	345	467	175	250	75	75	90	90
3,000	6,000	467	467	250	250	75	75	90	90

Change in Allocation per 10,000 acre-feet of Index (1,000 acre-feet)					
From	To	Fishery	Vernalis Water Quality	Bay-Delta	CVP Contractors
0	1,400	0.700	0.500	0.000	0.000
1,400	2,000	0.450	0.167	0.000	0.000
2,000	2,500	4.400	1.900	0.000	1.180
2,500	3,000	2.440	1.500	Receiving Maximum	Receiving Maximum
3,000	6,000	Receiving Maximum	Receiving Maximum	Receiving Maximum	Receiving Maximum

The majority of the effect of a change in New Melones Reservoir storage would not be realized during the current year of the transfer, but instead during the subsequent year or years when water supply allocations are subsequently determined. If the following year is dry, the previous year's effect in storage would translate to relatively small allocation changes to lower Stanislaus River purposes and potentially no change to allocations to CVP contractors. If the following year is normal or wetter, more noticeable changes to allocations would occur. In the wettest of conditions, allocations would not change.

Effect on Delta CVP/SWP Water Supply

The Exchange Contractors' development of transfer water could affect inflows to the Delta from the San Joaquin River. The change in inflow could decrease, or be neutral to, CVP/SWP Delta water supplies. The potential effects to the CVP/SWP Delta water supply occur when either the Delta is in "balanced conditions" or when the Delta is in "excess conditions" and CVP/SWP exports are limited by the export/inflow ratio described by Decision 1641. The total net Delta water supply balance to the CVP/SWP is shown in Table 4-15.

Table 4-15
Delta CVP/SWP Water Supply Effect – Alternative A Water Development

Incremental Change in Project Delta Supply due to Action - Acre-feet

A-1-0-S: 80 CONSERVATION SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-369	0	0	0	0	-2285	-2285	0	0	0	0	0	0	-4938
Above Normal	0	-369	0	0	0	0	-2285	-2285	0	0	0	0	0	0	-4938
Below Normal	0	0	0	0	0	-3097	-3084	-2935	0	0	0	0	0	0	-9116
Dry	0	0	-416	-559	-3129	-3097	-3084	-2935	-1406	-884	0	0	0	0	-15511
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

A-2-0-S: 80 GROUNDWATER SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

A-3-0-S: 80 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-89	0	0	0	0	-278	-245	0	0	0	0	0	0	-612
Above Normal	0	-89	0	0	0	0	-278	-245	0	0	0	0	0	0	-612
Below Normal	0	0	0	0	0	-278	-375	-314	0	0	0	0	0	0	-967
Dry	0	0	-39	-2	-18	-278	-375	-314	-19	0	0	0	0	0	-1046
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

For the **conservation scenario**, a potential net decrease in supply is shown for each year type. The decrease in net supply ranges from more than 4,900 acre-feet in a wet and above normal year, to more than 15,000 acre-feet during a dry year. These changes occur due to the development of the transfer water and also include counteractions in New Melones Reservoir releases in reaction to changes in the river system. For example, during the summer months when the tailwater recovery component is developing water by removing tailwater from the river system, New Melones Reservoir would also decrease flow in the river system as a result of providing less dilution flows. Thus, the CVP/SWP Delta supply would be affected by the compound effect of both actions. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP.

For the **groundwater scenario** there is no effect to the CVP/SWP Delta supply, commensurate with no effect at Vernalis. The effect exhibited during a critical year is actually the same effect shown for the conservation and fallowing scenario, and is the effect of the crop idling/temporary land fallowing program that occurs during a critical year of all the scenarios.

The effect of the **crop idling/temporary land fallowing scenario** for all noncritical years is a decrease of about 1,000 acre-feet or less.

Summary of Water Development Effects Among Alternative A Scenarios

Vernalis flows would be reduced by any of the source scenarios the Exchange Contractors employ. Conservation efforts as the source of water for transfers create the largest effect on Vernalis flows. Groundwater and crop idling/temporary land fallowing have the least effect on Vernalis flows due to their lesser interrelationship with the river. The effect during critical years is the same for each scenario since each scenario utilizes the same crop idling/temporary land fallowing program during such a year type. Water quality at Vernalis improves in each source scenario, although only slightly.

New Melones Reservoir storage (and commensurately, in the opposite direction, Goodwin releases to the Stanislaus River) typically would gain or remain neutral in all scenarios. The Delta supply for the CVP/SWP would have a potential of reduction in both the conservation and crop idling/temporary land fallowing scenario, more so for the conservation scenario. The groundwater scenario does not affect the CVP/SWP Delta supply, except during critical years when a common crop idling/temporary land fallowing program is employed.

4.2.2.2.2 Hydrologic Effects Due to Combined Water Development and Transfer

In addition to the hydrologic effects that occur due to the development of the transfer water by the Exchange Contractors, hydrologic effects would occur from the disposition of that water to transferees. Also, Reclamation may respond, relative to the existing condition/No Action Alternative setting, in reaction to the Exchange Contractors providing (or not providing) transfer water to the San Joaquin Valley wildlife areas. Such a response may be the reduction of water acquisitions from other entities in favor of the transfer of water from the Exchange Contractors. The results presented in this section illustrate the combined effects of the development of transfer water by the Exchange Contractors and the delivery of the water to a variety of users including those not hydraulically connected to the San Joaquin River. The effects are illustrated in groupings concerned with the disposition of the transfer water.

All Water to Wildlife Areas (Refuges)

These scenarios result in up to 80,000 acre-feet transfer to wildlife areas, generally from an irrigation delivery pattern to one consistent with wildlife habitat area requirements. Generally, combined Level 2 and Level 4 deliveries to the wildlife areas would occur year-round. The pattern of wildlife area deliveries generally is largest during early fall as flood-up operations occur. During late fall and winter the level of delivery maintains ponding in the wildlife areas. Pond drawdown begins in late winter, reducing deliveries. Seasonal irrigation (for food for wildlife) requires increased deliveries in late spring and summer. Deliveries then taper off until the flood-up operation recurs. Water would be delivered to the San Joaquin Valley wildlife areas through the Delta-Mendota Canal, SWP facilities, local conveyance facilities, or delivery exchange agreements.

Water may be delivered to wildlife areas within or outside of the San Joaquin River drainage basin. For deliveries to areas within the drainage basin (the subject of this section), a change in San Joaquin River flows and quality would occur, due both to the Exchange Contractors developing the transfer water and the wildlife areas use and management of the transfer water. Currently, 63,365 acre-feet are being delivered as Incremental Level 4 water supply to wildlife areas draining to the San Joaquin River. Another 12,329 acre-feet are currently being delivered to wildlife areas without hydraulic connection with the San Joaquin River. During noncritical years, this scenario would increase wildlife area deliveries to full Level 4 quantities (103,014 acre-feet), inclusive of an incremental delivery to wildlife areas draining to the San Joaquin River (17,823 acre-feet). The indirect effects would also include a reduction in Reclamation acquisitions from entities other than the Exchange Contractors. During critical years, an incremental delivery of 40,000 acre-feet (50,000 acre-feet of developed water reduced by 20 percent for conveyance losses) would occur.

Consumptive Use. When water is developed by the Exchange Contractors through tailwater recovery and conservation and groundwater, no increase or decrease in Exchange Contractor consumptive use would occur. For each acre-foot of water transferred, the Exchange Contractors would substitute an acre-foot of water from an alternative supply. When crop idling/temporary land fallowing is employed by the Exchange Contractors, a decrease in their consumptive use would occur due to the decrease in planted areas.

For the wildlife areas, the transfer would be partially depleted by an increase in consumptive use. As described in Appendix B, providing Level 4 deliveries primarily leads to a change in the refuges' irrigation practice. This change in management would lead to increased consumptive use of supplies. Some of the Incremental Level 4 supply is also used during flood-up operations leading to increased runoff from the areas during August. Overall, this analysis assumes that approximately 23 percent of the Incremental Level 4 transfer delivery to the wildlife areas would be returned to the river system as runoff, with the majority of the incremental runoff occurring during the month of August.

Vernalis. This refuge focus scenario would provide additional water deliveries to San Joaquin Valley wildlife areas that discharge to the San Joaquin River. Simulated hydrologic effects at Vernalis resulting from this option are shown in Table 4-16. Changes in flow at Vernalis range from an increase of about 200 cfs to a decrease of almost 55 cfs. During wet years, the changes in flow at Vernalis are solely the result of the net effect of the development and disposition of transfer water. For the tailwater recovery-focus option, the changes in flow reflect runoff from the wildlife area transferees during the early fall and the depletion of flow during other months by the tailwater recovery component. Winter months exhibit a minor amount of increased flow due to the reduction in Reclamation acquisitions from other San Joaquin Valley sources. In other noncritical years the monthly changes generally show the same trends, except during February of dry and below normal years and June of an above normal year when New Melones Reservoir reacts to flow changes caused by the transfers to maintain the Vernalis flow at the controlling flow objective. During all but wet years the flow at Vernalis is also at times affected by water quality release changes from New Melones Reservoir.

For both the groundwater scenario and the crop idling/temporary land fallowing scenario, the springtime and summertime reduction in Vernalis flows is less in comparison to the conservation scenario. This outcome is due to these other two source options removing less return flows from the San Joaquin River.

Table 4-16
Vernalis Flow Conditions – Alternative A, Refuge Focus

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

A-1-1-C: 80 CONSERVATION REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-2	-19	-17	-31	-40	-41	-41	9	-25	-17	4	1	3	4
Above Normal	-2	-19	-17	-31	-40	0	-41	9	-25	-17	4	1	3	4
Below Normal	-2	0	-17	-31	-40	-54	-52	46	-25	-17	4	1	3	0
Dry	-2	0	-18	-43	-53	-54	-52	46	-25	-17	4	1	3	0
Critical	-3	-21	-2	0	-1	-14	-19	199	5	-1	11	2	8	15

A-2-1-C: 80 GROUNDWATER REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	-2	-2	-3	-4	46	-1	-2	4	1	3	4
Above Normal	0	0	0	-2	-2	0	-4	46	-1	-2	4	1	3	4
Below Normal	0	0	0	-2	-2	-2	-2	94	-1	-2	4	1	3	0
Dry	0	0	1	-1	-2	-2	-2	93	-1	-2	4	1	3	0
Critical	-3	-21	-2	0	-1	-14	-19	199	5	-1	11	2	8	15

A-3-1-C: 80 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-5	-1	-2	-3	-7	-9	42	-2	-2	4	1	3	4
Above Normal	-1	-5	-1	-2	-3	0	-9	42	-2	-2	4	1	3	4
Below Normal	-1	0	-1	-2	-3	-7	-8	89	-2	-2	4	1	3	0
Dry	-1	0	-1	-1	-2	-7	-8	88	-2	-2	4	1	3	0
Critical	-3	-21	-2	0	-1	-14	-19	199	5	-1	11	2	8	15

No change in flow at Vernalis occurs during periods when it is assumed that flow objectives control (February of below normal and dry years, June of above normal years, and during the pulse flow periods during April and May). All scenarios have the same critical year effects, since only the crop idling/temporary land fallowing element is used during critical years. With the transfer, during the VAMP pulse flow period (mid-April through mid-May) the "existing flow" condition, as defined by the San Joaquin River Agreement (SJRA), may be slightly lower in noncritical years. The flow at Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

The water quality at Vernalis would also change due to the transfer. Table 4-17 shows the change in Vernalis water quality resulting from the transfers under each source emphasis. The table also illustrates the assumed existing condition/No Action Alternative water quality condition at Vernalis.

Water quality changes at Vernalis trend with the net addition (runoff) and removal (reduction in return flows) of water within the river system. Deliveries to the wildlife areas result in additional return flows to the river with worse water quality than existing condition/No Action Alternative water quality at Vernalis. The development of the transfer water by the Exchange Contractors removes flow in the river also with a quality worse than the existing condition/No Action Alternative water quality at Vernalis. During periods when the water quality objective is assumed to control New Melones releases (indicated by the 700 and 1,000 µS/cm values in Table 4-17), no change in water quality would occur due to the counteraction at New Melones Reservoir for transfer-related San Joaquin River flow and quality changes. During other periods, the estimated change in water quality could be within a range of 14 µS/cm improvement to a 19 µS/cm degradation. The largest degradation in water quality is anticipated to occur during

August when the majority of incremental return flows from the wildlife areas are expected to occur.

Table 4-17
Vernalis Water Quality Conditions – Alternative A, Refuge Focus

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

A-1-1-C: 80 CONSERVATION REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	-2	-1	-2	-3	-3	-4	9	-5	-2	1	0	0	0
Above Normal	-1	-3	-2	-4	-7	-14	-7	13	-6	-3	1	0	0	1
Below Normal	-1	-8	-2	-6	-8	0	0	0	-6	-3	1	0	1	2
Dry	-1	-10	0	-	-	0	0	0	-5	-3	1	0	1	2
Critical	-2	0	0	-	-	0	0	0	2	0	3	0	1	0

A-2-1-C: 80 GROUNDWATER REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	0	13	1	0	1	0	0	0
Above Normal	0	0	0	0	0	-1	0	19	1	0	1	0	0	1
Below Normal	0	0	0	0	0	0	0	0	1	0	1	0	1	2
Dry	0	0	0	-	-	0	0	0	1	0	1	0	1	2
Critical	-2	0	0	-	-	0	0	0	2	0	3	0	1	0

A-3-1-C: 80 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	0	13	1	0	1	0	0	0
Above Normal	0	-1	0	0	0	-2	-1	18	1	0	1	0	0	1
Below Normal	0	-2	0	0	0	0	0	0	1	0	1	0	1	2
Dry	0	-3	0	-	-	0	0	0	1	0	1	0	1	2
Critical	-2	0	0	-	-	0	0	0	2	0	3	0	1	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

Although the water quality at Vernalis may at times be degraded as a result of a refuge focus transfer, it is assumed that it would be mitigated by Reclamation operating New Melones Reservoir to continue to comply with water quality objectives consistent with past practice. Therefore, the transfer would not cause any additional noncompliance instances.

New Melones Reservoir Water Supply/Operation. New Melones Reservoir operations may be affected by the refuge focus transfers due to the linkage between its operations and San Joaquin River conditions. The potential changes in the net releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are illustrated in Table 4-18. The values are depicted as a change in New Melones Reservoir storage, and are directly representative of flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

For the refuge focus scenario, an overall annual decrease in New Melones Reservoir storage during non-wet years is anticipated. This decrease could range up to about 3,000 acre-feet in noncritical years, and is the net of gains in storage due to the Exchange Contractors removing drainage from the river and additional releases required to dilute the incremental drainage released from the wildlife areas. During critical years the effects could be larger, with over 5,000 acre-feet of reduced storage. These effects are due to the direct and indirect effects of providing water through the crop idling/temporary land fallowing component.

Table 4-18
Storage/Flow Change in New Melones Reservoir – Alternative A, Refuge Focus

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

A-1-1-C: 80 CONSERVATION REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-2467	0	0	0	0	0	0	0	0	-2467
Below Normal	0	-1054	0	0	0	751	674	-2285	0	0	0	0	0	234	-1680
Dry	0	-1054	67	701	826	751	674	-2259	0	0	0	0	0	234	-59
Critical	0	386	-97	-12	15	223	297	-6209	0	0	0	0	0	-267	-5665

A-2-1-C: 80 GROUNDWATER REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-182	0	0	0	0	0	0	0	0	-182
Below Normal	0	0	0	0	0	-62	-125	-2936	0	0	0	0	0	234	-2888
Dry	0	0	-68	-17	-18	-62	-125	-2909	0	0	0	0	0	234	-2965
Critical	0	386	-97	-12	15	223	297	-6209	0	0	0	0	0	-267	-5665

A-3-1-C: 80 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-387	0	0	0	0	0	0	0	0	-387
Below Normal	0	-255	0	0	0	11	-28	-2866	0	0	0	0	0	234	-2904
Dry	0	-255	-55	-14	-13	11	-28	-2839	0	0	0	0	0	234	-2960
Critical	0	386	-97	-12	15	223	297	-6209	0	0	0	0	0	-267	-5665

Delta Supply. The transfer program to the wildlife areas could affect inflows to the Delta from the San Joaquin River. The total net Delta water supply balance to the CVP/SWP is shown in Table 4-19.

Table 4-19
Delta CVP/SWP Water Supply Effect – Alternative A, Refuge Focus

Incremental Change in Project Delta Supply due to Action - Acre-feet

A-1-1-C: 80 CONSERVATION REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-369	0	0	0	0	-2547	548	0	0	0	0	0	82	-2286
Above Normal	0	-369	0	0	0	0	-2547	548	0	0	0	0	0	82	-2286
Below Normal	0	0	0	0	0	-3218	-3222	2833	0	0	0	0	0	0	-3606
Dry	0	0	-389	-570	-3264	-3218	-3222	2807	-1495	-1011	0	0	0	0	-10362
Critical	0	-1165	-131	4	-55	-849	-1146	12252	312	-39	634	0	0	834	10650

A-2-1-C: 80 GROUNDWATER REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	-263	2833	0	0	0	0	0	82	2652
Above Normal	0	0	0	0	0	0	-263	2833	0	0	0	0	0	82	2652
Below Normal	0	0	0	0	0	-120	-137	5768	0	0	0	0	0	0	5510
Dry	0	0	27	-11	-135	-120	-137	5741	-89	-127	0	0	0	0	5149
Critical	0	-1165	-131	4	-55	-849	-1146	12252	312	-39	634	0	0	834	10650

A-3-1-C: 80 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-89	0	0	0	0	-540	2588	0	0	0	0	0	82	2040
Above Normal	0	-89	0	0	0	0	-540	2588	0	0	0	0	0	82	2040
Below Normal	0	0	0	0	0	-398	-512	5454	0	0	0	0	0	0	4543
Dry	0	0	-12	-13	-153	-398	-512	5427	-108	-127	0	0	0	0	4104
Critical	0	-1165	-131	4	-55	-849	-1146	12252	312	-39	634	0	0	834	10650

For the conservation scenario, a net decrease in supply is shown for each year except a critical year (the critical year effect is the same for all source scenarios, indicative of the crop idling/temporary land fallowing emphasis). The decrease in net supply ranges from a little more than 2,000 acre-feet in a wet year (shown as -2,286 acre-feet), to more than 10,000 acre-feet during dry years (shown as -10,362 acre-feet). During a critical year, a gain of over 10,000 acre-feet occurs. These changes occur not only due to the development and disposition of the transfer water, but also due to the New Melones Reservoir reaction to changes in the river system. For example, during the summer months when the conservation component is developing water by

removing tailwater from the river system, New Melones Reservoir would also decrease flow in the river system as a result of providing less dilution flows. Thus, the CVP/SWP Delta supply would be affected by the compound effect of both actions. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP.

For the other two source options (groundwater and crop idling/temporary land fallowing), the effect during critical years would continue to be positive to the CVP/SWP supply, and during other years the balance would switch from being negative to the CVP/SWP to a net gain in supply to the CVP/SWP.

All Water to Agriculture

This agriculture focus scenario would result in up to 80,000 acre-feet of transfer water being provided to CVP agricultural contractors. This water could be delivered to contractors within or outside of the drainage of the San Joaquin River. Potential CVP shortages to contractors within the drainage of the San Joaquin River substantiate the potential need for the entire 80,000 acre-feet of transfer to those entities. The direct effects of the Exchange Contractors developing transfer water are combined with the effects of the CVP contractors producing increased runoff to the San Joaquin River. Additional indirect effects occur due to Reclamation acquiring additional water for delivery to the wildlife areas from entities other than the Exchange Contractors.

The water transferred to agricultural users would essentially exchange the delivery of water from the Exchange Contractors to a CVP agricultural contractor. San Joaquin River flow and quality, New Melones Reservoir release, and Delta inflows would be affected as the result of both the Exchange Contractors developing transfer water and the additional effects of the transfers.

Consumptive Use. When water is developed by the Exchange Contractors through conservation and groundwater, no increase or decrease in Exchange Contractors consumptive use would occur. For each acre-foot of water transferred, the Exchange Contractors would substitute an acre-foot of water from an alternative supply. When the Exchange Contractors employ crop idling/temporary land fallowing, a decrease in their consumptive use would occur.

If the transferred water is used by the agricultural transferee to replace pumped groundwater, no overall increase in consumptive use would occur, only a trade-off of one source for another would occur. However, if the transferred water is used to either irrigate land that would have been left fallow due to lack of water supply or to increase the application rate on existing irrigated lands, an increase would occur in consumptive use for the water purchaser. (The 80,000 acre-feet of additional water that could become available represents less than 5 percent of the existing contracted water use for the 10 districts that could purchase the water described in Appendix A, excluding Friant Division districts.) This latter scenario represents an increase in crop consumptive use by the affected districts; however, the amount of CVP water use is unchanged.

Vernalis. This agriculture focus scenario would provide additional water deliveries to San Joaquin Valley CVP agricultural contractors that discharge to the San Joaquin River. Table 4-20 below illustrates the potential range in flow change at Vernalis that may occur as a result of this scenario. Simulated flow changes at Vernalis range from an increase of 13 cfs to a decrease of

46 cfs. Each year-type's flow changes are unique in reason, and differ due to the program assumed to develop the transfer water. During wet years, the changes in flow at Vernalis are solely the result of the net effect of the development and disposition of transfer water. For the conservation scenario, the changes in flow mostly reflect the net result of removing runoff from the Exchange Contractors and the addition of runoff from the agricultural transferees. A lesser effect occurs within the net amount due to an increase in Reclamation acquisitions from other San Joaquin Valley sources to satisfy wildlife area deliveries. In other noncritical years the monthly changes generally show the same trends, except during February of dry and below normal years and June of an above normal year when New Melones Reservoir reacts to flow changes caused by the transfers to maintain the Vernalis flow at the controlling flow objective. During all but wet years the flow at Vernalis is also at times affected by water quality release changes from New Melones Reservoir.

Table 4-20
Vernalis Flow Conditions – Alternative A, Agriculture Focus

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

A-1-2-C: 80 CONSERVATION AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-2	-19	-16	-24	-30	-29	-24	-28	-11	-9	2	0	1	1
Above Normal	-2	-19	-16	-24	-30	0	-24	-28	-11	-9	2	0	1	1
Below Normal	-2	0	-16	-24	-30	-46	-43	-42	-11	-9	2	0	1	0
Dry	-2	0	-19	-37	-44	-46	-43	-41	-11	-9	2	0	1	0
Critical	-3	-21	-4	5	7	-5	-5	-5	13	6	2	0	1	1

A-2-2-C: 80 GROUNDWATER AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	1	5	8	9	13	10	13	6	2	0	1	1
Above Normal	0	0	1	5	8	0	13	10	13	6	2	0	1	1
Below Normal	0	0	1	5	8	6	7	6	13	6	2	0	1	0
Dry	0	0	1	5	7	6	7	7	13	6	2	0	1	0
Critical	-3	-21	-4	5	7	-5	-5	-5	13	6	2	0	1	1

A-3-2-C: 80 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-5	0	5	7	6	8	6	13	6	2	0	1	1
Above Normal	-1	-5	0	5	7	0	8	6	13	6	2	0	1	1
Below Normal	-1	0	0	5	7	1	1	1	13	6	2	0	1	0
Dry	-1	0	-1	5	6	1	1	2	13	6	2	0	1	0
Critical	-3	-21	-4	5	7	-5	-5	-5	13	6	2	0	1	1

For both the groundwater scenario and the crop idling/temporary land fallowing scenario, the springtime and summertime reduction in Vernalis flows is reversed in comparison to the conservation scenario. This outcome is due to these other two source options removing less water from the San Joaquin River.

No change in flow at Vernalis occurs during periods when it is assumed that flow objectives control (February of below normal and dry years, June of above normal years, and during the pulse flow periods during April and May). All scenarios have the same critical year effects, since only crop idling/temporary land fallowing element is used during critical years. With the transfer, during the VAMP pulse flow period (mid-April through mid-May) the "existing flow" condition, as defined by the SJRA, may be slightly lower in noncritical years. The flow at

Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

The water quality at Vernalis would also change due to the transfer. Table 4-21 shows the change in Vernalis water quality resulting from the transfers under each source option. The table also illustrates the assumed existing condition/No Action water quality condition at Vernalis.

Table 4-21
Vernalis Water Quality Conditions – Alternative A, Agriculture Focus

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

A-1-2-C: 80 CONSERVATION AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	-2	-1	-2	-3	-3	-4	-6	-6	-2	0	0	0	0
Above Normal	-1	-3	-2	-4	-7	-11	-8	-7	-9	-3	0	0	0	0
Below Normal	-1	-8	-2	-6	-8	0	0	0	-9	-3	0	0	0	0
Dry	-1	-10	0	-	-	0	0	0	-8	-3	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	-1	0	0	0	0	0

A-2-2-C: 80 GROUNDWATER AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
Above Normal	0	0	0	0	0	2	-1	-1	-1	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
Dry	0	0	0	-	-	0	0	0	-1	0	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	-1	0	0	0	0	0

A-3-2-C: 80 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	-1	-1	-1	0	0	0	0	0
Above Normal	0	-1	0	0	0	0	-2	-2	-2	0	0	0	0	0
Below Normal	0	-2	0	0	0	0	0	0	-2	0	0	0	0	0
Dry	0	-3	0	-	-	0	0	0	-1	0	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	-1	0	0	0	0	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

Water quality changes at Vernalis trend with the net addition (runoff) and removal (reduction in return flows) of water within the river system. Deliveries to the agricultural contractors generally result in additional return flows to the river at a quality better than existing condition/No Action water quality at Vernalis, and the development of the transfer water by the Exchange Contractors removes flow in the river, typically with worse water quality than existing condition/No Action water quality at Vernalis. During periods when the water quality objective is assumed to control New Melones releases (indicated by the 700 and 1,000 µS/cm values in Table 4-21), no change in water quality would occur due to the counteraction at New Melones Reservoir for transfer-related San Joaquin River flow and quality changes. During other periods, the estimated change in water quality could be within a range of 11 µS/cm improvement to about a 2 µS/cm degradation.

The analysis indicates that water quality at Vernalis would improve or be neutral with this agriculture focus scenario under all of the source scenarios. It is assumed that Reclamation would continue to operate New Melones Reservoir to comply with water quality objectives

consistent with past practice. Therefore, the transfer would not cause any additional noncompliance instances.

New Melones Reservoir Water Supply/Operation. New Melones Reservoir operations may be affected by the transfers due to the linkage between its operations and San Joaquin River conditions. The potential changes in the net releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are illustrated in Table 4-22. The values are depicted as a change in New Melones Reservoir storage, and are directly representative of flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-22
Storage/Flow Change in New Melones Reservoir – Alternative A, Agriculture Focus

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

A-1-2-C: 80 CONSERVATION AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1731	0	0	0	0	0	0	0	0	-1731
Below Normal	0	-1054	0	0	0	1000	1181	876	0	0	0	0	0	56	2059
Dry	0	-1054	158	742	900	1000	1181	795	0	0	0	0	0	56	3777
Critical	0	386	47	-12	30	260	350	223	0	0	0	0	0	14	1296

A-2-2-C: 80 GROUNDWATER AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	554	0	0	0	0	0	0	0	0	554
Below Normal	0	0	0	0	0	187	381	226	0	0	0	0	0	56	851
Dry	0	0	23	24	56	187	381	145	0	0	0	0	0	56	872
Critical	0	386	47	-12	30	260	350	223	0	0	0	0	0	14	1296

A-3-2-C: 80 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	349	0	0	0	0	0	0	0	0	349
Below Normal	0	-255	0	0	0	260	478	296	0	0	0	0	0	56	835
Dry	0	-255	36	26	60	260	478	214	0	0	0	0	0	56	877
Critical	0	386	47	-12	30	260	350	223	0	0	0	0	0	14	1296

For the agricultural water delivery focus scenarios, an overall annual increase in New Melones Reservoir storage occurs during under most of the source scenarios. This increase could range up to about 4,000 acre-feet in the conservation scenario. The exception is during an above normal year in the conservation scenario when the only change in New Melones Reservoir releases is the reaction to the net removal of flow from the river during June. Critical year effects are due to the direct and indirect effects of providing water through the crop idling/temporary land fallowing component.

Delta Supply. The transfer program to the agricultural contractors could affect inflows to the Delta from the San Joaquin River. The total net Delta water supply balance to the CVP/SWP is shown in Table 4-23.

For the conservation emphasis, a net decrease in CVP/SWP supply is shown for each year. The decrease in net supply during noncritical years ranges from a little more than 3,500 acre-feet in a wet and above normal year to almost 13,000 acre-feet during a dry year. During a critical year, a loss of about 300 acre-feet occurs (resulting from the crop idling/temporary land fallowing program that occurs in critical years of all source scenarios). These changes occur not only due to the development and disposition of the transfer water, but also due to the New Melones Reservoir reaction to changes in the river system. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP.

Table 4-23
Delta CVP/SWP Water Supply Effect – Alternative A, Agriculture Focus

Incremental Change in Project Delta Supply due to Action - Acre-feet

A-1-2-C: 80 CONSERVATION AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-369	0	0	0	0	-1486	-1697	0	0	0	0	0	20	-3533
Above Normal	0	-369	0	0	0	0	-1486	-1697	0	0	0	0	0	20	-3533
Below Normal	0	0	0	0	0	-2731	-2666	-2573	0	0	0	0	0	0	-7971
Dry	0	0	-399	-513	-2718	-2731	-2666	-2492	-635	-550	0	0	0	0	-12705
Critical	0	-1165	-273	325	432	-289	-338	-337	773	372	100	0	0	47	-354

A-2-2-C: 80 GROUNDWATER AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	799	587	0	0	0	0	0	20	1406
Above Normal	0	0	0	0	0	0	799	587	0	0	0	0	0	20	1406
Below Normal	0	0	0	0	0	366	418	361	0	0	0	0	0	0	1146
Dry	0	0	17	46	411	366	418	443	771	334	0	0	0	0	2806
Critical	0	-1165	-273	325	432	-289	-338	-337	773	372	100	0	0	47	-354

A-3-2-C: 80 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-89	0	0	0	0	521	343	0	0	0	0	0	20	794
Above Normal	0	-89	0	0	0	0	521	343	0	0	0	0	0	20	794
Below Normal	0	0	0	0	0	88	43	47	0	0	0	0	0	0	178
Dry	0	0	-22	44	393	88	43	128	752	334	0	0	0	0	1760
Critical	0	-1165	-273	325	432	-289	-338	-337	773	372	100	0	0	47	-354

For the other two source scenarios, the effect during critical years would continue to be a slight loss to the CVP/SWP supply, and during other years the balance would switch from being negative to the CVP/SWP to a net gain in supply to the CVP/SWP.

All Water Transferred Out of Basin

A secondary scenario of water being transferred to all wildlife purposes or all agriculture and M&I users within the drainage of the San Joaquin River is the variation of the location of where that water is delivered, including transfers for CVP EWA replacement water. Hydrologically, San Joaquin River effects would occur when the disposition of water has no continuity with the San Joaquin River. For purposes of estimating hydrologic effects in the San Joaquin River, it does not matter if water is delivered to urban use, agricultural use, or wildlife area use outside of the San Joaquin River drainage basin; none of this use would have any return flow effect upon the San Joaquin River. The only effect of this option would be the direct effects caused by the development of the water for the transfer and the sometimes indirect effects of Reclamation actions of maintaining wildlife area deliveries consistent with the existing condition/No Action Alternative setting. This out-of-basin definition is for the hydrologic analyses and differs from Reclamation's regulatory definition to meet consumptive use limitations in the transfer guidelines, consistent with CVPIA.[1]

This hydrologic out-of-basin transfer would provide up to 80,000 acre-feet of water to uses (any combination of wildlife areas, agriculture, and urban) occurring outside the drainage of the San Joaquin River. These uses could include deliveries to the two refuges that are not hydraulically connected to the San Joaquin River (Pixley and Kern NWRs located in the Tulare Lake Basin),

[1] This scenario is subject to the regulatory constraint that no more than 70,000 acre-feet of temporary water supply from reductions in consumptive use and groundwater substitution plus the quantifiable decrease in irretrievable losses (Section 2.3.2) can be transferred "out of basin" to Pixley and Kern NWRs, Friant Division, and Cross Valley Contractors. Reclamation defines the in-basin use area as the Delta Export Service Area contractors including San Felipe Division and the EWA.

SCVWD and SBCWD (located in the San Felipe Division), CVP water contractors of the Friant Division, the Cross-Valley Contractors of the CVP, Westlands WD, and any other south of Delta CVP contractor not hydraulically connected to the San Joaquin River.

Vernalis. These scenarios would provide additional water deliveries to areas that do not have direct surface water discharge to the San Joaquin River. Simulated hydrologic effects at Vernalis resulting from these scenarios are shown in Table 4-24, which also shows the assumed existing condition/No Action Vernalis flows. Simulated flow changes at Vernalis range from no change to a decrease of 57 cfs. A year-type's flow changes are usually unique in reason, and differ due to the program assumed to develop the transfer water. The changes in flow at Vernalis are primarily the result of the direct effect of the development of transfer water and the effects of New Melones Reservoir reacting to Vernalis flow and quality conditions. The results also include the indirect effect of Reclamation increasing its acquisition of water supplies from entities other than the Exchange Contractors for wildlife area deliveries. The greatest potential flow differences occur for the conservation scenario. The changes in flow reflect the depletion of flow during the year by the tailwater recovery component and the reduction of runoff from entities that Reclamation acquires water for wildlife area deliveries. During February of dry and below normal years and June of an above normal year, New Melones Reservoir reacts to flow changes caused by the transfers to maintain the Vernalis flow at the controlling flow objective, which results in no flow change occurring at Vernalis. During all but wet years the flow at Vernalis is also at times affected by water quality release changes from New Melones Reservoir. During critical years, the flow change at Vernalis is always reflective of the effect of the crop idling/land fallowing source of water.

Table 4-24
Vernalis Flow Conditions – Alternative A, Out-of-Basin Transfer

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

A-1-3-C: 80 CONSERVATION OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-2	-19	-18	-33	-43	-45	-47	-44	-33	-19	-1	0	0	-1
Above Normal	-2	-19	-18	-33	-43	0	-47	-44	-33	-19	-1	0	0	-1
Below Normal	-2	0	-18	-33	-43	-57	-55	-52	-33	-19	-1	0	0	0
Dry	-2	0	-20	-45	-56	-57	-55	-53	-33	-19	-1	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

A-2-3-C: 80 GROUNDWATER OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	-1	-4	-5	-7	-9	-7	-9	-4	-1	0	0	-1
Above Normal	0	0	-1	-4	-5	0	-9	-7	-9	-4	-1	0	0	-1
Below Normal	0	0	-1	-4	-5	-4	-5	-4	-9	-4	-1	0	0	0
Dry	0	0	-1	-3	-5	-4	-5	-5	-9	-4	-1	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

A-3-3-C: 80 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-5	-2	-4	-6	-10	-14	-11	-10	-4	-1	0	0	-1
Above Normal	-1	-5	-2	-4	-6	0	-14	-11	-10	-4	-1	0	0	-1
Below Normal	-1	0	-2	-4	-6	-9	-11	-9	-10	-4	-1	0	0	0
Dry	-1	0	-2	-4	-5	-9	-11	-10	-10	-4	-1	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

For both the groundwater scenario and the crop idling/temporary land fallowing scenario, the springtime and summertime reduction in Vernalis flows is less in comparison to the conservation scenario. This outcome is due to these other two source options removing less return flows from the San Joaquin River.

With the transfer, during the VAMP pulse flow period (mid-April through mid-May) the "existing flow" condition (as defined by the SJRA) may be slightly lower. The flow at Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

Water quality at Vernalis would also change due to the transfer. Table 4-25 shows the change in Vernalis water quality resulting from the transfers under each source scenario. The table also illustrates the assumed existing condition/No Action Alternative water quality condition at Vernalis.

Table 4-25
Vernalis Water Quality Conditions – Alternative A, Out-of-Basin Transfer

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

A-1-3-C: 80 CONSERVATION OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	-2	-1	-2	-3	-3	-4	-5	-5	-2	0	0	0	0
Above Normal	-1	-3	-2	-4	-7	-14	-7	-6	-6	-3	0	0	0	0
Below Normal	-1	-8	-2	-6	-9	0	0	0	-6	-3	0	0	0	0
Dry	-1	-10	0	-	-	0	0	0	-6	-3	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

A-2-3-C: 80 GROUNDWATER OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1	1	1	1	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Dry	0	0	0	-	-	0	0	0	1	0	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

A-3-3-C: 80 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	-1	0	0	0	-2	0	0	1	0	0	0	0	0
Below Normal	0	-2	0	0	0	0	0	0	1	0	0	0	0	0
Dry	0	-3	0	-	-	0	0	0	1	0	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

Water quality changes at Vernalis trend with the removal (reduction in return flows) of water within the river system. The development of the transfer water by the Exchange Contractors would remove flow in the river, typically with a quality worse than the existing condition/No Action Alternative water quality at Vernalis. During periods when the water quality objective is assumed to control New Melones releases (indicated by the 700 and 1000 µS/cm values in Table 4-25), no change in water quality would occur due to the anticipated counteraction at New Melones Reservoir for transfer-related San Joaquin River flow and quality changes. During other

periods, the estimated change in water quality would be an improvement, if not a nearly neutral effect in quality. The transfer would not cause any additional noncompliance instances at Vernalis.

New Melones Reservoir Water Supply/Operation. The flow and quality effects of the transfer to the San Joaquin River upstream of the Stanislaus River could trigger a change in releases from New Melones Reservoir to counter such effects. The potential changes in the net releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are illustrated in Table 4-26. The values are depicted as a change in New Melones Reservoir storage, and are directly representative of flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-26
Storage Change in New Melones Reservoir – Alternative A, Out-of-Basin Transfer

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

A-1-3-C: 80 CONSERVATION OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-2685	0	0	0	0	0	0	0	0	-2685
Below Normal	0	-1054	0	0	0	677	524	487	0	0	0	0	0	-41	593
Dry	0	-1054	118	701	804	677	524	546	0	0	0	0	0	-41	2275
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

A-2-3-C: 80 GROUNDWATER OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-401	0	0	0	0	0	0	0	0	-401
Below Normal	0	0	0	0	0	-136	-276	-163	0	0	0	0	0	-41	-616
Dry	0	0	-17	-17	-40	-136	-276	-105	0	0	0	0	0	-41	-631
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

A-3-3-C: 80 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-606	0	0	0	0	0	0	0	0	-606
Below Normal	0	-255	0	0	0	-63	-178	-94	0	0	0	0	0	-41	-631
Dry	0	-255	-4	-14	-35	-63	-178	-35	0	0	0	0	0	-41	-626
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

The changes in storage shown in Table 4-26 indicate the changes that would be required to maintain Vernalis flow and quality conditions exactly at the Vernalis objective compliance level. When a reduction in flow is calculated, the reduction may not actually be allowed because another release objective may require the continuation of some level of that release. Modeling limitations did not allow the identification of such circumstances. Accumulated changes in New Melones Reservoir storage vary by year type and source option.

Changing releases from New Melones Reservoir would change the flow rate in the Lower Stanislaus River. The potential change in flow ranges from a reduction of up to 13 cfs during March through August (during dry years, and intermittent months in other years) to an increase of up to 45 cfs during June (during above normal years).

An indirect impact that may result from a change in New Melones Reservoir operations would be the allocation of water to uses within the Interim Plan of Operations, including impacts to water users and fish and water quality purposes. For this out-of-basin transfer scenario, the estimated change in storage at New Melones Reservoir in a year could range between a gain of over 2,000 acre-feet (during a dry year for the conservation scenario) to a decrease in storage almost 2,700 acre-feet (during an above normal year for the conservation scenario).

Delta Supply. The transfer program could affect inflows to the Delta from the San Joaquin River. At different times the change in inflow could increase, decrease, or be neutral to the CVP/SWP water supplies. The total net Delta water supply balance to the CVP/SWP is shown in Table 4-27.

Table 4-27
Delta CVP/SWP Water Supply Effect – Alternative A, Out-of-Basin Transfer

Incremental Change in Project Delta Supply due to Action - Acre-feet

A-1-3-C: 80 CONSERVATION OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-369	0	0	0	0	-2863	-2710	0	0	0	0	0	-14	-5956
Above Normal	0	-369	0	0	0	0	-2863	-2710	0	0	0	0	0	-14	-5956
Below Normal	0	0	0	0	0	-3363	-3387	-3196	0	0	0	0	0	0	-9946
Dry	0	0	-428	-592	-3427	-3363	-3387	-3255	-1964	-1126	0	0	0	0	-17542
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

A-2-3-C: 80 GROUNDWATER OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	-578	-425	0	0	0	0	0	-14	-1017
Above Normal	0	0	0	0	0	0	-578	-425	0	0	0	0	0	-14	-1017
Below Normal	0	0	0	0	0	-265	-302	-262	0	0	0	0	0	0	-829
Dry	0	0	-12	-33	-297	-265	-302	-320	-558	-242	0	0	0	0	-2031
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

A-3-3-C: 80 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-89	0	0	0	0	-856	-670	0	0	0	0	0	-14	-1629
Above Normal	0	-89	0	0	0	0	-856	-670	0	0	0	0	0	-14	-1629
Below Normal	0	0	0	0	0	-543	-677	-576	0	0	0	0	0	0	-1796
Dry	0	0	-51	-35	-316	-543	-677	-635	-577	-242	0	0	0	0	-3076
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

For the conservation scenario, a net decrease in supply is shown for each year. The decrease in net supply ranges from about 4,600 acre-feet in a critical year to more than 17,000 acre-feet during a below normal year. Within the other source scenarios the maximum potential effect of the transfer is less than 4,600 acre-feet (all source scenarios have the same critical year program utilizing crop idling/temporary land fallowing). These changes would occur due to the development of the transfer water and the indirect action of Reclamation acquiring additional supplies for wildlife area deliveries, and are compounded by the New Melones Reservoir reaction to changes in the river system. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP.

Summary of Combined Effects Among Alternative A Scenarios

All scenarios of Alternative A would cause changes to flows at Vernalis. Decreases in flows would generally occur year-round with the conservation scenario except during August when deliveries to wildlife areas may create additional runoff that exceeds the reduction in flow caused by tailwater recover. However, the changes to flow are small relative to the total flow, less than 5 percent. For the groundwater and crop idling/temporary land fallowing scenarios, the change in flow at Vernalis is almost neutral, or a gain, regardless of the location of transfer water use (disposition). Only minor changes to water quality occur at Vernalis under any source or disposition combination.

The potential change in New Melones Reservoir storage and releases to the lower Stanislaus River is variable. The range in variability is less within the agricultural and out-of-basin

disposition scenarios. Deliveries to in-basin wildlife areas using conservation typically result in the potential for reductions to New Melones Reservoir storage. The conservation scenario with delivery to the refuges produces the largest change, over 5,000 acre-feet reduction in storage during a critical year. The other combinations of source and disposition lead to smaller changes and generally gains in storage or a relatively low potential of decreased storage. The potential effect on water supply allocations under the Interim Plan of Operations would also vary in relation to the accumulated change in New Melones Reservoir storage.

The potential CVP/SWP Delta supply effect is also variable by year type, supply source and disposition. Generally, utilizing conservation results in the greatest exposure to decreases in CVP/SWP Delta supplies. Transferring water out-of-basin also typically results in exposure to a decrease in CVP/SWP Delta supplies. In-basin utilization of transfers developed from groundwater or crop idling/land fallowing typically leads to increases in CVP/SWP Delta supplies.

4.2.2.3 Alternative B: 50,000 Acre-Feet

Alternative B consists of a smaller, unique program utilizing only crop idling/temporary land fallowing as the source of transfer supply. For this alternative, the Exchange Contractors would provide up to 50,000 acre-feet of water during both noncritical and critical years through crop idling/temporary land fallowing. The Exchange Contractors would use crop idling/temporary land fallowing as the means to reduce their need for delivery of CVP substitute water. The reduction in delivery to the Exchange Contractors would be provided to any of the potential transferees.

Detailed results for this alternative are provided in Appendix B. Results of the analysis are described below.

4.2.2.3.1 Hydrologic Effects Due to Water Development

Only the crop idling/temporary land fallowing method of developing transfer water is evaluated in this alternative. For the crop idling/temporary land fallowing scenario, the Exchange Contractors would develop 50,000 acre-feet of water for transfer during all year types. The effect on San Joaquin River hydrology occurs as irrigated acres are reduced due to crop idling/temporary land fallowing and less runoff would occur. Of the 50,000 acre-feet to be developed, 42,000 acre-feet are assumed to have hydraulic connection with the San Joaquin River and the other 8,000 acre-feet are assumed to be associated with lands that do not have drainage to the San Joaquin River that affects Vernalis flows. Simulated hydrologic effects at Vernalis resulting from this scenario in each year type are shown in Table 4-28, which also includes the assumed existing condition/No Action Vernalis flows.

For each acre-foot of water developed, only a small amount of water is removed from the river. Therefore, this alternative results in a relatively small effect to Vernalis flows. This analysis assumes cotton to be representative of the crop fallowed, and therefore, the effect has a pattern associated with its irrigation.

Table 4-28
Vernalis Flow Conditions – Alternative B Water Development

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

B-3-0-S: 50 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-3	-14	-5	0	-1	-11	-14	-12	-1	0	0	0	0	0
Above Normal	-3	-14	-5	0	-1	0	-14	-12	-1	0	0	0	0	0
Below Normal	-3	0	-5	0	-1	-14	-19	-16	-1	0	0	0	0	0
Dry	-3	0	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

Certain months (e.g., June of an above-normal year and February in below normal and dry years) show no change in flow. This is due to the New Melones Reservoir releases required to meet flow or water quality criteria at Vernalis. During certain other months, when New Melones Reservoir operations are maintaining required water quality conditions at Vernalis, the flow change at Vernalis is the combination of both the effects of the Exchange Contractors developing the transfer water and the counteraction by New Melones Reservoir releases to maintain the water quality conditions at Vernalis.

Water quality at Vernalis may also change due to the development of transfer water by the Exchange Contractors. Table 4-29 shows the change in water quality at Vernalis for Alternative B.

Table 4-29
Vernalis Water Quality Conditions – Alternative B Water Development

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

B-3-0-S: 50 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-1	0	0	0	-1	-2	-2	0	0	0	0	0	0
Above Normal	-1	-2	-1	0	0	-4	-3	-2	0	0	0	0	0	0
Below Normal	-1	-6	-1	0	0	0	0	0	0	0	0	0	0	0
Dry	-1	-8	0	-	-	0	0	0	0	0	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

Water quality changes at Vernalis trend with the changes in flow at Vernalis. The water quality associated with the flows affected by crop idling/temporary land fallowing is assumed to have the same water quality as tailwater recapture. Since this quality is worse than the melded water quality at Vernalis, the removal of runoff by the Exchange Contractors would improve water

quality at Vernalis. For those months with no change in water quality but with a change in flow, New Melones Reservoir releases are maintaining the water quality requirement at Vernalis.

New Melones Reservoir operations may be affected by the Exchange Contractors' development of transfer water due to the linkage between its operations and San Joaquin River conditions. The potential changes in the net releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are shown in Table 4-30. The values are depicted as a change in New Melones Reservoir storage, and are directly related to changes in flow to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-30
Change in Storage in New Melones Reservoir – Alternative B Water Development

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

B-3-0-S: 50 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-626	0	0	0	0	0	0	0	0	-626
Below Normal	0	-779	0	0	0	223	297	213	0	0	0	0	0	0	-47
Dry	0	-779	39	8	15	223	297	213	0	0	0	0	0	0	15
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

The changes shown in Table 4-30 indicate the releases from New Melones that would be required to counter the effect of developing the transfer water on maintaining Vernalis flow and quality conditions exactly at the Vernalis objective compliance level. Accumulated changes in New Melones Reservoir storage vary by year type, but the change in storage within a year is less than 1,200 acre-feet, positive or negative. However, when a reduction in flow is calculated, the reduction may not actually be allowed because another release objective may require the continuation of some level of that release. Modeling limitations did not allow the identification of such circumstances. The potential change in flow to the lower Stanislaus River mirror the changes in the New Melones storage. The change in flow ranges from an increase of 14 cfs during February (during below normal and dry years, for flow objective at Vernalis) to a decrease of up to 7 cfs during February during a critical year.

The Exchange Contractors' development of transfer water could affect inflows to the Delta from the San Joaquin River. The total net Delta water supply balance to the CVP/SWP is shown in Table 4-31.

Table 4-31
Delta CVP/SWP Water Supply Effect – Alternative B Water Development

Incremental Change in Project Delta Supply due to Action - Acre-feet

B-3-0-S: 50 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	
Wet	0	-273	0	0	0	0	-849	-748	0	0	0	0	0	0	-1869
Above Normal	0	-273	0	0	0	0	-849	-748	0	0	0	0	0	0	-1869
Below Normal	0	0	0	0	0	-849	-1146	-960	0	0	0	0	0	0	-2955
Dry	0	0	-120	-6	-55	-849	-1146	-960	-58	0	0	0	0	0	-3194
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

The decrease in net supply ranges from about 1,900 acre-feet in a wet and above normal year, to more than 4,600 acre-feet during a critical year. These changes occur due to the development of

the transfer water and also include counteractions in New Melones Reservoir releases in reaction to changes in the river system.

Summary of Water Development Effects Among Alternative B Scenarios

Flows in the San Joaquin River at Vernalis would be reduced by development of transfer water through crop idling/temporary land fallowing. The reduction is minor, less than 2 percent in any month. Water quality at Vernalis improves slightly.

This alternative would have a minor effect on storage in New Melones Reservoir (and commensurately Goodwin releases to the Stanislaus River). Storage could change within a range of plus or minus 1,200 acre-feet. The Delta supply for the CVP/SWP may be slightly reduced but by a minor amount, less than 5,000 acre-feet.

4.2.2.3.2 Hydrologic Effects Due to Combined Water Development and Transfer

In addition to the hydrologic effects that occur due to the development of the transfer water by the Exchange Contractors through crop idling/temporary land fallowing, additional hydrologic effects would occur from the disposition of that water to transferees. Also, Reclamation may respond, relative to the existing condition/No Action setting, in reaction to the Exchange Contractors providing transfer water to the San Joaquin Valley wildlife areas. Such a response may be a reduction in water acquisitions from other entities in favor of the transfer of water from the Exchange Contractors. The results presented in this section illustrate the combination of the direct hydrologic effects of the development of transfer water by the Exchange Contractors and the additional indirect effects that result from the circumstances just described. The effects are illustrated by category of transfer disposition.

All Water to Refuges

These refuge focus scenarios would result in up to a 50,000 acre-foot transfer to wildlife areas in all years, generally from an irrigation delivery pattern to one consistent with wildlife area requirements. Water would be delivered to the San Joaquin Valley wildlife areas through the Delta-Mendota Canal, SWP facilities, local conveyance facilities, or delivery exchange agreements.

Water may be delivered to wildlife areas within or outside of the San Joaquin River drainage basin. For deliveries to areas within the drainage basin (the subject of this section), a change in San Joaquin River flows and quality would occur. The change would be due to the Exchange Contractors developing the transfer water (direct effects illustrated above) and as the result of the wildlife areas' use and management of the transfer water. Other indirect effects would occur due to Reclamation changing its acquisitions from entities other than the Exchange Contractors. With a transfer from the Exchange Contractors to Reclamation for delivery to wildlife areas, an incremental delivery of 17,823 acre-feet of Incremental Level 4 supply would occur to wildlife areas in the drainage of the San Joaquin River during noncritical years. During critical years, an incremental delivery of 40,000 acre-feet (50,000 acre-feet of developed water, reduced 20 percent for conveyance losses) would be delivered to wildlife areas.

Consumptive Use. When water is developed by the Exchange Contractors through crop idling/temporary land fallowing, a decrease in the Exchange Contractors' consumptive use

would occur. Up to 50,000 acre-feet of water would be developed by this alternative by reducing the amount of acreage farmed in the Exchange Contractors service area.

For the wildlife areas, a majority of the transfer would be depleted by an increase in consumptive use in the refuges. The remainder would become runoff, discharged to the San Joaquin River.

Vernalis. The refuge focus scenario would provide additional water deliveries to San Joaquin Valley wildlife areas that discharge to the San Joaquin River. Hydrologic effects at Vernalis resulting from this scenario are shown in Table 4-32, which also shows the baseline flows. Changes in average monthly flows at Vernalis range from an increase of almost 200 cfs (during August in a critical year) to a decrease of about 20 cfs. The changes in flow reflect the net effect of incremental runoff from the wildlife area transferees during August and subsequent fall and winter months and the slight depletion of flow during agricultural irrigation season as a result of reduced return flows associated with the reduction of irrigated acreage. During February of dry and below normal years and June of an above normal year, New Melones Reservoir reacts to flow changes caused by the transfers to maintain the Vernalis flow at the controlling flow objective. During all but wet years the flow at Vernalis is also at times affected by changes in water quality releases from New Melones Reservoir.

Table 4-32
Vernalis Flow Conditions – Alternative B, Refuge Focus

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

B-3-1-C: 50 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-3	-14	-5	-3	-5	-16	-22	31	-6	-4	4	1	3	4
Above Normal	-3	-14	-5	-3	-5	0	-22	31	-6	-4	4	1	3	4
Below Normal	-3	0	-5	-3	-5	-18	-23	76	-6	-4	4	1	3	0
Dry	-3	0	-5	-3	-5	-18	-23	76	-6	-4	4	1	3	0
Critical	-3	-21	-2	0	-1	-14	-19	199	5	-1	11	2	8	15

With the transfer, during the VAMP pulse flow period (mid-April through mid-May), the "existing flow" condition (as defined by the SJRA) may be slightly lower than in the existing condition/No Action Alternative setting. The flow at Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

Water quality at Vernalis would also change due to the transfer. Table 4-33 shows the change in Vernalis water quality that would result from the transfers for this alternative. The table also shows the assumed existing condition/No Project Alternative water quality condition at Vernalis.

Water quality changes at Vernalis trend with the net addition (runoff) and removal (reduction in return flows) of water within the river system. Deliveries to the wildlife areas would result in return flows to the river with worse quality than the water quality at Vernalis. The development of the transfer water by the Exchange Contractors would remove a minor amount of flow in the river, also with a quality worse than the water quality at Vernalis. During periods when the pre-transfer water quality objective is assumed to control New Melones releases (indicated by the

700 and 1,000 µS/cm values in Table 4-33) no change in water quality would occur since it was assumed that Reclamation would mitigate increases with releases from New Melones Reservoir for transfer-related San Joaquin River flow and quality changes. During other periods, the estimated change in water quality could change within a range of minor improvement (8 µS/cm) to 17 µS/cm degradation.

Table 4-33
Vernalis Water Quality Conditions – Alternative B, Refuge Focus

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

B-3-1-C: 50 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-1	0	0	0	-1	-2	12	1	0	1	0	0	0
Above Normal	-1	-2	0	0	0	-5	-2	17	1	0	1	0	0	1
Below Normal	-1	-6	0	0	0	0	0	0	2	0	1	0	1	2
Dry	-1	-8	0	0	0	0	0	0	1	0	1	0	1	2
Critical	-2	0	0	0	0	0	0	0	2	0	3	0	1	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

Although the water quality at Vernalis may at times be degraded as a result of the transfer, it is anticipated that Reclamation would operate New Melones Reservoir to continue to comply with water quality objectives consistent with past practice. Therefore, the transfer would not cause any additional noncompliance instances.

New Melones Reservoir Water Supply/Operation. New Melones Reservoir operations may be affected by the transfers due to the linkage between its operations and San Joaquin River conditions. The potential changes in storage in New Melones Reservoir are shown in Table 4-34. The values are directly related to flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-34
Change in Storage in New Melones Reservoir – Alternative B, Refuge Focus

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

B-3-1-C: 50 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-968	0	0	0	0	0	0	0	0	-968
Below Normal	0	-779	0	0	0	107	62	-2788	0	0	0	0	0	218	-3180
Dry	0	-779	-36	-16	-19	107	62	-2738	0	0	0	0	0	218	-3200
Critical	0	386	-97	-12	15	223	297	-6209	0	0	0	0	0	-267	-5665

The changes shown in Table 4-34 indicate the releases from New Melones that would be required to counter the effect of developing the transfer water on maintaining Vernalis flow and quality conditions exactly at the Vernalis objective compliance level. Accumulated changes in

New Melones Reservoir storage vary in magnitude by year type, but the reduction in storage within a year is less than 6,000 acre-feet. However, when a reduction in flow is calculated, the reduction may not actually be allowed because another release objective may require the continuation of some level of that release. Modeling limitations did not allow the identification of such circumstances. The potential change in flow to the lower Stanislaus River mirror the changes in the New Melones storage. The change in flow ranges from an increase of 101 cfs during August for water quality purposes to a decrease of up to 7 cfs during February.

An indirect impact that may result from a change in New Melones Reservoir operations is the allocation of water to uses within the Interim Plan of Operations, including impacts to water users and use of water for fish and water quality purposes. For this refuge focus scenario, the estimated reduction in storage at New Melones Reservoir in a year ranges from zero in a wet year to less than 6,000 acre-feet. The majority of the effect of a change in New Melones Reservoir storage would not be realized during the current year of the transfer, but instead during the subsequent year or years when water supply allocations are subsequently determined. If the following year is dry, the previous year's effect in storage would translate to relatively small allocation changes to lower Stanislaus River purposes and potentially no change in allocations to CVP contractors. If the following year is normal or wetter, more noticeable changes to allocations would occur. In the wettest of conditions, allocations would not change.

Delta Supply. The transfer program could affect inflows to the Delta from the San Joaquin River. The total net Delta water supply balance to the CVP/SWP is shown in Table 4-35.

Table 4-35
Delta CVP/SWP Water Supply Effect – Alternative B, Refuge Focus

Incremental Change in Project Delta Supply due to Action - Acre-feet

B-3-1-C: 50 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	
Wet	0	-273	0	0	0	0	-1341	1916	0	0	0	0	0	76	379
Above Normal	0	-273	0	0	0	0	-1341	1916	0	0	0	0	0	76	379
Below Normal	0	0	0	0	0	-1075	-1403	4704	0	0	0	0	0	0	2226
Dry	0	0	-97	-31	-309	-1075	-1403	4654	-368	-223	0	0	0	0	1149
Critical	0	-1165	-131	4	-55	-849	-1146	12252	312	-39	634	0	0	834	10650

For this alternative, a net increase in supply is shown for each year ranging from a slight increase (379 acre-feet) in wet and above normal years to over 10,000 acre-feet in a critical year. These changes would occur not only due to the development and disposition of the transfer water, but also due to the New Melones Reservoir reaction to changes in the river system. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP.

All Water to Agriculture

Each year this agriculture focus scenario would result in up to 50,000 acre-feet of transfer water being provided to CVP agricultural contractors that drain to the San Joaquin River. The water transferred to agricultural users would essentially exchange the delivery of water from the Exchange Contractors to a CVP agricultural contractor. For water transferred to in-basin agricultural users, the San Joaquin River, New Melones Reservoir, and Delta inflows would be affected as the result of changes in return flows from the Exchange Contractors and the

transferees. Indirect effects would also occur due to Reclamation acquiring water for delivery to wildlife areas from entities other than the Exchange Contractors.

Consumptive Use. When water is developed by the Exchange Contractors through crop idling/temporary land fallowing, a decrease in their consumptive use would occur.

If the transferred water is used by the transferee to replace pumped groundwater, no overall increase in consumptive use would occur by the transferee, only a trade-off of one source for another would occur. However, if the transferred water is used to either irrigate land that would have been left fallow due to lack of water supply or to increase the application rate on existing irrigated lands, an increase would occur in consumptive use for the water purchaser. This increase should be on the same order as the decrease in consumptive use by the Exchange Contractors. This latter scenario represents an increase in crop consumptive use by the affected districts; however, the amount of CVP water use would remain unchanged.

Vernalis. This scenario would provide additional water deliveries to San Joaquin Valley CVP agricultural contractors that discharge to the San Joaquin River. Table 4-36 shows the predicted changes to flows at Vernalis that may occur as a result of this scenario. The changes are minor, less than 2 percent of existing flows.

Table 4-36
Vernalis Flow Conditions – Alternative B, Agricultural Water

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

B-3-2-C: 50 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-3	-14	-5	1	2	-7	-9	-9	4	2	1	0	0	0
Above Normal	-3	-14	-5	1	2	0	-9	-9	4	2	1	0	0	0
Below Normal	-3	0	-5	1	2	-12	-16	-14	4	2	1	0	0	0
Dry	-3	0	-5	1	1	-12	-16	-13	4	2	1	0	0	0
Critical	-3	-21	-4	5	7	-5	-5	-5	13	6	2	0	1	1

Crop idling/land fallowing is the only source of water for this alternative. The change in flow occurs due to reduced return flows from fallowed acreage and the addition of return flows from the transferees. Also included is the effect of Reclamation acquiring water supplies from other entities than the Exchange Contractors to provide deliveries to the wildlife areas. The net effect upon flow at Vernalis is positive in some months and negative in other months, all depending upon the timing of return flows from each component. The change in flow ranges from an increase of 13 cfs to a decrease of 21 cfs. The flow effects include the counteraction of New Melones Reservoir releases when its operations are reacting to Vernalis flow and water quality requirements.

With the transfer, during the VAMP pulse flow period (mid-April through mid-May), the "existing flow" condition would likely be almost neutral to the pre-transfer condition. The flow at Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

Water quality changes at Vernalis are shown in Table 4-37 and include the net effect of developing transfer water by the Exchange Contractors and disposing the transfer water to agricultural contractors that discharge to the San Joaquin River. The net effect also includes the effect of Reclamation acquiring water from agricultural contractors for delivery to wildlife areas. Water developed through this scenario would result in removal of return flows to the river of a quality worse than that assumed to be returned. The effects to water quality are minor.

The effects upon water quality include the counteraction of New Melones Reservoir release operations during periods when water quality and flow objectives at Vernalis are controlling.

Table 4-37
Vernalis Water Quality Conditions – Alternative B, Agriculture Focus

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

B-3-2-C: 50 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-1	0	0	0	-1	-2	-2	0	0	0	0	0	0
Above Normal	-1	-2	-1	0	0	-3	-3	-2	-1	0	0	0	0	0
Below Normal	-1	-6	-1	0	0	0	0	0	-1	0	0	0	0	0
Dry	-1	-8	0	0	0	0	0	0	-1	0	0	0	0	0
Critical	-2	0	0	0	0	0	0	0	-1	0	0	0	0	0

New Melones Reservoir Water Supply/Operations. Changes in flow and/or water quality in the San Joaquin River may result in changes to releases from New Melones Reservoir. The potential changes in storage in New Melones Reservoir due to the changes in releases are shown in Table 4-38. The values are directly related to flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-38
Storage/Flow Change in New Melones Reservoir – Alternative B, Agriculture Focus

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

B-3-2-C: 50 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-431	0	0	0	0	0	0	0	0	-431
Below Normal	0	-779	0	0	0	289	432	293	0	0	0	0	0	20	254
Dry	0	-779	47	17	35	289	432	264	0	0	0	0	0	20	323
Critical	0	386	47	-12	30	260	350	223	0	0	0	0	0	14	1296

The changes shown in Table 4-38 indicate the releases from New Melones that would be required to counter the effect of developing the transfer water on maintaining Vernalis flow and quality conditions exactly at the Vernalis objective compliance level. Accumulated changes in New Melones Reservoir storage vary by year type, but the change in storage within a year is less than 1,300 acre-feet, positive or negative. The potential change in flow to the lower Stanislaus River mirror the changes in the New Melones storage. The changes in flow range from an increase of 14 cfs during February to a decrease of up to 7 cfs during July. However, when a reduction in flow is calculated, the reduction may not actually be allowed because another

release objective may require the continuation of some level of that release. Modeling limitations did not allow the identification of such circumstances.

An indirect impact that may result from a change in New Melones Reservoir operations is the allocation of water to uses within the Interim Plan of Operations, including impacts to water users and for fish and water quality purposes. For this agriculture focus scenario, the estimated reduction in storage at New Melones Reservoir in a year ranges from zero in a wet year to a decrease of 431 acre-feet in an above normal year to an increase of over 1,200 acre-feet during a critical year. The majority of the effect of a change in New Melones Reservoir storage would not be realized during the current year of the transfer, but instead during the subsequent year or years when water supply allocations are subsequently determined. If the following year is dry, the previous year's effect in storage would translate to relatively small allocation changes to lower Stanislaus River purposes and potentially no change in allocations to CVP contractors. If the following year is normal or wetter, more noticeable changes to allocations would occur. In the wettest of conditions, allocations would not change.

Delta Supply. The transfer program could affect inflows to the Delta from the San Joaquin River. The net change to Delta water supply balance to the CVP/SWP is shown in Table 4-39.

Table 4-39
Delta CVP/SWP Water Supply Effect – Alternative B, Agriculture Focus

Incremental Change in Project Delta Supply due to Action - Acre-feet

B-3-2-C: 50 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	
Wet	0	-273	0	0	0	0	-566	-540	0	0	0	0	0	7	-1372
Above Normal	0	-273	0	0	0	0	-566	-540	0	0	0	0	0	7	-1372
Below Normal	0	0	0	0	0	-720	-998	-833	0	0	0	0	0	0	-2550
Dry	0	0	-114	10	90	-720	-998	-804	215	118	0	0	0	0	-2202
Critical	0	-1165	-273	325	432	-289	-338	-337	773	372	100	0	0	47	-354

For this alternative, a net decrease in supply is shown for each year ranging from a slight decrease (354 acre-feet) in a critical year to over 2,500 acre-feet in a below normal year. These changes would occur not only due to the development and disposition of the transfer water, but also due to the New Melones Reservoir reaction to changes in the river system. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP. These changes in CVP/SWP Delta supply are minor.

All Water Transferred Out of Basin

This out-of-basin scenario provides up to 50,000 acre-feet of water each year to uses (any combination of wildlife areas, agriculture, and urban) occurring outside the drainage of the San Joaquin River. These uses could include deliveries to the two refuges that are not hydraulically connected to the San Joaquin River, Pixley and Kern NWRs (located in the Tulare Lake Basin), SCVWD and SBCWD (located in the San Felipe Division), CVP water contractors of the Friant Division, and the Cross-Valley Contractors of the CVP.

Vernalis. This scenario would provide additional water deliveries to areas that do not directly discharge surface water to the San Joaquin River. Simulated hydrologic effects at Vernalis resulting from this scenario are shown in Table 4-40, which also shows the existing condition/No Action Alternative Vernalis flows. The effect is due to the reduced return flows from the fallowed areas and the reduction of return flows from entities providing water to Reclamation to serve the wildlife areas. Simulated flow changes at Vernalis range from no change to a decrease of 24 cfs (July). The flow effects include the counteraction of New Melones Reservoir releases when its operations are reacting to Vernalis flow and water quality requirements. The maximum changes are less than 2 percent of the baseline flows.

Table 4-40
Vernalis Flow Conditions – Alternative B, Out-of-Basin Transfer

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

B-3-3-C: 50 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-3	-14	-6	-4	-6	-17	-23	-19	-10	-4	-1	0	0	-1
Above Normal	-3	-14	-6	-4	-6	0	-23	-19	-10	-4	-1	0	0	-1
Below Normal	-3	0	-6	-4	-6	-19	-24	-20	-10	-4	-1	0	0	0
Dry	-3	0	-6	-4	-6	-19	-24	-21	-10	-4	-1	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

With the transfer, during the VAMP pulse flow period (mid-April through mid-May), the "existing flow" condition would likely be almost neutral to the pre-transfer condition. The flow at Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

Water quality at Vernalis would also change due to the transfer. Table 4-41 shows the change in Vernalis water quality resulting from the transfers with this source option. The table also shows the assumed existing condition/No Action Alternative water quality condition at Vernalis.

The slight water quality changes at Vernalis trend with the removal (reduction in return flows) of water within the river system. The development of the transfer water by the Exchange Contractors would remove flow in the river, typically with a quality worse than the pre-transfer water quality at Vernalis. The decreases in return flow associated with Reclamation acquiring water for delivery to the wildlife areas have a quality typically better than the melded water quality at Vernalis. During periods when the water quality objective is assumed to control New Melones releases (indicated by the 700 and 1,000 µS/cm values in Table 4-41), no change in water quality would occur due to the anticipated compensation at New Melones Reservoir for transfer-related San Joaquin River flow and quality changes. During other periods, the estimated change in water quality would be a minor improvement in quality. The transfer would not cause any additional noncompliance instances at Vernalis.

Table 4-41
Vernalis Water Quality Conditions – Alternative B, Out-of-Basin Transfer

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

B-3-3-C: 50 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-1	0	0	0	-1	-2	-1	0	0	0	0	0	0
Above Normal	-1	-2	-1	0	0	-5	-2	-2	1	0	0	0	0	0
Below Normal	-1	-6	-1	0	0	0	0	0	1	0	0	0	0	0
Dry	-1	-8	0	0	0	0	0	0	1	0	0	0	0	0
Critical	-2	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

New Melones Reservoir Water Supply/Operation. The flow and quality effects of the transfer to the San Joaquin River upstream of the Stanislaus River could trigger a change in releases from New Melones Reservoir to counter such effects. The changes in storage in New Melones Reservoir due to these releases are shown in Table 4-42. The values are directly related to changes in flow to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-42
Change in Storage in New Melones Reservoir, Alternative B, Out-of-Basin Transfer

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

B-3-3-C: 50 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1027	0	0	0	0	0	0	0	0	-1027
Below Normal	0	-779	0	0	0	87	21	49	0	0	0	0	0	-41	-662
Dry	0	-779	22	-9	-25	87	21	108	0	0	0	0	0	-41	-616
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

The changes shown in Table 4-42 indicate the releases from New Melones that would be required to counter the effect of developing the transfer water on maintaining Vernalis flow and quality conditions exactly at the Vernalis objective compliance level. Accumulated changes in New Melones Reservoir storage vary by year type but the change in storage within a year is less than 1,200 acre-feet, positive or negative. However, when a reduction in flow is calculated, the reduction may not actually be allowed because another release objective may require the continuation of some level of that release. Modeling limitations did not allow the identification of such circumstances. The potential change in flow to the lower Stanislaus River mirror the changes in the New Melones storage. The changes in flow range from an increase of 17 cfs during June to a decrease of up to 7 cfs during February.

An indirect impact that may result from a change in New Melones Reservoir operations is the allocation of water to uses within the Interim Plan of Operations, including impacts to water

users and the use of water for fish and water quality purposes. For this scenario, the estimated change in storage at New Melones Reservoir in a year could range between a minor gain of over 1,000 acre-feet (during a critical year) to a decrease in storage of about 1,000 acre-feet during an above normal year. The effect to water supply allocations would be minor.

Delta Supply. The transfer program could affect inflows to the Delta from the San Joaquin River. The net change in Delta water supply balance to the CVP/SWP is shown in Table 4-43.

Table 4-43
Delta CVP/SWP Water Supply Effect – Alternative B, Out-of-Basin Transfer

Incremental Change in Project Delta Supply due to Action - Acre-feet

B-3-3-C: 50 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	
Wet	0	-273	0	0	0	0	-1427	-1173	0	0	0	0	0	-14	-2886
Above Normal	0	-273	0	0	0	0	-1427	-1173	0	0	0	0	0	-14	-2886
Below Normal	0	0	0	0	0	-1114	-1448	-1222	0	0	0	0	0	0	-3784
Dry	0	0	-132	-40	-353	-1114	-1448	-1281	-616	-242	0	0	0	0	-5225
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

For this out-of-basin scenario, a net decrease in supply is shown for each year. The decrease in net supply ranges from about 2,900 acre-feet in a wet year to about 5,200 acre-feet during a dry year. These changes occur due to the development of the transfer water and the acquisition by Reclamation of wildlife water, and are compounded by the New Melones Reservoir reaction to changes in the river system. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. These changes are minor relative to the CVP/SWP Delta water supply.

Summary of Combined Effects Among Alternative B Scenarios

All scenarios of this alternative would typically cause a reduction to flows at Vernalis, though they are minor and estimated to be less than 25 cfs. An exception is with the disposition of transfer water to the wildlife areas, where an increase in flow at Vernalis ranges from 30 to 200 cfs. This circumstance is primarily due to wildlife area return flows and the additional releases required from New Melones Reservoir to compensate for the additional loading associated with those flows.

None of the scenarios under Alternative B would result in a significant change in water quality at Vernalis. Water quality would be neutral to the existing condition/No Action Alternative setting when New Melones Reservoir reacts to changes in San Joaquin River water quality due to the transfers. Otherwise, water quality at Vernalis would slightly improve with the overall exception during August when water quality at Vernalis is not controlling New Melones Reservoir releases.

The potential change in New Melones Reservoir storage and releases to the lower Stanislaus River varies among the disposition scenarios. The effect at New Melones Reservoir is normally a decrease in storage when delivering transfer water to the wildlife areas. The other delivery scenarios have a varying effect upon storage, positive and negative depending upon year type. The potential for reductions to storage is smaller when delivering to agriculture or out-of-basin. The potential effect on water supply allocations under the Interim Plan of Operations would also vary in relation to the accumulated change in New Melones Reservoir storage.

The potential CVP/SWP Delta supply effect is almost always opposite to the effect at New Melones Reservoir. The CVP/SWP Delta supply shows an increase for the wildlife area delivery scenario and a small potential decrease in water supply for the other two delivery scenarios. The effect is minor.

4.2.2.4 Alternative C: 130,000 Acre-Feet

Alternative C would consist of up to 130,000 acre-feet of water being developed from all sources in noncritical years. This water would be developed through a variety of sources including up to 80,000 acre-feet from conservation/tailwater recovery, 20,000 acre-feet from groundwater substitution, and 50,000 acre-feet from crop idling/temporary land fallowing. The combination of conservation sources (including tailwater recovery) and groundwater substitution would not exceed 80,000 acre-feet. During critical years, up to 50,000 acre-feet of water would be developed from crop idling/temporary land fallowing. Water would be acquired from the Exchange Contractors, who would receive less substitute surface water directly from Reclamation. The transfer water would be provided to any of the potential transferees.

Detailed results for this alternative are provided in Appendix B. Three water delivery scenarios are discussed below: up to 80,000 acre-feet of water to the wildlife areas with the remaining water being delivered to agricultural contractors, all water to agriculture contractors, and all water to users outside of the San Joaquin River drainage basin.

4.2.2.4.1 Hydrologic Effects Due to Water Development

Three methods are proposed to develop water for transfer, conservation including tailwater recovery, groundwater substitution, and crop idling/temporary land fallowing. Each of these methods would have different effects, although sometimes no effect, upon San Joaquin River flows. In this alternative, up to 130,000 acre-feet of transfer water would be developed by the Exchange Contractors' action. The hydrologic effect to the San Joaquin River for a certain amount of this water is currently included in the existing condition/No Action Alternative setting, to which the full potential action is compared. In the existing condition/No Action Alternative setting the Exchange Contractors already develop this water either for existing transfers (existing condition) or are utilizing the developed water for their own internal purposes (No Action Alternative).

For the conservation scenario, the Exchange Contractors would increase their tailwater recapture efforts by 16,365 acre-feet during noncritical years to achieve 80,000 acre-feet of transfer water through conservation efforts. They would also develop 50,000 acre-feet of water through crop idling/temporary land fallowing, for a total developed transfer of 130,000 acre-feet in noncritical years. For the groundwater scenario, the Exchange Contractors will increase their groundwater substitution efforts by 10,365 acre-feet to reach 16,365 acre-feet of substitute groundwater pumping. This substitute groundwater pumping, supplemented with 63,635 acre-feet of conservation (existing condition/No Action Alternative) and 50,000 acre-feet of crop idling/temporary land fallowing develops 130,000 acre-feet in noncritical years. The crop idling/temporary land fallowing scenario is identical to the conservation scenario, maximizing crop idling/temporary land fallowing and then supplementing the program through conservation for a developed transfer of 130,000 acre-feet. During critical years, only the crop

idling/temporary land fallowing program is available, for a total of 50,000 acre-feet of developed water.

Simulated hydrologic effects at Vernalis resulting from each of these scenarios in each year type are shown in Table 4-44, which also shows the assumed existing condition/No Action Alternative Vernalis flows.

Table 4-44
Vernalis Flow Conditions – Alternative C Water Development

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

C-1-0-S: 130 CONSERVATION SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-5	-33	-22	-30	-38	-49	-51	-49	-25	-15	0	0	0	0
Above Normal	-5	-33	-22	-30	-38	0	-51	-49	-25	-15	0	0	0	0
Below Normal	-5	0	-22	-30	-38	-66	-69	-63	-25	-15	0	0	0	0
Dry	-5	0	-25	-42	-52	-66	-69	-63	-25	-15	0	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

C-2-0-S: 130 GROUNDWATER SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-3	-14	-5	0	-1	-11	-14	-12	-1	0	0	0	0	0
Above Normal	-3	-14	-5	0	-1	0	-14	-12	-1	0	0	0	0	0
Below Normal	-3	0	-5	0	-1	-14	-19	-16	-1	0	0	0	0	0
Dry	-3	0	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

C-3-0-S: 130 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-5	-33	-22	-30	-38	-49	-51	-49	-25	-15	0	0	0	0
Above Normal	-5	-33	-22	-30	-38	0	-51	-49	-25	-15	0	0	0	0
Below Normal	-5	0	-22	-30	-38	-66	-69	-63	-25	-15	0	0	0	0
Dry	-5	0	-25	-42	-52	-66	-69	-63	-25	-15	0	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

The effects of developing the water upon flows at Vernalis vary depending upon the source of the developed water and the year type. The conservation/crop idling/temporary land fallowing scenarios have a greater potential to affect Vernalis flows than the groundwater scenario. This is because there are no return flow effects from groundwater and increased pumping does not reduce return flows as is the case for conservation. Certain months (e.g., June of an above normal year and February in below normal and dry years) show no change in flow under any source scenario. This is due to the required Vernalis flow condition being maintained by New Melones Reservoir operations. During these months any change in San Joaquin River flows upstream of the Stanislaus River are assumed to be counteracted by a change in New Melones Reservoir releases. During certain other months, when New Melones Reservoir operations are maintaining required water quality conditions at Vernalis, the flow change at Vernalis is the combination of both the effects of the Exchange Contractors developing the transfer water and the counteraction by New Melones Reservoir releases to maintain the water quality conditions at Vernalis. During critical years, the effect is due to a crop idling/land fallowing program. For each of the water development scenarios, only crop idling/land fallowing is available during critical years.

Water quality at Vernalis may also change due to the development of transfer water by the Exchange Contractors. Table 4-45 shows the change in water quality at Vernalis associated with the development of each of the sources of transfer water.

Table 4-45
Vernalis Water Quality Conditions – Alternative C Water Development

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

C-1-0-S: 130 CONSERVATION SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-3	-1	-2	-3	-4	-6	-7	-6	-2	0	0	0	0
Above Normal	-1	-5	-2	-4	-7	-17	-10	-9	-8	-3	0	0	0	0
Below Normal	-2	-15	-3	-6	-8	0	0	0	-8	-3	0	0	0	0
Dry	-2	-18	0	-	-	0	0	0	-7	-3	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

C-2-0-S: 130 GROUNDWATER SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-1	0	0	0	-1	-2	-2	0	0	0	0	0	0
Above Normal	-1	-2	-1	0	0	-4	-3	-2	0	0	0	0	0	0
Below Normal	-1	-6	-1	0	0	0	0	0	0	0	0	0	0	0
Dry	-1	-8	0	0	0	0	0	0	0	0	0	0	0	0
Critical	-2	0	0	0	0	0	0	0	0	0	0	0	0	0

C-3-0-S: 130 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-3	-1	-2	-3	-4	-6	-7	-6	-2	0	0	0	0
Above Normal	-1	-5	-2	-4	-7	-17	-10	-9	-8	-3	0	0	0	0
Below Normal	-2	-15	-3	-6	-8	0	0	0	-8	-3	0	0	0	0
Dry	-2	-18	0	-	-	0	0	0	-7	-3	0	0	0	0
Critical	-2	0	0	-	-	0	0	0	0	0	0	0	0	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

Water quality changes at Vernalis trend with the changes in flow at Vernalis. The water quality of the Exchange Contractors' tailwater is typically worse than the melded quality of water at Vernalis. Therefore, the removal of tailwater by the Exchange Contractors would improve water quality at Vernalis. The crop idling/temporary land fallowing program is assumed to affect the same flows that are available for tailwater recapture. Water developed through groundwater has no affect upon San Joaquin River flow or quality; therefore water quality shows a smaller improvement through the groundwater source scenario. Several months during below normal, dry and critical years show no change in water quality although there is a change in flow. These are periods when New Melones Reservoir releases are maintaining the water quality requirement at Vernalis. A change in upstream flows and associated quality would be counteracted by releases from New Melones Reservoir to maintain the water quality requirement at Vernalis.

New Melones Reservoir operations may be affected by the Exchange Contractors' development of transfer water due to the linkage between its operations and San Joaquin River conditions. The potential changes in storage in New Melones Reservoir due to the releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are shown in Table 4-46. The values are directly related to flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-46
Storage/Flow Change in New Melones Reservoir – Alternative C Water Development

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

C-1-0-S: 130 CONSERVATION SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-2911	0	0	0	0	0	0	0	0	-2911
Below Normal	0	-1834	0	0	0	1036	1097	863	0	0	0	0	0	0	1161
Dry	0	-1834	173	726	860	1036	1097	863	0	0	0	0	0	0	2921
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

C-2-0-S: 130 GROUNDWATER SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-626	0	0	0	0	0	0	0	0	-626
Below Normal	0	-779	0	0	0	223	297	213	0	0	0	0	0	0	-47
Dry	0	-779	39	8	15	223	297	213	0	0	0	0	0	0	15
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

C-3-0-S: 130 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-2911	0	0	0	0	0	0	0	0	-2911
Below Normal	0	-1834	0	0	0	1036	1097	863	0	0	0	0	0	0	1161
Dry	0	-1834	173	726	860	1036	1097	863	0	0	0	0	0	0	2921
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

The changes shown in Table 4-46 indicate the releases from New Melones that would be required to counter the effect of developing the transfer water on maintaining Vernalis flow and quality conditions exactly at the Vernalis objective compliance level. Accumulated changes in New Melones Reservoir storage vary by year type, but the change in storage within a year is less than 3,000 acre-feet, positive or negative. The potential change in flow to the lower Stanislaus River mirror the changes in the New Melones storage. The changes in flow range from an increase of 49 cfs during June (during an above normal year, conservation/crop idling/land fallowing scenario) to a decrease of up to 18 cfs during July during dry and below normal years. However, when a reduction in flow is calculated, the reduction may not actually be allowed because another release objective may require the continuation of some level of that release. Modeling limitations did not allow the identification of such circumstances.

The majority of the effect of a change in New Melones Reservoir storage would not be realized during the current year of the transfer, but instead during the subsequent year or years when water supply allocations are subsequently determined. If the following year is dry, the previous year's effect in storage would translate to relatively small allocation changes to lower Stanislaus River purposes and potentially no change to allocations to CVP contractors. If the following year is normal or wetter, more noticeable changes to allocations would occur. In the wettest of conditions, allocations would not change.

The Exchange Contractors' development of transfer water could affect inflows to the Delta from the San Joaquin River. The change in net Delta water supply balance to the CVP/SWP is shown in Table 4-47.

For the each of the source scenarios a potential net decrease in CVP/SWP Delta supply is shown for each year type. The decrease in net supply ranges from more than 4,600 acre-feet in a critical year (common to each scenario because only crop idling/land fallowing occurs), to more than 18,000 acre-feet during a dry year. These changes occur due to the development of the transfer water and also include counteractions in New Melones Reservoir releases in reaction to changes in the river system. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. The combined net effect on the two

supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP. These changes are minor and should not affect water supplies from the CVP/SWP Delta in the year of the transfer but may affect carryover storage.

Table 4-47
Delta CVP/SWP Water Supply Effect – Alternative C Water Development

Incremental Change in Project Delta Supply due to Action - Acre-feet

C-1-0-S: 130 CONSERVATION SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-642	0	0	0	0	-3133	-3032	0	0	0	0	0	0	-6807
Above Normal	0	-642	0	0	0	0	-3133	-3032	0	0	0	0	0	0	-6807
Below Normal	0	0	0	0	0	-3947	-4230	-3895	0	0	0	0	0	0	-12072
Dry	0	0	-536	-565	-3185	-3947	-4230	-3895	-1464	-884	0	0	0	0	-18706
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

C-2-0-S: 130 GROUNDWATER SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-273	0	0	0	0	-849	-748	0	0	0	0	0	0	-1869
Above Normal	0	-273	0	0	0	0	-849	-748	0	0	0	0	0	0	-1869
Below Normal	0	0	0	0	0	-849	-1146	-960	0	0	0	0	0	0	-2955
Dry	0	0	-120	-6	-55	-849	-1146	-960	-58	0	0	0	0	0	-3194
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

C-3-0-S: 130 FALLOWING SOURCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-642	0	0	0	0	-3133	-3032	0	0	0	0	0	0	-6807
Above Normal	0	-642	0	0	0	0	-3133	-3032	0	0	0	0	0	0	-6807
Below Normal	0	0	0	0	0	-3947	-4230	-3895	0	0	0	0	0	0	-12072
Dry	0	0	-536	-565	-3185	-3947	-4230	-3895	-1464	-884	0	0	0	0	-18706
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

Summary of Water Development Effects Among Alternative C Scenarios

Vernalis flows would be reduced by any of the source scenarios the Exchange Contractors employ, although the reductions would be minor. The conservation/crop idling/temporary land fallowing scenarios create the largest effect on Vernalis flows. The effect during critical years is the same for each scenario since each scenario utilizes the same crop idling/temporary land fallowing program during such a year type. Water quality at Vernalis improves slightly with each source scenario, commensurate with the amount of tailwater removed through conservation and crop idling/temporary land fallowing.

New Melones Reservoir storage (and commensurately, in the opposite direction, Goodwin releases to the Stanislaus River), typically would gain or remain neutral in all scenarios. The effects to Delta supply for the CVP/SWP would cause a potential reduction in all scenarios, and less for the groundwater scenario.

4.2.2.4.2 Hydrologic Effects Due to Combined Water Development and Transfer

In addition to the hydrologic effects that occur due to the development of the transfer water by the Exchange Contractors, additional hydrologic effects would occur from the disposition of that water to transferees. Also, Reclamation may respond, relative to the existing condition/No Action Alternative setting in reaction to the Exchange Contractors providing or not providing transfer water to the San Joaquin Valley wildlife areas. Such a response may be the reduction of water acquisitions from other entities in favor of the transfer of water from the Exchange Contractors. The results presented in this section illustrate the combination of the direct hydrologic effects of the development of transfer water by the Exchange Contractors and the

additional effects that result from the circumstances just described. The effects are illustrated in groupings concerned with the disposition of the transfer water.

All Water to Refuges

During noncritical years, this scenario would result in up to 80,000 acre-feet transfer to wildlife areas, generally from an irrigation delivery pattern to one consistent with wildlife habitat area requirements. Water would be delivered to the San Joaquin Valley wildlife habitat areas through Delta-Mendota Canal, local conveyance facilities, or delivery exchange agreements. The remainder of the transfer (50,000 acre-feet) is assumed to be delivered to agricultural contractors. During critical years, 50,000 acre-feet of water would be developed through crop idling/temporary land fallowing. During these years, 40,000 acre-feet (50,000 acre-feet of developed water reduced 20 percent for conveyance losses) will be delivered to the wildlife areas.

Water may be delivered to wildlife areas and agricultural contractors within or outside of the San Joaquin River drainage basin. For deliveries to areas within the drainage basin (the subject of this section), a change in San Joaquin River flows and quality would occur, due both to the Exchange Contractors developing the transfer water and the wildlife areas/agricultural contractors' use and management of the transfer water. Indirect effects would also include the change in Reclamation acquisitions for the wildlife areas.

Consumptive Use. When water is developed by the Exchange Contractors through tailwater recovery, other conservation, and groundwater, no increase or decrease in Exchange Contractor consumptive use would occur. For each acre-foot of water transferred, the Exchange Contractors would substitute an acre-foot of water from an alternative supply. When crop idling/temporary land fallowing is employed by the Exchange Contractors, a decrease in their consumptive use would occur due to the decrease in planted areas.

For the wildlife areas, the transfer would be partially depleted by an increase in consumptive use. As described in Appendix B, providing Incremental Level 4 deliveries primarily leads to a change in the refuges' irrigation practice. This change in management would lead to increased consumptive use of supplies. Some of the Incremental Level 4 supply is also used during flood-up operations leading to increased runoff from the areas during August. Overall, this analysis assumes that approximately 23 percent of the Incremental Level 4 transfer delivery to the wildlife management areas would be returned to the river system as runoff, with the majority of the incremental runoff occurring during the month of August.

Vernalis. This refuge focus scenario would provide additional water deliveries to San Joaquin Valley wildlife areas that discharge to the San Joaquin River. Hydrologic effects at Vernalis resulting from this option are shown in Table 4-48, which also shows the assumed baseline flows. Flow changes at Vernalis range from an increase of about 200 cfs to a decrease of 64 cfs. During wet years, the changes in flow at Vernalis are solely the result of the net effect of the development and disposition of transfer water. For the conservation/crop idling/temporary land fallowing scenarios, the changes in flow reflect runoff from the wildlife area transferees during the early fall and the depletion of flow during other months by the conservation and crop idling/temporary land fallowing programs. Winter months exhibit a minor amount of increased flow due to wildlife area and agricultural contractor return flows slightly exceeding the reduction in return flows caused by Reclamation acquisitions from other San Joaquin Valley sources. In

other noncritical years the monthly changes generally show the same trends, except during February of dry and below normal years and June of an above normal year when New Melones Reservoir reacts to flow changes caused by the transfers to maintain the Vernalis flow at the controlling flow objective. During all but wet years the flow at Vernalis is also at times affected by water quality release changes from New Melones Reservoir.

Table 4-48
Vernalis Flow Conditions – Alternative C, Refuge Focus

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

C-1-1-C: 130 CONSERVATION REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-5	-33	-21	-26	-32	-42	-41	7	-12	-11	6	1	4	5
Above Normal	-5	-33	-21	-26	-32	0	-41	7	-12	-11	6	1	4	5
Below Normal	-5	0	-21	-26	-32	-62	-64	37	-12	-11	6	1	4	0
Dry	-5	0	-23	-38	-47	-62	-64	38	-12	-11	6	1	4	0
Critical	-3	-21	-2	0	-1	-14	-19	199	5	-1	11	2	8	15

C-2-1-C: 130 GROUNDWATER REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-3	-14	-4	4	5	-4	-4	44	11	4	6	1	4	5
Above Normal	-3	-14	-4	4	5	0	-4	44	11	4	6	1	4	5
Below Normal	-3	0	-4	4	5	-10	-14	85	11	4	6	1	4	0
Dry	-3	0	-3	3	4	-10	-14	85	11	4	6	1	4	0
Critical	-3	-21	-2	0	-1	-14	-19	199	5	-1	11	2	8	15

C-3-1-C: 130 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-5	-33	-21	-26	-32	-42	-41	7	-12	-11	6	1	4	5
Above Normal	-5	-33	-21	-26	-32	0	-41	7	-12	-11	6	1	4	5
Below Normal	-5	0	-21	-26	-32	-62	-64	37	-12	-11	6	1	4	0
Dry	-5	0	-23	-38	-47	-62	-64	38	-12	-11	6	1	4	0
Critical	-3	-21	-2	0	-1	-14	-19	199	5	-1	11	2	8	15

For the groundwater scenario, the springtime and summertime effect of reduced tailwater returns in Vernalis flows is less in comparison to the other two source scenarios. This outcome is due to the groundwater source option removing less (no) return flows from the San Joaquin River. Overall the change in flow is minor except during August in critical years when there could be a 20 percent increase in flow due to wetland releases.

No change in flow at Vernalis occurs during periods when it is assumed that flow objectives control (February of below normal and dry years, June of above normal years, and during the pulse flow periods during April and May). All scenarios have the same critical year effects, since only the crop idling/land fallowing component is used during critical years. With the transfer, during the VAMP pulse flow period (mid-April through mid-May) the "existing flow" condition, as defined by the SJRA, may be slightly lower in noncritical years. The flow at Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

Water quality at Vernalis would also change due to the transfer. Table 4-49 shows the change in Vernalis water quality resulting from the transfers under each source option. The table also provides the assumed existing condition/No Action water quality condition at Vernalis.

Table 4-49
Vernalis Water Quality Conditions – Alternative C, Refuge Focus

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

C-1-1-C: 130 CONSERVATION REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-3	-1	-2	-3	-4	-6	6	-6	-2	1	0	0	0
Above Normal	-1	-5	-2	-4	-7	-15	-11	10	-8	-3	1	0	0	1
Below Normal	-2	-15	-3	-6	-8	0	0	0	-8	-3	1	0	1	2
Dry	-2	-18	0	-3	-	-	0	0	-7	-3	1	0	0	3
Critical	-2	0	0	0	-	-	0	0	2	0	3	0	1	0

C-2-1-C: 130 GROUNDWATER REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-1	0	0	0	-1	-2	11	0	0	1	0	0	0
Above Normal	-1	-2	0	0	0	-2	-3	16	-1	0	1	0	0	1
Below Normal	-1	-6	0	0	0	0	0	0	-1	0	1	0	1	2
Dry	-1	-8	0	0	0	0	0	0	0	0	1	0	0	3
Critical	-2	0	0	0	0	0	0	0	2	0	3	0	1	0

C-3-1-C: 130 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-3	-1	-2	-3	-4	-6	6	-6	-2	1	0	0	0
Above Normal	-1	-5	-2	-4	-7	-15	-11	10	-8	-3	1	0	0	1
Below Normal	-2	-15	-3	-6	-8	0	0	0	-8	-3	1	0	1	2
Dry	-2	-18	0	-3	-	-	0	0	-7	-3	1	0	0	3
Critical	-2	0	0	0	-	-	0	0	2	0	3	0	1	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

Water quality changes at Vernalis trend with the net addition (runoff) and removal (reduction in return flows) of water within the river system. Deliveries to the wildlife areas result in additional return flows to the river with a water quality worse than existing condition/No Action Alternative water quality at Vernalis. The development of the transfer water by the Exchange Contractors removes flow in the river, typically also with a quality worse than the existing condition/No Action Alternative water quality at Vernalis. During periods when the water quality objective is assumed to control New Melones releases (indicated by the 700 and 1,000 µS/cm values in Table 4-49) no change in water quality would occur due to the counteraction at New Melones Reservoir for transfer-related San Joaquin River flow and quality changes. During other periods, the estimated change in water quality could be within a range of 18 µS/cm improvement to a 16 µS/cm degradation. The slight degradation in water quality is anticipated to occur during August when the majority of incremental return flows from the wildlife areas are expected to occur and water quality is not controlling operations for Vernalis.

Although the water quality at Vernalis may at times be degraded as a result of the transfer, it is assumed that it would be mitigated by Reclamation operating New Melones Reservoir to continue to comply with water quality objectives consistent with past practice. Therefore, the transfer would not cause any additional noncompliance instances.

New Melones Reservoir Water Supply/Operation. New Melones Reservoir operations may be affected by the transfers due to the linkage between its operations and San Joaquin River conditions. The potential changes in New Melones storage due to the net releases from New

Melones Reservoir, for either Vernalis water quality or flow purposes, are shown in Table 4-50. The values are directly related to flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-50
Changes to Storage in New Melones Reservoir – Alternative C, Refuge Focus

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

C-1-1-C: 130 CONSERVATION REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-2496	0	0	0	0	0	0	0	0	-2496
Below Normal	0	-1834	0	0	0	1176	1382	-1829	0	0	0	0	0	295	-811
Dry	0	-1834	130	735	901	1176	1382	-1890	0	0	0	0	0	295	895
Critical	0	386	-97	-12	15	223	297	-6209	0	0	0	0	0	-267	-5665

C-2-1-C: 130 GROUNDWATER REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-212	0	0	0	0	0	0	0	0	-212
Below Normal	0	-779	0	0	0	363	582	-2479	0	0	0	0	0	295	-2019
Dry	0	-779	-4	17	57	363	582	-2540	0	0	0	0	0	295	-2011
Critical	0	386	-97	-12	15	223	297	-6209	0	0	0	0	0	-267	-5665

C-3-1-C: 130 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-2496	0	0	0	0	0	0	0	0	-2496
Below Normal	0	-1834	0	0	0	1176	1382	-1829	0	0	0	0	0	295	-811
Dry	0	-1834	130	735	901	1176	1382	-1890	0	0	0	0	0	295	895
Critical	0	386	-97	-12	15	223	297	-6209	0	0	0	0	0	-267	-5665

For the refuge focus scenario, an annual decrease in New Melones Reservoir storage is anticipated for above normal, below normal and critical years. This decrease could range up to about 5,600 acre-feet in critical years. Critical year effects are due to the direct and indirect effects of providing water through the crop idling/temporary land fallowing element. Flow changes in the Stanislaus River would range between an increase of 101 cfs for water quality purposes to a decrease (common to the critical year crop idling/land fallowing program) of 22 cfs.

Delta Supply. The transfer program to the wildlife areas could affect inflows to the Delta from the San Joaquin River. The change in net Delta water supply balance to the CVP/SWP is shown in Table 4-51.

For the conservation and crop idling/temporary land fallowing scenarios, a net decrease in supply is shown for each year except a critical year (the critical year effect is the same for all source scenarios, indicative of the crop idling/temporary land fallowing scenario). The decrease in net supply ranges from a about 2,600 acre-feet in a wet year, to about 10,000 acre-feet during a dry year. During a critical year, a gain of over 10,000 acre-feet occurs. With the groundwater scenario, a gain in CVP/SWP Delta water supply occurs each year. The changes occur not only due to the development and disposition of the transfer water, but also due to the New Melones Reservoir reaction to changes in the river system. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP.

Table 4-51
Delta CVP/SWP Water Supply Effect – Alternative C, Refuge Focus

Incremental Change in Project Delta Supply due to Action - Acre-feet

C-1-1-C: 130 CONSERVATION REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-642	0	0	0	0	-2535	433	0	0	0	0	0	103	-2641
Above Normal	0	-642	0	0	0	0	-2535	433	0	0	0	0	0	103	-2641
Below Normal	0	0	0	0	0	-3672	-3917	2262	0	0	0	0	0	0	-5327
Dry	0	0	-490	-527	-2877	-3672	-3917	2323	-722	-651	0	0	0	0	-10533
Critical	0	-1165	-131	4	-55	-849	-1146	12252	312	-39	634	0	0	834	10650

C-2-1-C: 130 GROUNDWATER REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-273	0	0	0	0	-251	2718	0	0	0	0	0	103	2297
Above Normal	0	-273	0	0	0	0	-251	2718	0	0	0	0	0	103	2297
Below Normal	0	0	0	0	0	-575	-833	5197	0	0	0	0	0	0	3789
Dry	0	0	-74	32	252	-575	-833	5258	684	233	0	0	0	0	4978
Critical	0	-1165	-131	4	-55	-849	-1146	12252	312	-39	634	0	0	834	10650

C-3-1-C: 130 FALLOWING REFUGE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-642	0	0	0	0	-2535	433	0	0	0	0	0	103	-2641
Above Normal	0	-642	0	0	0	0	-2535	433	0	0	0	0	0	103	-2641
Below Normal	0	0	0	0	0	-3672	-3917	2262	0	0	0	0	0	0	-5327
Dry	0	0	-490	-527	-2877	-3672	-3917	2323	-722	-651	0	0	0	0	-10533
Critical	0	-1165	-131	4	-55	-849	-1146	12252	312	-39	634	0	0	834	10650

All Water to Agriculture

This scenario would result in up to 130,000 acre-feet of transfer water being provided to CVP agricultural contractors. This water could be delivered to contractors within or outside of the drainage of the San Joaquin River. Potential CVP shortages to contractors within the drainage of the San Joaquin River substantiate the potential need for the entire 130,000 acre-feet of transfer to those entities. The direct effects of the Exchange Contractors developing transfer water are combined with the additional effects of the CVP contractors producing increased runoff to the San Joaquin River. Addition indirect effects occur due to Reclamation acquiring additional water for delivery to the wildlife areas from entities other than the Exchange Contractors.

The water transferred to agricultural users would essentially exchange the delivery of water from the Exchange Contractors to a CVP agricultural contractor. San Joaquin River flow and quality, New Melones Reservoir release, and Delta inflows would be affected as the result of the Exchange Contractors developing transfer water and the indirect effects of the transfers.

Consumptive Use. When water is developed by the Exchange Contractors through conservation and groundwater, no increase or decrease in Exchange Contractor consumptive use would occur. For each acre-foot of water transferred, the Exchange Contractors would substitute an acre-foot of water from an alternative supply. When the Exchange Contractors employ crop idling/temporary land fallowing, a decrease in their consumptive use would occur.

If the transferred water is used by the agricultural transferee to replace pumped groundwater, no overall increase in consumptive use would occur, only a trade-off of one source for another would occur. However, if the transferred water is used to either irrigate land that would have been left fallow due to lack of water supply or to increase the application rate on existing irrigated lands, an increase would occur in consumptive use for the water purchaser. (The 130,000 acre-feet of additional water that could become available represents less than 5 percent of the existing contracted water use for the potential 10 districts that could purchase the water.) This latter scenario represents an increase in crop consumptive use by the affected districts; however, the amount of CVP water use is unchanged.

Vernalis. This agricultural water scenario would provide additional water deliveries to San Joaquin Valley CVP agricultural contractors that discharge to the San Joaquin River. Table 4-52 shows the potential range in flow change at Vernalis that may occur as a result of this scenario. Changes in flow at Vernalis range from an increase of 26 cfs to a decrease of 55 cfs. During wet years, the changes in flow at Vernalis are solely the result of the net effect of the development and disposition of transfer water. For the conservation/crop idling/temporary land fallowing scenarios, the changes in flow mostly reflect the net result of removing runoff from the Exchange Contractors and the addition of runoff from the agricultural transferees. A smaller effect occurs due to an increase in Reclamation acquisitions from other San Joaquin Valley sources to satisfy wildlife area deliveries. For the groundwater scenario, less reduction in flow due to the removal of return flows occurs. In other noncritical years the monthly changes generally show the same trends, except during February of dry and below normal years and June of an above normal year when New Melones Reservoir reacts to flow changes caused by the transfers to maintain the Vernalis flow at the controlling flow objective. During all but wet years the flow at Vernalis is also at times affected by water quality release changes from New Melones Reservoir. Overall the changes in flow at Vernalis are less than 5 percent of the baseline flows.

Table 4-52
Vernalis Flow Conditions – Alternative C, Agriculture Focus

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

C-1-2-C: 130 CONSERVATION AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-5	-33	-20	-19	-22	-30	-24	-29	2	-3	3	1	1	2
Above Normal	-5	-33	-20	-19	-22	0	-24	-29	2	-3	3	1	1	2
Below Normal	-5	0	-20	-19	-22	-54	-55	-51	2	-3	3	1	1	0
Dry	-5	0	-23	-32	-38	-54	-55	-48	2	-3	3	1	1	0
Critical	-3	-21	-4	5	7	-5	-5	-5	13	6	2	0	1	1

C-2-2-C: 130 GROUNDWATER AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-3	-14	-3	10	15	9	13	8	26	12	3	1	1	2
Above Normal	-3	-14	-3	10	15	0	13	8	26	12	3	1	1	2
Below Normal	-3	0	-3	10	15	-1	-5	-3	26	12	3	1	1	0
Dry	-3	0	-4	9	13	-1	-5	-1	26	12	3	1	1	0
Critical	-3	-21	-4	5	7	-5	-5	-5	13	6	2	0	1	1

C-3-2-C: 130 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-5	-33	-20	-19	-22	-30	-24	-29	2	-3	3	1	1	2
Above Normal	-5	-33	-20	-19	-22	0	-24	-29	2	-3	3	1	1	2
Below Normal	-5	0	-20	-19	-22	-54	-55	-51	2	-3	3	1	1	0
Dry	-5	0	-23	-32	-38	-54	-55	-48	2	-3	3	1	1	0
Critical	-3	-21	-4	5	7	-5	-5	-5	13	6	2	0	1	1

No change in flow at Vernalis occurs during periods when it is assumed that flow objectives control (February of below normal and dry years, June of above normal years, and during the pulse flow periods during April and May). All scenarios have the same critical year effects, owing to the circumstance that only the crop idling/temporary land fallowing element is employed during critical years. With the transfer, during the VAMP pulse flow period (mid-April through mid-May) the "existing flow" condition, as defined by the SJRA, may be slightly lower in noncritical years. The flow at Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

Water quality at Vernalis would also change due to the transfer. Table 4-53 shows the change in Vernalis water quality resulting from the transfers under each source option. The table also provides the assumed existing condition/No Action Alternative water quality condition at Vernalis.

Table 4-53
Vernalis Water Quality Conditions – Alternative C, Agriculture Focus

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

C-1-2-C: 130 CONSERVATION AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-3	-1	-2	-3	-4	-6	-8	-7	-2	0	0	0	0
Above Normal	-1	-5	-2	-4	-6	-13	-12	-11	-11	-3	0	0	0	0
Below Normal	-2	-15	-3	-6	-8	0	0	0	-11	-2	0	0	0	0
Dry	-2	-18	0	-3	-	-	0	0	-9	-2	0	0	0	1
Critical	-2	0	0	0	-	-	0	0	-1	0	0	0	0	0

C-2-2-C: 130 GROUNDWATER AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-1	0	0	0	-1	-2	-2	-1	0	0	0	0	0
Above Normal	-1	-2	0	0	1	0	-5	-4	-3	0	0	0	0	0
Below Normal	-1	-6	-1	0	1	0	0	0	-3	1	0	0	0	0
Dry	-1	-8	0	0	-1	0	0	0	-2	1	0	0	0	1
Critical	-2	0	0	0	0	0	0	0	-1	0	0	0	0	0

C-3-2-C: 130 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-3	-1	-2	-3	-4	-6	-8	-7	-2	0	0	0	0
Above Normal	-1	-5	-2	-4	-6	-13	-12	-11	-11	-3	0	0	0	0
Below Normal	-2	-15	-3	-6	-8	0	0	0	-11	-2	0	0	0	0
Dry	-2	-18	0	-3	-	-	0	0	-9	-2	0	0	0	1
Critical	-2	0	0	0	-	-	0	0	-1	0	0	0	0	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

Water quality changes at Vernalis trend with the net addition (runoff) and removal (reduction in return flows) of water within the river system. Deliveries to the agricultural contractors result in additional return flows to the river at a quality better than existing condition/No Action Alternative water quality at Vernalis. The development of the transfer water by the Exchange Contractors removes flow in the river, typically with a quality worse than the existing condition/No Action Alternative water quality at Vernalis. During periods when the water quality objective is assumed to control New Melones releases (indicated by the 700 and 1,000 µS/cm values in Table 4-53) no change in water quality would occur due to the counteraction at New Melones Reservoir for transfer-related San Joaquin River flow and quality changes. During other periods, the estimated change in water quality could be within a range of 18 µS/cm improvement to a 1 µS/cm degradation.

The analysis indicates that water quality at Vernalis will almost always improve or be neutral with this scenario with all the source scenarios. It is assumed that Reclamation will continue to operate New Melones Reservoir to comply with water quality objectives consistent with past practice. Therefore, the transfer would not cause any additional noncompliance instances.

New Melones Reservoir Water Supply/Operation. New Melones Reservoir operations may be affected by the transfers due to the linkage between its operations and San Joaquin River conditions. The potential changes in the net releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are illustrated in Table 4-54. The values are directly related to flow changes to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-54
Storage/Flow Change in New Melones Reservoir – Alternative C, Agriculture Focus

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

C-1-2-C: 130 CONSERVATION AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1760	0	0	0	0	0	0	0	0	-1760
Below Normal	0	-1834	0	0	0	1425	1888	1332	0	0	0	0	0	117	2928
Dry	0	-1834	222	776	975	1425	1888	1163	0	0	0	0	0	117	4732
Critical	0	386	47	-12	30	260	350	223	0	0	0	0	0	14	1296

C-2-2-C: 130 GROUNDWATER AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	524	0	0	0	0	0	0	0	0	524
Below Normal	0	-779	0	0	0	612	1088	682	0	0	0	0	0	117	1720
Dry	0	-779	87	58	130	612	1088	513	0	0	0	0	0	117	1826
Critical	0	386	47	-12	30	260	350	223	0	0	0	0	0	14	1296

C-3-2-C: 130 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1760	0	0	0	0	0	0	0	0	-1760
Below Normal	0	-1834	0	0	0	1425	1888	1332	0	0	0	0	0	117	2928
Dry	0	-1834	222	776	975	1425	1888	1163	0	0	0	0	0	117	4732
Critical	0	386	47	-12	30	260	350	223	0	0	0	0	0	14	1296

For the agricultural water delivery scenario, an overall annual increase in New Melones Reservoir storage occurs during most of the scenarios. This increase could range up to about 4,700 acre-feet. The exception is during an above normal year when the only change in New Melones Reservoir releases is the reaction to the net removal of flow from the river during June. Critical year effects are due to the direct and indirect effects of providing water through the crop idling/land fallowing element. Changes to flow in the Stanislaus River would range between an increase of 33 cfs to a decrease of 31 cfs.

Delta Supply. The transfer program to the agricultural contractors could affect inflows to the Delta from the San Joaquin River. The change in net Delta water supply balance to the CVP/SWP is shown in Table 4-55.

For the conservation/crop idling/land fallowing scenarios, a net decrease in supply is shown for each year. The decrease in net supply during noncritical years for these scenarios ranges from about 3,900 acre-feet in a wet and above normal year to almost 13,000 acre-feet during a dry year. During a critical year, a loss of about 300 acre-feet occurs (resulting from the crop idling/land fallowing program that occurs in critical years of all source scenarios). For the groundwater scenario, the CVP/SWP Delta supply is essentially neutral or gains each year. The changes occur not only due to the development and disposition of the transfer water, but also due to the New Melones Reservoir reaction to changes in the river system. These changes are minor relative to the total supply available from the Delta. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP.

Table 4-55
Delta CVP/SWP Water Supply Effect – Alternative C, Agriculture Focus

Incremental Change in Project Delta Supply due to Action - Acre-feet

C-1-2-C: 130 CONSERVATION AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-642	0	0	0	0	-1474	-1812	0	0	0	0	0	41	-3887
Above Normal	0	-642	0	0	0	0	-1474	-1812	0	0	0	0	0	41	-3887
Below Normal	0	0	0	0	0	-3186	-3362	-3144	0	0	0	0	0	0	-9692
Dry	0	0	-501	-470	-2331	-3186	-3362	-2976	138	-190	0	0	0	0	-12877
Critical	0	-1165	-273	325	432	-289	-338	-337	773	372	100	0	0	47	-354

C-2-2-C: 130 GROUNDWATER AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-273	0	0	0	0	811	472	0	0	0	0	0	41	1051
Above Normal	0	-273	0	0	0	0	811	472	0	0	0	0	0	41	1051
Below Normal	0	0	0	0	0	-88	-278	-210	0	0	0	0	0	0	-576
Dry	0	0	-85	89	798	-88	-278	-41	1544	695	0	0	0	0	2634
Critical	0	-1165	-273	325	432	-289	-338	-337	773	372	100	0	0	47	-354

C-3-2-C: 130 FALLOWING AGRICULTURE COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-642	0	0	0	0	-1474	-1812	0	0	0	0	0	41	-3887
Above Normal	0	-642	0	0	0	0	-1474	-1812	0	0	0	0	0	41	-3887
Below Normal	0	0	0	0	0	-3186	-3362	-3144	0	0	0	0	0	0	-9692
Dry	0	0	-501	-470	-2331	-3186	-3362	-2976	138	-190	0	0	0	0	-12877
Critical	0	-1165	-273	325	432	-289	-338	-337	773	372	100	0	0	47	-354

All Water Transferred Out of Basin

An alternative to transferring all water to wildlife purposes or all agriculture users is transfers to entities outside of the drainage of the San Joaquin River. Hydrologically, San Joaquin River effects would occur differently when the disposition of water has no continuity with the San Joaquin River. For purposes of estimating hydrologic effects in the San Joaquin River, it does not matter if water is delivered to urban use, agricultural use, or wildlife area use outside of the San Joaquin River drainage basin; none of this use would have any direct surface water return flow effect upon the San Joaquin River. The only effect of this option would be the direct effects caused by the development of the water for the transfer and the sometimes indirect effects of Reclamation actions of maintaining wildlife area deliveries consistent with the existing condition/No Action Alternative level. This out-of-basin definition is for the hydrologic analyses and differs from Reclamation's regulatory definition to meet consumptive use limitations in the transfer guidelines, consistent with CVPIA.[2]

This out-of-basin scenario would provide up to 130,000 acre-feet of water to uses (any combination of wildlife areas, agriculture, and urban) occurring outside the drainage of the San Joaquin River. These uses could include deliveries to the two refuges that are not hydraulically connected to the San Joaquin River, Pixley and Kern NWRs (located in the Tulare Lake Basin), SCVWD and SBCWD (located in the San Felipe Division), CVP water contractors of the Friant Division, the Cross-Valley Contractors of the CVP, Westlands WD, and any other south of Delta contractor not hydraulically connected to the San Joaquin River.

[2] This scenario is subject to the regulatory constraint that no more than 70,000 acre-feet of temporary water supply from reductions in consumptive use and groundwater substitution plus the quantifiable decrease in irretrievable losses (Section 2.3.2) can be transferred "out of basin" to Pixley and Kern NWRs, Friant Division, and Cross Valley Contractors. Reclamation defines the in-basin use area as the Delta Export Service Area contractors including San Felipe Division and the EWA.

Vernalis. This out-of-basin scenario would provide additional water deliveries to areas that do not discharge to the San Joaquin River. Hydrologic effects at Vernalis resulting from this scenario are shown in Table 4-56, which also provides the assumed baseline flows. Changes in flow at Vernalis range from no change to a decrease of 74 cfs. The changes in flow at Vernalis are primarily the result of the direct effect of the development of transfer water and the effects of New Melones Reservoir reacting to Vernalis flow and quality conditions. The results also include the indirect effect of Reclamation increasing its acquisition of water supplies from entities other than the Exchange Contractors for wildlife area deliveries. The greatest potential flow differences occur for the conservation/crop idling/temporary land fallowing scenarios. The changes in flow reflect the reduction in return flow during the year by the conservation and crop idling/temporary land fallowing components and the reduction of runoff from entities that Reclamation acquires water for wildlife area deliveries. During February of dry and below normal years and June of an above normal year, New Melones Reservoir reacts to flow changes caused by the transfers to maintain the Vernalis flow at the controlling flow objective, which results in no flow change occurring at Vernalis. During all but wet years the flow at Vernalis is also at times affected by water quality release changes from New Melones Reservoir. During critical years, the flow change at Vernalis is always reflective of the effect of the crop idling/land fallowing source of water.

Table 4-56
Vernalis Flow Conditions – Alternative C, Out-of-Basin Transfer

Benchmark Vernalis Flow - cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	7500	13600	15700	13600	12000	7400	5100	3100	2500	3600	3000	4600	7500	13600
Above Normal	5800	7200	6200	5900	4600	2600	2100	2000	1500	2000	1800	2300	5800	7200
Below Normal	2300	3200	3300	3700	3700	2100	1900	1500	1200	1900	1700	2200	2300	3200
Dry	1900	2600	2300	2700	2200	1800	1400	1100	1000	1700	1600	2100	1900	2600
Critical	1300	1700	1600	1800	1500	1300	1000	1000	1000	1500	1400	1500	1300	1700

Change in Vernalis Flow with Action - cfs

C-1-3-C: 130 CONSERVATION OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-5	-33	-23	-34	-43	-56	-60	-56	-34	-19	-1	0	0	-1
Above Normal	-5	-33	-23	-34	-43	0	-60	-56	-34	-19	-1	0	0	-1
Below Normal	-5	0	-23	-34	-43	-71	-74	-68	-34	-19	-1	0	0	0
Dry	-5	0	-25	-46	-57	-71	-74	-69	-34	-19	-1	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

C-2-3-C: 130 GROUNDWATER OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-3	-14	-6	-4	-6	-17	-23	-19	-10	-4	-1	0	0	-1
Above Normal	-3	-14	-6	-4	-6	0	-23	-19	-10	-4	-1	0	0	-1
Below Normal	-3	0	-6	-4	-6	-19	-24	-20	-10	-4	-1	0	0	0
Dry	-3	0	-6	-4	-6	-19	-24	-21	-10	-4	-1	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

C-3-3-C: 130 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-5	-33	-23	-34	-43	-56	-60	-56	-34	-19	-1	0	0	-1
Above Normal	-5	-33	-23	-34	-43	0	-60	-56	-34	-19	-1	0	0	-1
Below Normal	-5	0	-23	-34	-43	-71	-74	-68	-34	-19	-1	0	0	0
Dry	-5	0	-25	-46	-57	-71	-74	-69	-34	-19	-1	0	0	0
Critical	-3	-21	-6	0	-1	-14	-19	-16	-1	0	0	0	0	0

With the transfer, during the VAMP pulse flow period (mid-April through mid-May) the "existing flow" condition (as defined by the SJRA) may be slightly lower. The flow at Vernalis during this period is the result of the procedures and targets defined by the SJRA, and would likely be the same either with or without the transfer.

Water quality at Vernalis would also change due to the transfer. Table 4-57 illustrates the change in Vernalis water quality that results from the transfers under each source scenario. The table

also provides the assumed existing condition/No Action Alternative water quality condition at Vernalis.

Water quality changes at Vernalis trend with the removal (reduction in return flows) of water within the river system. The development of the transfer water by the Exchange Contractors would remove flow in the river, typically with a quality worse than the existing condition/No Action Alternative water quality at Vernalis. Removal of return flows due to crop idling/land fallowing will also remove flow of lesser quality. During periods when the water quality objective is assumed to control New Melones releases (indicated by the 700 and 1000 µS/cm values in Table 4-57), no change in water quality would occur due to the anticipated counteraction at New Melones Reservoir for transfer-related San Joaquin River flow and quality changes. During other periods, the estimated change in water quality would be a slight improvement. if not a neutral effect in quality. The changes to water quality are minor and would not cause any additional noncompliance instances at Vernalis.

Table 4-57
Vernalis Water Quality Conditions – Alternative C, Out-of-Basin Transfer

Benchmark Vernalis Water Quality - µmhos

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	352	286	310	269	212	310	341	460	442	359	497	432	352	286
Above Normal	404	380	465	364	334	486	509	534	588	494	657	639	404	380
Below Normal	757	631	690	465	382	700	700	700	680	510	681	657	757	631
Dry	880	736	1000	700	700	700	700	700	772	547	708	678	880	736
Critical	1000	1000	1000	700	700	700	700	700	772	595	772	859	1000	1000

Change in Vernalis Water Quality with Action - µmhos

C-1-3-C: 130 CONSERVATION OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-3	-1	-2	-3	-4	-6	-7	-6	-2	0	0	0	0
Above Normal	-1	-5	-2	-5	-7	-18	-10	-8	-7	-3	0	0	0	0
Below Normal	-2	-15	-3	-6	-9	0	0	0	-7	-3	0	0	0	0
Dry	-2	-18	0	-3	-	-	0	0	-6	-3	0	0	0	0
Critical	-2	0	0	0	-	-	0	0	0	0	0	0	0	0

C-2-3-C: 130 GROUNDWATER OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-1	0	0	0	-1	-2	-1	0	0	0	0	0	0
Above Normal	-1	-2	-1	0	0	-5	-2	-2	1	0	0	0	0	0
Below Normal	-1	-6	-1	0	0	0	0	0	1	0	0	0	0	0
Dry	-1	-8	0	0	0	0	0	0	1	0	0	0	0	0
Critical	-2	0	0	0	0	0	0	0	0	0	0	0	0	0

C-3-3-C: 130 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wet	-1	-3	-1	-2	-3	-4	-6	-7	-6	-2	0	0	0	0
Above Normal	-1	-5	-2	-5	-7	-18	-10	-8	-7	-3	0	0	0	0
Below Normal	-2	-15	-3	-6	-9	0	0	0	-7	-3	0	0	0	0
Dry	-2	-18	0	-3	-	-	0	0	-6	-3	0	0	0	0
Critical	-2	0	0	0	-	-	0	0	0	0	0	0	0	0

Note: Values for April and May during dry and critical years have been omitted from the table due to modeling limitations. During the first half of April and the later half of May of these periods, Vernalis water quality objectives are assumed to control. During transfers it is assumed that New Melones releases would continue to provide compliance with the objectives; therefore, no change in water quality would occur.

New Melones Reservoir Water Supply/Operation. The flow and quality effects of the transfer to the San Joaquin River upstream of the Stanislaus River could trigger a change in releases from New Melones Reservoir to counter such effects. The potential changes in storage in New Melones due to the net releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are shown in Table 4-58. The values are directly related to flow changes to the

lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 4-58
Changes in Storage in New Melones Reservoir – Alternative C, Out-of-Basin Transfer

Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet

C-1-3-C: 130 CONSERVATION OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-3312	0	0	0	0	0	0	0	0	-3312
Below Normal	0	-1834	0	0	0	900	821	700	0	0	0	0	0	-41	546
Dry	0	-1834	156	709	819	900	821	758	0	0	0	0	0	-41	2290
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

C-2-3-C: 130 GROUNDWATER OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1027	0	0	0	0	0	0	0	0	-1027
Below Normal	0	-779	0	0	0	87	21	49	0	0	0	0	0	-41	-662
Dry	0	-779	22	-9	-25	87	21	108	0	0	0	0	0	-41	-616
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

C-3-3-C: 130 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-3312	0	0	0	0	0	0	0	0	-3312
Below Normal	0	-1834	0	0	0	900	821	700	0	0	0	0	0	-41	546
Dry	0	-1834	156	709	819	900	821	758	0	0	0	0	0	-41	2290
Critical	0	386	39	8	15	223	297	213	0	0	0	0	0	0	1180

The changes shown in Table 4-58 indicate the releases from New Melones that would be required to counter the effect of developing the transfer water on maintaining Vernalis flow and quality conditions exactly at the Vernalis objective compliance level. Accumulated changes in New Melones Reservoir storage vary by year type but the change in storage within a year is less than about 3,000 acre-feet, positive or negative. The potential change in flow to the lower Stanislaus River mirror the changes in the New Melones storage. The changes in flow range from an increase of up to 56 cfs during June (during an above normal year) to a decrease of up to 15 cfs during March through August. However, when a reduction in flow is calculated, the reduction may not actually be allowed because another release objective may require the continuation of some level of that release. Modeling limitations did not allow the identification of such circumstances.

An indirect impact that may result from a change in New Melones Reservoir operations would be the allocation of water to uses within the Interim Plan of Operations, including impacts to water users and the use of water for fish and water quality purposes. For this scenario, the estimated change in storage at New Melones Reservoir in a year could range between a gain of over 2,000 acre-feet during a dry year, to a decrease in storage of 3,300 acre-feet during an above normal year. These changes are minor and should not result in any significant changes in allocation.

Delta Supply. The transfer program could affect inflows to the Delta from the San Joaquin River. At different times the change in inflow could increase, decrease, or be neutral to the CVP/SWP water supplies. The change in net Delta water supply balance to the CVP/SWP is shown in Table 4-59.

Table 4-59
Delta CVP/SWP Water Supply Effect – Alternative C, Out-of-Basin Transfer

Incremental Change in Project Delta Supply due to Action - Acre-feet

C-1-3-C: 130 CONSERVATION OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-642	0	0	0	0	-3711	-3457	0	0	0	0	0	-14	-7825
Above Normal	0	-642	0	0	0	0	-3711	-3457	0	0	0	0	0	-14	-7825
Below Normal	0	0	0	0	0	-4212	-4532	-4157	0	0	0	0	0	0	-12901
Dry	0	0	-548	-598	-3482	-4212	-4532	-4216	-2022	-1126	0	0	0	0	-20736
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

C-2-3-C: 130 GROUNDWATER OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-273	0	0	0	0	-1427	-1173	0	0	0	0	0	-14	-2886
Above Normal	0	-273	0	0	0	0	-1427	-1173	0	0	0	0	0	-14	-2886
Below Normal	0	0	0	0	0	-1114	-1448	-1222	0	0	0	0	0	0	-3784
Dry	0	0	-132	-40	-353	-1114	-1448	-1281	-616	-242	0	0	0	0	-5225
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

C-3-3-C: 130 FALLOWING OUT COMPOSITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Wet	0	-642	0	0	0	0	-3711	-3457	0	0	0	0	0	-14	-7825
Above Normal	0	-642	0	0	0	0	-3711	-3457	0	0	0	0	0	-14	-7825
Below Normal	0	0	0	0	0	-4212	-4532	-4157	0	0	0	0	0	0	-12901
Dry	0	0	-548	-598	-3482	-4212	-4532	-4216	-2022	-1126	0	0	0	0	-20736
Critical	0	-1165	-342	-28	-55	-849	-1146	-960	-58	0	0	0	0	0	-4604

For each scenario, a net decrease in supply is shown for each year. The decrease in net supply ranges from about 2,900 acre-feet with the groundwater scenario to more than 20,000 acre-feet during a dry year for the conservation/crop idling/temporary land fallowing scenario. The groundwater scenario affects the Delta supply to a lesser degree, approximately 5,200 acre-feet or less. All source options have the same critical year program utilizing crop idling/land fallowing. These changes would occur due to the development of the transfer water and the indirect action of Reclamation acquiring additional supplies for wildlife area deliveries, and are compounded by the New Melones Reservoir reaction to changes in the river system. A portion of the CVP/SWP Delta supply impact is a result of and reflective of the gains or losses in New Melones Reservoir storage. The combined net effect on the two supplies should be considered when evaluating the impacts of the proposed transfer upon the CVP/SWP.

Summary of Effects Among Alternative C Scenarios

All scenarios of this alternative would cause changes to flows at Vernalis. The groundwater scenario is most neutral to Vernalis flow. Of the refuge focus water scenarios, flow during August is expected to increase at Vernalis due to the combination of incremental return flows from the wildlife areas and the reaction of New Melones Reservoir release to maintain water quality or flow in the San Joaquin River at Vernalis. The fall and follow-on winter conditions are generally the same under all scenarios.

Water quality at Vernalis would also change due to the transfers. These potential changes are nearly the same between comparable scenarios with an improvement or neutrality in water quality expected. The exception would be in the refuge focus water scenario during August when some degradation may occur when water quality is not controlling operations at New Melones Reservoir. All of the potential changes are minor.

The potential change in New Melones Reservoir storage and releases to the lower Stanislaus River varies among the scenarios. The refuge focus water scenario poses the greatest potential for reductions to storage due to the potential releases to counteract flow and quality effects of the transfer, in particular the incremental return flows of the wildlife areas. The potential effect to

water supply allocations under the Interim Plan of Operations would also vary in relation to the accumulated change in New Melones Reservoir storage, but no major changes in allocation are expected. The potential CVP/SWP Delta supply effect is also variable by delivery scenario.

4.2.3 Cumulative Effects

The cumulative impact analysis examines the incremental impact of the proposed transfer program when added to other related past and reasonably foreseeable future projects to determine if individually minor effects could add up to a significant cumulative effect.

The Exchange Contractors water transfer would occur in an environment where other changes to the movement of water in the San Joaquin Valley will also be occurring. Several activities that could occur during the 10-year Exchange Contractors water transfer period are changes to operation of the Grassland Bypass Project, modification of flow regimes in the San Joaquin River and tributaries to satisfy environmental concerns (e.g., EWA and VAMP), implementation of TMDLs for salt and boron and for dissolved oxygen, changes resulting from the Regional Board's irrigated lands conditional waiver, additional actions under the Westside regional drainage plan and other drainage programs, and changes to upper San Joaquin River operations.

Under the No Action/No Project Alternative and existing conditions drainwater from the Grasslands drainage area is collected in the San Luis Drain and discharged to Mud Slough and the San Joaquin River. This water generally has poor water quality and, therefore, tends to reduce the quality of water in the San Joaquin River at Vernalis. In addition, the EWA, VAMP, and other environmental water programs have purchased water from willing sellers or have had it provided by Reclamation to augment flows in the San Joaquin River and its tributaries to provide better fish and wildlife habitat. Over the period of the Exchange Contractors proposed water transfer (10 years) the Grassland Bypass Project will be phased out and flows of drainwater to the San Joaquin River will be reduced, which will have the effect of improving the quality of water at Vernalis and reducing the flows. The volume of water that will be removed is on the order of 30,000 acre-feet/year, a change in flow greater than most of the options analyzed for this project. The improvement in water quality due to elimination or large reduction in drainage flows would tend to offset any decrease in water quality that could occur due to some of the transfer scenarios. The other referenced changes that could occur are all intended to or will incidentally provide improvements to the water quality conditions of the San Joaquin River. These non-project changes will lead to an improvement in the ambient environmental setting upon which the effects of the Proposed Project will be evaluated. When cumulatively combined with the Proposed Project, those actions and the Proposed Project will not lead to a greater impact than has been estimated for the Proposed Project relative to the existing condition and, therefore, are not cumulatively significant. Furthermore, as these regulatory changes are implemented over time, the annual transfer approval process modeling will incorporate measured changes to water quality in the San Joaquin River that may result.

The less-than-significant impacts or minimal effects from the proposed transfer program on consumptive use and flows at Vernalis would not trigger a significant cumulative impact to the San Joaquin River Basin, i.e., are not cumulatively considerable. The hydrologic modeling for flows incorporates recent activities and regulatory constraints on the San Joaquin River (see Appendix B).

4.2.4 Impact and Mitigation Summary

The impacts to surface water resources in the San Joaquin River Basin associated with three different action alternatives were discussed in detail in Section 4.2.2. This section of the report, 4.2.4, summarizes the impacts (and any assumed or needed mitigation, and the potential impacts associated with the mitigation) and provides the determinations of significance as required by CEQA. The summary is provided by alternative. Effects to New Melones Reservoir operation and Delta CVP/SWP supply are potentially significant and can be mitigated by measures and actions implemented during the transfer approval process. The mitigation program is explained in detail in Section 13. The thresholds of significance are very low for the criteria. Even small changes can result in potentially significant impacts.

4.2.4.1 No Action Alternative

Under the No Action Alternative the existing water transfers would stop and the Exchange Contractors would take delivery of their entire allotment of CVP water. The Exchange Contractors have been the major (or often the only) supplier of Incremental Level 4 water to the wildlife areas. Under the No Action Alternative the wildlife areas would no longer receive this water and Interior would continue to acquire supplies from other sources. For the analysis presented in this EIS/EIR, it was assumed that the wildlife areas would be able to obtain Incremental Level 4 supplies from other sources commensurate with recent deliveries. Under No Action/No Project, the following comparisons to existing conditions are explained and then summarized in Table 4-60.

- Consumptive use by the Exchange Contractors would be unchanged. There could be a decrease in total consumptive use in the project area depending upon where Interior obtains water for the wildlife areas.
- Flows in the San Joaquin River at Vernalis would be unchanged.
- Water quality at Vernalis is expected to be unchanged.
- Releases from New Melones Reservoir (under the Interim Plan of Operation) used to control water quality and flow at Vernalis would remain unchanged.
- CVP/SWP Delta water supply would be unchanged.

Table 4-60
Summary of Effects of the No Action/No Project Alternative

Affected Resource and Area of Potential Effect	No Action/No Project Compared to Existing Conditions
Consumptive Use	No impact
Flows at Vernalis	No impact
Water Quality at Vernalis	No impact
New Melones Reservoir Operation	No impact
Delta Supply	No impact

In summary, No Action/No Project reflects the existing condition for surface water resources.

4.2.4.2 Alternative A: 80,000 Acre-Feet

Under this alternative the Exchange Contractors could transfer up to 80,000 acre-feet of water per year. This is an increase of 10,365 acre-feet over the existing conditions. Three potential sources of water were considered in the analysis:

- An increase in tailwater recapture of 16,365 acre-feet and a decrease in groundwater pumping of 6,000 acre-feet.
- An increase in groundwater pumping of 10,365 acre-feet.
- Temporary crop idling/temporary land fallowing to develop 16,365 acre-feet of water and reduce groundwater pumping by 6,000 acre-feet.

Three potential areas to transfer the water to were considered.

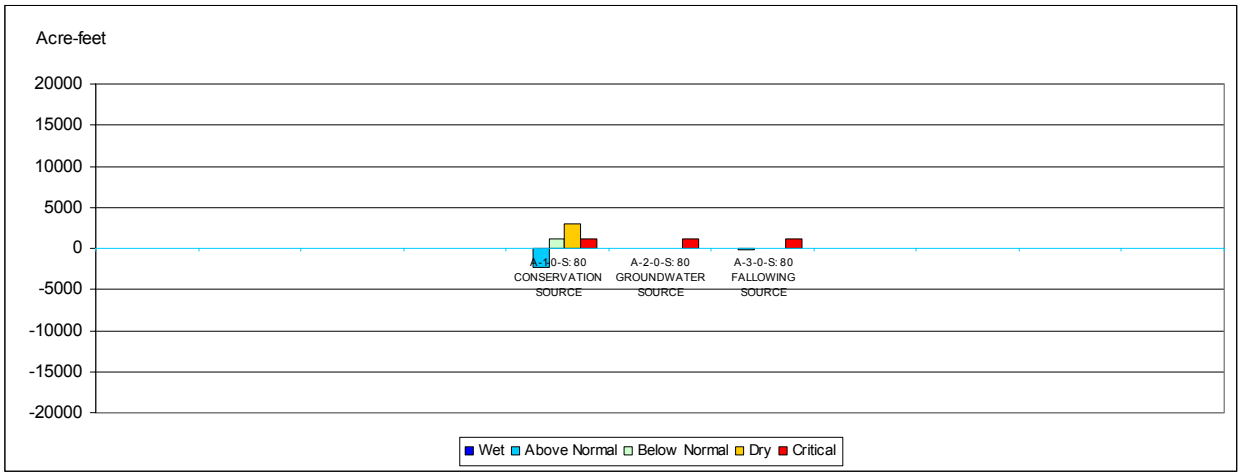
- All water to wildlife areas connected to the San Joaquin River.
- All water to San Joaquin River drainage agriculture.
- All water transferred out-of-basin to wildlife areas, agriculture, and/or M&I users.

The impacts to the San Joaquin River basin include the following. The significance of the impacts from water development and the combined effects of water development and transfer are summarized in Table 4-61 at the end of this section. Mitigation assumptions are identified where needed to reduce impacts to less-than-significant. More information on these mitigation measures is contained in Section 13.

Water Development Only

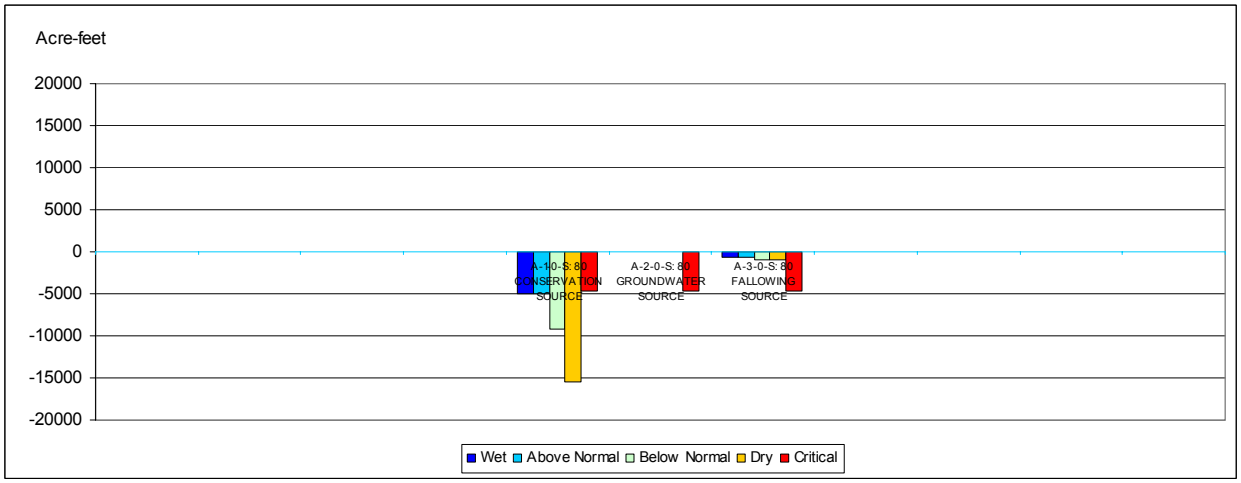
- The development of water by tailwater recovery would cause a small decrease, less than 5 percent at a maximum, in flow at Vernalis. Developing water by increasing groundwater pumping or fallowing would have a very small, insignificant decrease in flow. The effect during critical years is the same for each scenario since each scenario utilizes the same crop idling/temporary land fallowing program during such a year type. Water quality at Vernalis improves slightly under each source scenario.
- The tailwater recovery component of conservation has a larger impact on flows than the groundwater substitution or crop idling/temporary land fallowing components of water development.
- New Melones Reservoir storage typically would gain or remain neutral under all scenarios. Commensurately, Goodwin releases to the Stanislaus River would be slightly reduced at times, if the water gained at New Melones Reservoir remains in storage. In certain circumstances, additional releases may be required from New Melones in reaction to flow or quality changes upstream of Vernalis due to the development of water. Although relatively minor in magnitude, the change in storage is potentially significant in its effect upon water supply allocations under the New Melones Interim Plan of Operations. Figure 4-4 summarizes the effects on New Melones Reservoir storage due to water development only.

Figure 4-4 Effects of Water Development – Alternative A: 80,000 Acre-Feet Net Change in New Melones Storage



- As Figure 4-5 illustrates, there is a potential for reduction in the Delta supply for the CVP/SWP in both the conservation and crop idling/temporary land fallowing scenarios, more so for the conservation scenario. These potentially significant impacts can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13). The groundwater scenario develops no reduction to the Delta CVP/SWP supply, except during critical years when a common crop idling/temporary land fallowing program is employed in each source scenario.

Figure 4-5 Effects of Water Development – Alternative A: 80,000 Acre-Feet Change in CVP/SWP Delta Water Supply

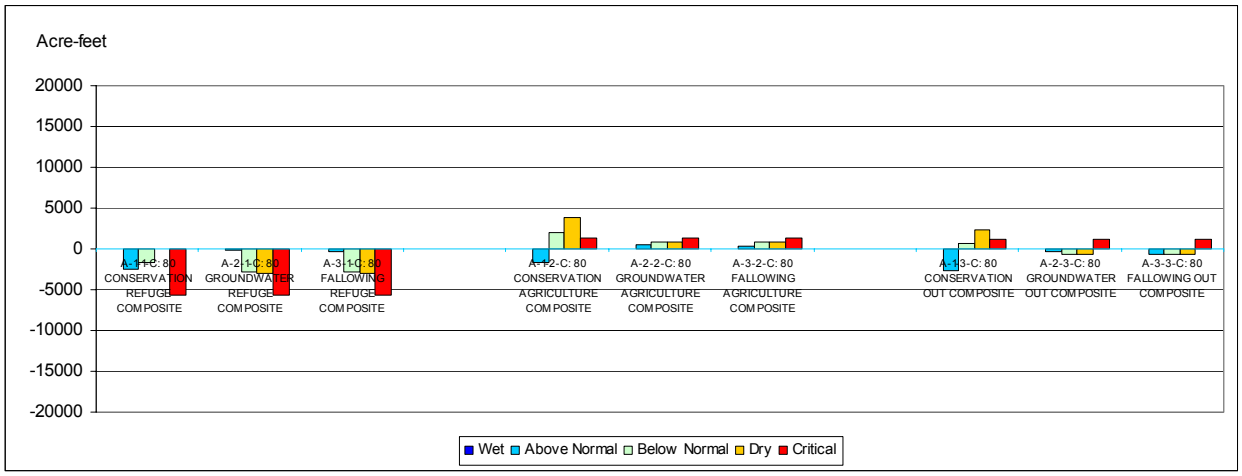


Combined Water Development and Transfer

- Except when including a crop idling/temporary land fallowing component, no change would occur in consumptive use for the Exchange Contractors. Consumptive use by the water purchaser could increase if the water is transferred to agriculture or out-of-basin and is used to increase productivity rather than replace other sources. There would be an increase in consumptive use if the water is transferred to the wildlife areas.

- If water is delivered to within-drainage basin entities, decreases in flow due to developing transfer water would be offset by return flows from these entities, more so when the disposition is to the wildlife areas.
- Transferring the water to the within-drainage basin wildlife areas could cause a small degradation in water quality at Vernalis during periods when the wildlife areas release water. If the decrease occurs during periods when New Melones is releasing for water quality standards at Vernalis, New Melones would react to the change by releasing additional water from New Melones. Transferring water to agriculture results in an insignificant change in water quality. An out-of-basin transfer results in occasional degradations in water quality that could result in additional releases from New Melones Reservoir.
- Storage in New Melones Reservoir could slightly decrease due to releasing water in reaction to water quality and flow changes in the San Joaquin River if water is transferred to the wildlife areas. The decrease could be up to 5,600 acre-feet. A lesser decrease in storage could also occur under certain other combinations of source and disposition. Although relatively minor in magnitude, the change in storage is potentially significant in its effect upon water supply allocations under the New Melones Interim Plan of Operations. This impact can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13). Figure 4-6 summarizes the results on New Melones storage for the 80,000 acre-feet alternative.

Figure 4-6 Composite Effects of Transfer – Alternative A: 80,000 Acre-Feet Net Change in New Melones Storage



- Effects would occur to Delta supply for all scenarios. When delivering to the wildlife areas, the depletion effects of developing water would be offset with additional return flows and releases from New Melones for water quality and flow objectives. At different times, the change in inflow could increase, decrease, or be neutral to the CVP/SWP Delta water supply. Figure 4-7 summarizes these results. Potential reductions to CVP/SWP Delta water supply would be potentially significant. This impact can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13).

Figure 4-7 Composite Effects of Transfer – Alternative A: 80,000 Acre-Feet Change in CVP/SWP Delta Water Supply

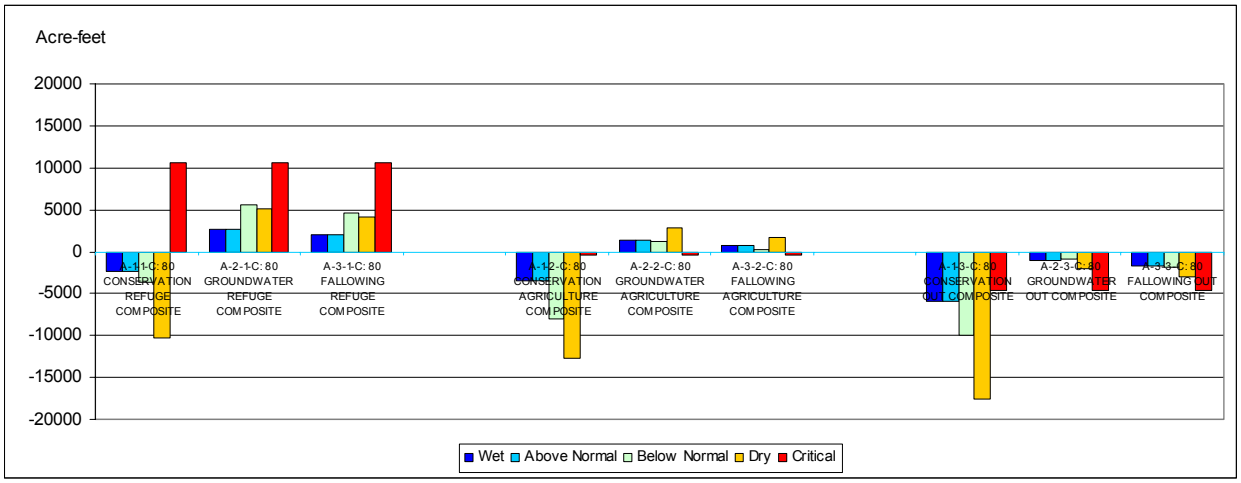


Table 4-61 summarizes the impacts and effects for water development only in the first row and then for the combined effects of development and use in the following three rows for each area of potential effect.

Table 4-61
Summary of Effects of Alternative A: 80,000 Acre-Feet

Affected Resource and Area of Potential Effect		CEQA	NEPA
Consumptive Use	Water Development	No adverse impact	Neutral effect
	All Water to Refuges	Less-than-significant adverse impact	Minimal effect
	All Water to Agriculture	Less-than-significant adverse impact	Minimal effect
	Out-of-Basin	Less-than-significant adverse impact	Minimal effect
Flow at Vernalis	Water Development	Less-than-significant adverse impact	Minimal effect
	All Water to Refuges	No adverse impact	Minimal effect
	All Water to Agriculture	No adverse impact, less-than-significant adverse impact for conservation option	Minimal effect
	Out-of-Basin	No adverse impact, less-than - significant adverse impact for conservation option	Minimal effect

Table 4-61
Summary of Effects of Alternative A: 80,000 Acre-Feet

Affected Resource and Area of Potential Effect		CEQA	NEPA
Water Quality at Vernalis	Water Development	Beneficial impact	Positive effect
	All Water to Refuges	Less-than-significant adverse impact due to reaction of New Melones Reservoir to changes in San Joaquin River conditions	Minimal effect due to reaction of New Melones Reservoir to changes in San Joaquin River conditions
	All Water to Agriculture	No adverse impact	Neutral effect
	Out-of-Basin	Less-than-significant adverse impact due to reaction of New Melones Reservoir to changes in San Joaquin River conditions	Minimal effect due to reaction of New Melones Reservoir to changes in San Joaquin River conditions
New Melones Reservoir Operation	Water Development	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Refuges	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Agriculture	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	Out-of-Basin	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
Delta Supply	Water Development	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Refuges	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Agriculture	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	Out-of-Basin	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures

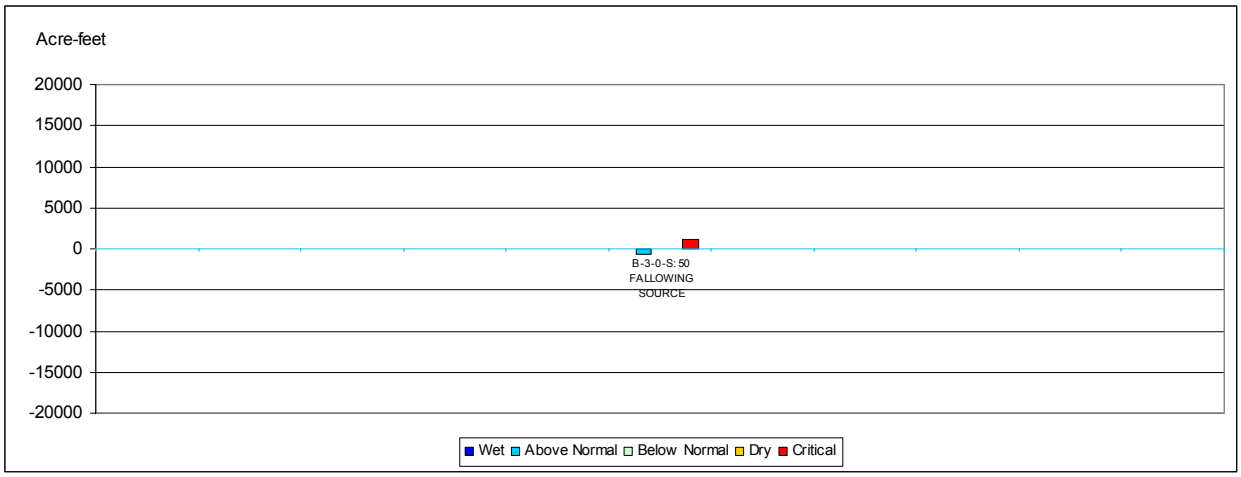
4.2.4.3 Alternative B: 50,000 Acre-Feet

Under this alternative the Exchange Contractors could transfer up to 50,000 acre-feet of water per year. This water would be developed through crop idling/temporary land fallowing. The impacts to the San Joaquin River basin include the following. The significance of the impacts associated with water development only and the combined effects of water development and transfer is summarized in Table 4-62.

Water Development Only

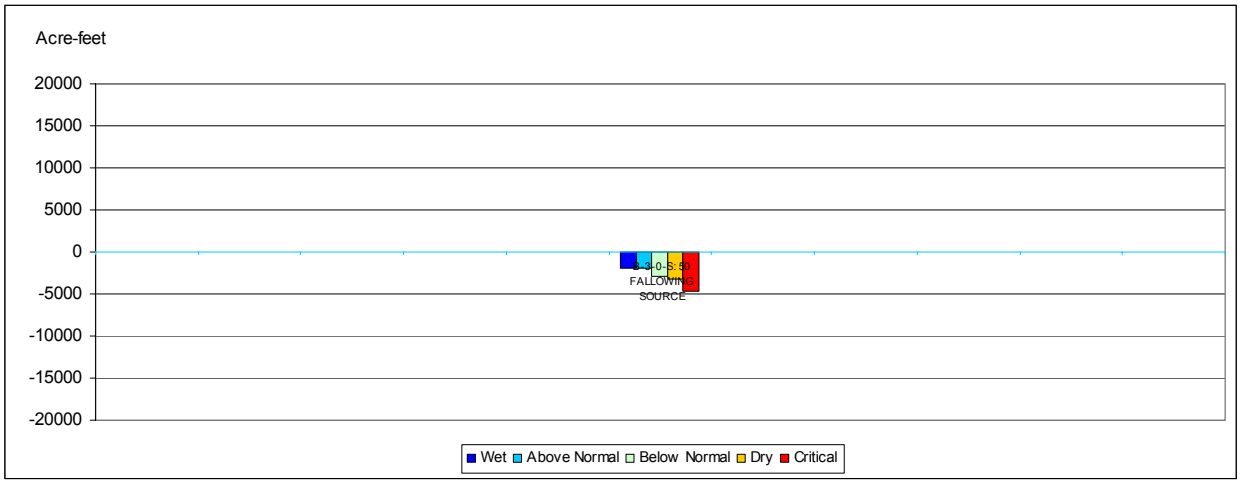
- Flows in the San Joaquin River at Vernalis would be reduced by development of transfer water through crop idling/temporary land fallowing. The reduction is minor, less than 2 percent in any month. Water quality at Vernalis improves slightly.
- This alternative would have no or only a minor effect on storage in New Melones Reservoir (and commensurately Goodwin releases to the Stanislaus River). Storage could change within a range of plus or minus 1,200 acre-feet. In certain circumstances, additional releases may be required from New Melones in reaction to flow or quality changes upstream of Vernalis due to the development of water. Although relatively minor in magnitude, the change in storage is potentially significant in its effect upon water supply allocations under the New Melones Interim Plan of Operations. This impact can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13). Figure 4-8 summarizes the effects on New Melones Reservoir storage due to water development only.

Figure 4-8 Effects of Water Development – Alternative B: 50,000 Acre-Feet Net Change in New Melones Storage



- The Delta supply for the CVP/SWP may be slightly reduced but by a small amount, less than 5,000 acre-feet. This impact is potentially significant and mitigatable to less than significant through measures incorporated into the transfer approval process (see Section 13). Figure 4-9 summarizes the effects on the CVP/SWP Delta water supply due to water development only.

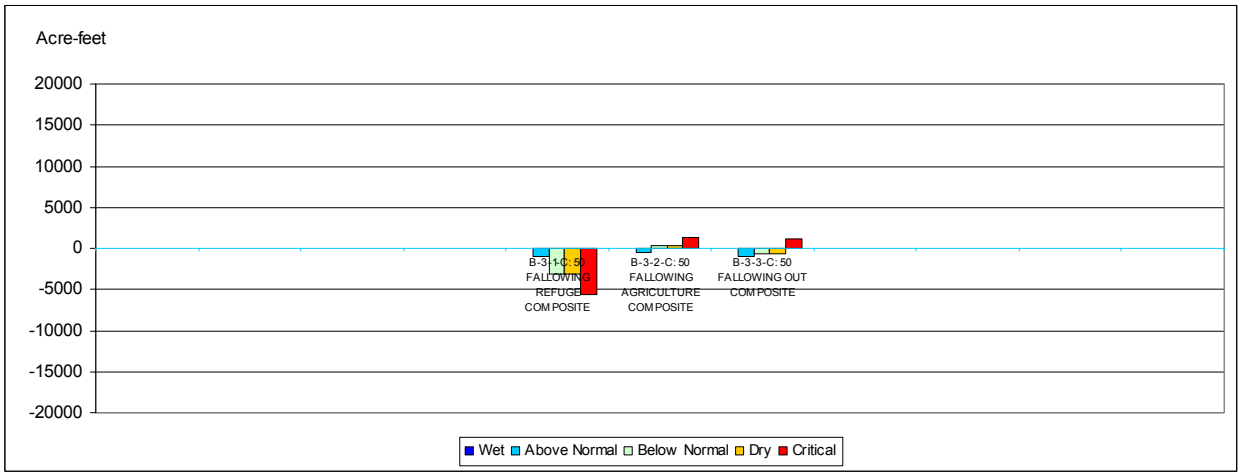
Figure 4-9 Effects of Water Development – Alternative B: 50,000 Acre-Feet Change in CVP/SWP Delta Water Supply



Combined Water Development and Transfer

- Consumptive use by the Exchange Contractors would decrease by their action of crop idling/temporary land fallowing to develop transfer water. Countering this decrease would be an increase in consumptive use if all water were transferred to the wildlife areas. For the agriculture focus and out-of-basin scenarios, consumptive use by the water purchaser could increase if the water was used to increase irrigation.
- Developing water through crop idling/temporary land fallowing would have minimal effects on flow at Vernalis. When delivering to the wildlife areas, the flow would increase during August and only minor reductions to flow would occur during other months. No significant impact on flows would occur for the other scenarios.
- Development of water by crop idling/temporary land fallowing alone has no significant impact to water quality at Vernalis. During periods when New Melones is releasing water for water quality objectives at Vernalis, the combined effects of water development and use, especially by the refuges, may require additional released water from New Melones Reservoir to maintain water quality objectives. Essentially no effect would occur to water quality for the agriculture focus scenario, but the out-of-basin transfer scenario could trigger occasional releases from New Melones Reservoir.
- A potential reduction in New Melones Reservoir storage primarily occurs in the to refuge focus transfer. In certain circumstances, additional releases may be required from New Melones to mitigate a change in flow or quality at Vernalis. Although relatively minor in magnitude, the change in storage is potentially significant in its effect upon water supply allocations under the New Melones Interim Plan of Operations. This impact can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13). Figure 4-10 summarizes these results.

Figure 4-10 Composite Effects of Transfer – Alternative B: 50,000 Acre-Feet Net Change in New Melones Storage



- A small potential effect on CVP/SWP Delta water supply would occur as shown in Figure 4-11. When delivering to the wildlife areas, the return flow and releases from New Melones for water quality and flow objectives increase the CVP/SWP Delta water supply. The other delivery focuses deplete the CVP/SWP Delta water supply by minor amounts. These potentially significant impacts can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13).

Figure 4-11 Composite Effects of Transfer – Alternative B: 50,000 Acre-Feet Change in CVP/SWP Delta Water Supply

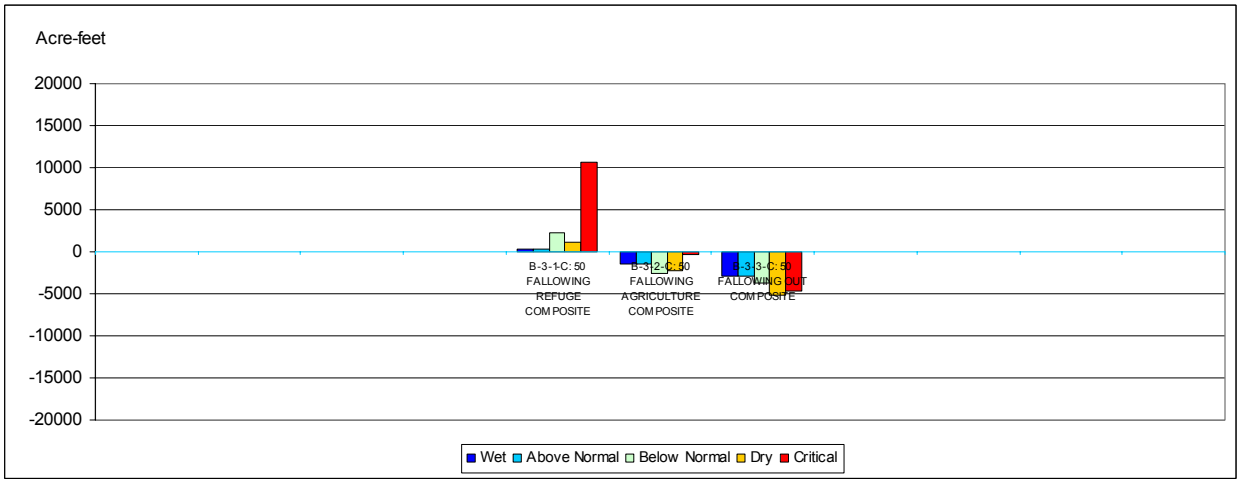


Table 4-62
Summary of Effects of Alternative B: 50,000 Acre-Feet

Affected Resource and Area of Potential Effect		CEQA	NEPA
Consumptive Use	Water Development	No adverse impact	Neutral effect
	All Water to Refuges	Less-than-significant adverse impact	Minimal effect
	All Water to Agriculture	Less-than-significant adverse impact	Minimal effect
	Out-of-Basin	Less-than-significant adverse impact	Minimal effect
Flow at Vernalis	Water Development	Less-than-significant adverse impact	Minimal effect
	All Water to Refuges	Less-than-significant impact	Minimal effect
	All Water to Agriculture	No adverse impact	Neutral effect
	Out-of-Basin	No adverse impact	Neutral effect
Water Quality at Vernalis	Water Development	Beneficial impact	Positive effect
	All Water to Refuges	Less-than-significant adverse impact due to reaction of New Melones Reservoir to changes in San Joaquin River conditions	Minimal effect due to reaction of New Melones Reservoir to changes in San Joaquin River conditions
	All Water to Agriculture	No adverse impact	Neutral effect
	Out-of-Basin	Less-than-significant adverse impact due to reaction of New Melones Reservoir to changes in San Joaquin River conditions	Minimal effect due to reaction of New Melones Reservoir to changes in San Joaquin River conditions
New Melones Reservoir Operation	Water Development	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Refuges	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Agriculture	Potentially significant adverse impact,	Negative effect, mitigatable to minimal with transfer approval process measures
	Out-of-Basin	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures

Table 4-62
Summary of Effects of Alternative B: 50,000 Acre-Feet

Affected Resource and Area of Potential Effect		CEQA	NEPA
Delta Supply	Water Development	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Refuges	No adverse impact	Neutral effect
	All Water to Agriculture	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	Out-of-Basin	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures

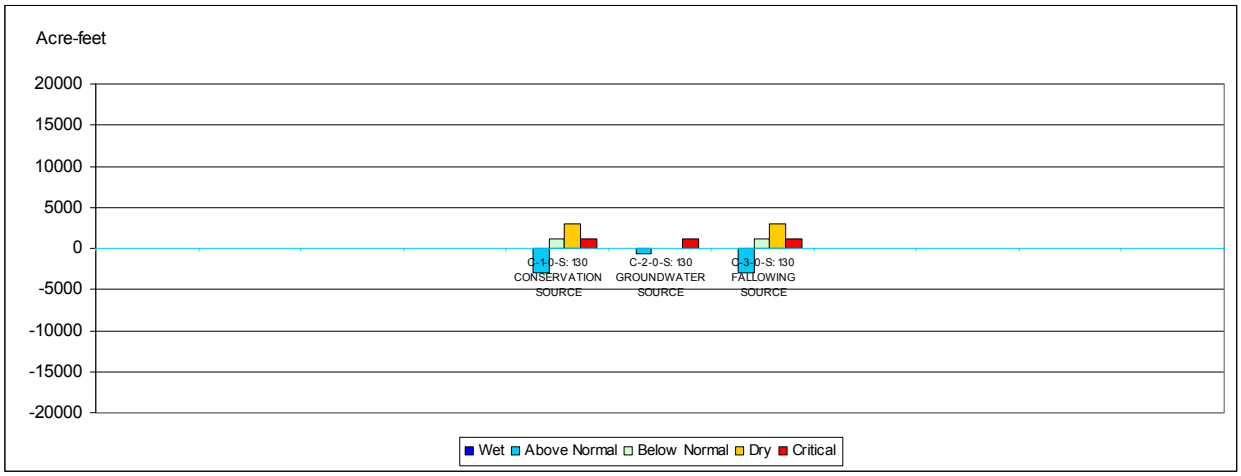
4.2.4.4 Alternative C: 130,000 Acre-Feet

Under this alternative the Exchange Contractors could transfer up to 130,000 acre-feet of water per year. This water would be obtained through multiple sources including an additional 15,465 acre-feet of tailwater recovery, 50,000 acre-feet from crop idling/temporary land fallowing, and for the groundwater scenario an additional 10,365 acre-feet from groundwater substitution. The impacts to the San Joaquin River basin include the following. The individual and combined effects of water development and transfer are summarized in Table 4-63.

Water Development Only

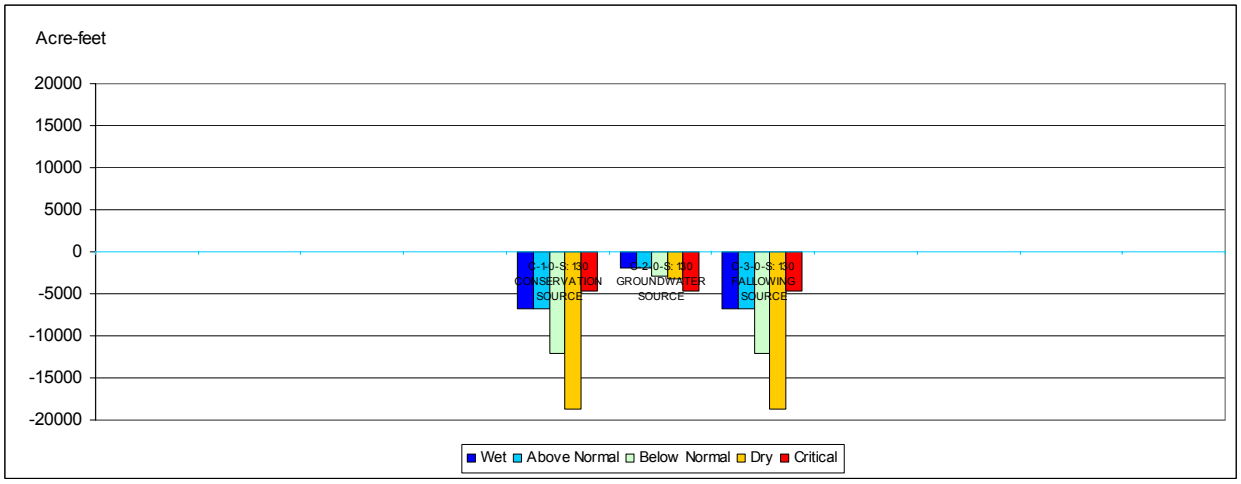
- Vernalis flows would be reduced by any of the source scenarios the Exchange Contractors employ, although the reductions would be minor. The conservation/crop idling/temporary land fallowing scenarios create the largest affect on Vernalis flows. The effect during critical years is the same for each scenario since each scenario utilizes the same crop idling/temporary land fallowing program during such a year type. Water quality at Vernalis improves slightly with each source scenario, commensurate with the amount of tailwater removed through conservation and crop idling/temporary land fallowing.
- New Melones Reservoir storage typically would gain or remain neutral under all scenarios. Commensurately, Goodwin releases to the Stanislaus River would be slightly reduced at times, if the water gained at New Melones Reservoir remains in storage. In certain circumstances, additional releases may be required from New Melones in a reaction to a change in flow or quality upstream of Vernalis due to the development of water. Although relatively minor in magnitude, the change in storage is potentially significant in its effect upon water supply allocations under the New Melones Interim Plan of Operations. This impact can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13). Figure 4-12 summarizes the effects on New Melones Reservoir storage due to water development only.

Figure 4-12 Effects of Water Development – Alternative C: 130,000 Acre-Feet Net Change in New Melones Storage



- As Figure 4-13 illustrates, there is a potential for reduction in Delta supply for the CVP/SWP in all the scenarios, more so for the conservation and crop idling/temporary land fallowing scenarios. During critical years, a common crop idling/temporary land fallowing program is employed in each source scenario. These potentially significant impacts can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13).

Figure 4-13 Effects of Water Development – Alternative C: 130,000 Acre-Feet Change in CVP/SWP Delta Water Supply



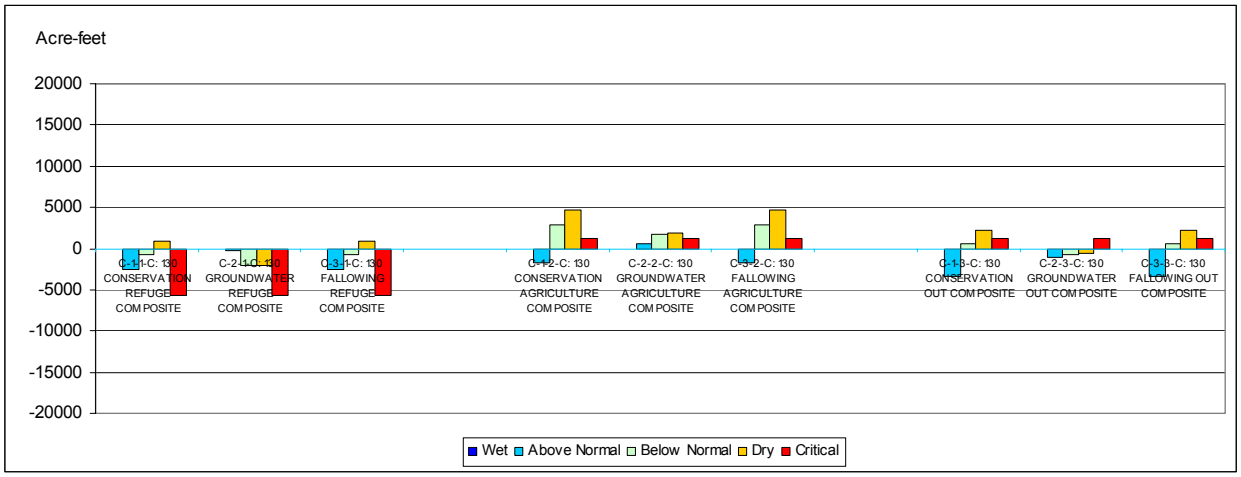
Combined Water Development and Transfer

- Consumptive use by the Exchange Contractors would decrease due to due to some of the water being obtained from crop idling/temporary land fallowing. For the agriculture focus and out-of-basin transfer scenarios, consumptive use by the water purchaser could increase if

the water was used to increase irrigation. There would be a slight increase in consumptive use if water were transferred to the wildlife areas.

- There would be a small decrease in flows at Vernalis due to tailwater recapture and crop idling/temporary land fallowing removing water. The decrease would be less than 5 percent. If water were transferred to the wildlife areas, flow would increase with August wildlife area releases. Only minor decreases or increases would occur during other times for all scenarios.
- Water development alone has a beneficial impact to water quality at Vernalis. If water is transferred to the refuges, some of that beneficial impact is negated. No or very little offsetting negative effects would occur to water quality for the agriculture focus and out-of-basin scenarios.
- Water development with transfers of water to agriculture and out-of-basin users have minor impacts to storage in New Melones Reservoir, typically leading to gains in storage (agriculture), but with some reductions as well (out of basin). Transferring water to the refuges has a mixed result in terms of potential changes in storage. In certain circumstances, additional releases may be required from New Melones in reaction to changes in flow or quality conditions upstream of Vernalis. Although relatively minor in magnitude, the change in storage is potentially significant in its effect upon water supply allocations under the New Melones Interim Plan of Operations. This impact can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13). Figure 4-14 summarizes these results.

Figure 4-14 Composite Effects of Transfer – Alternative C: 130,000 Acre-Feet Net Change in New Melones Storage



- Effects would occur to the CVP/SWP Delta supply for all scenarios. When delivering to the wildlife areas, the depletion effects of developing water will be offset with additional return flows and releases from New Melones for water quality and flow objectives. At different times, the change in inflow could increase, decrease, or be neutral to the CVP/SWP Delta water supply. Figure 4-15 summarizes these results. Potentially significant impacts to CVP/SWP Delta water supply can be mitigated to less than significant through measures incorporated into the transfer approval process (see Section 13). Potential negative effects are reduced when a groundwater source program is employed.

Figure 4-15 Composite Effects of Transfer – Alternative C: 130,000 Acre-Feet Change in CVP/SWP Delta Water Supply

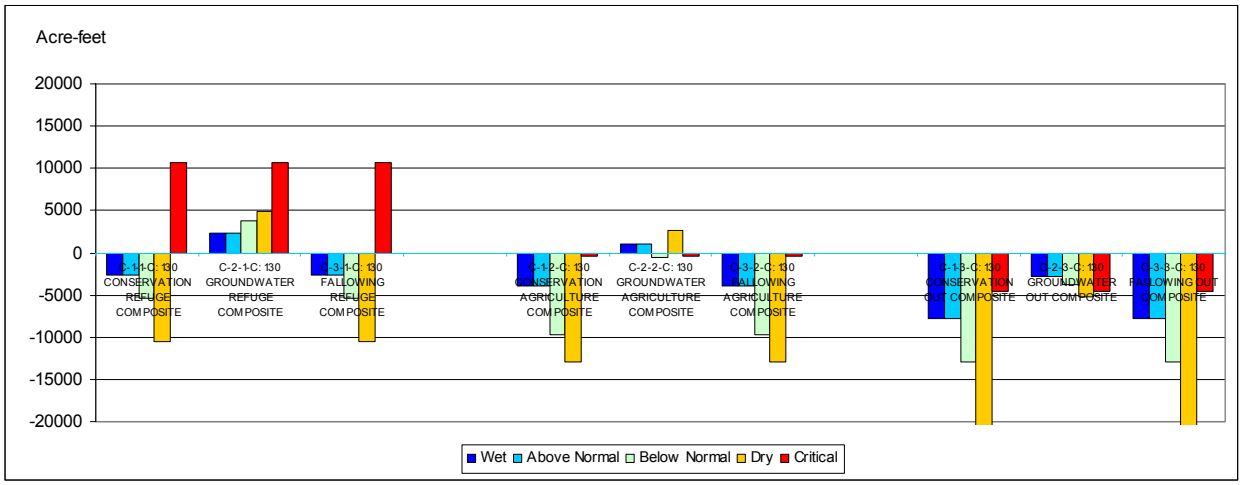


Table 4-63
Summary of Effects of Alternative C: 130,000 Acre-Feet

Affected Resource and Area of Potential Effect		CEQA	NEPA
Consumptive Use	Water Development	No adverse impact	Neutral effect
	All Water to Refuges	Less-than-significant adverse impact	Minimal effect
	All Water to Agriculture	Less-than-significant adverse impact	Minimal effect
	Out-of-Basin	Less-than-significant adverse impact	Minimal effect
Flow at Vernalis	Water Development	Less-than-significant adverse impact	Minimal effect
	All Water to Refuges	No adverse impact, less-than-significant beneficial effect in August	Minimal effect
	All Water to Agriculture	Less-than-significant adverse impact	Minimal effect
	Out-of-Basin	Less-than-significant adverse impact	Minimal effect
Water Quality at Vernalis	Water Development	Beneficial impact	Positive effect
	All Water to Refuges	Less-than-significant adverse impact due to reaction of New Melones Reservoir to changes in San Joaquin River conditions	Minimal effect due to reaction of New Melones Reservoir to changes in San Joaquin River conditions
	All Water to Agriculture	Beneficial impact	Positive effect
	Out-of-Basin	Less-than-significant adverse impact due to reaction of New Melones Reservoir to changes in San Joaquin River conditions	Minimal effect due to reaction of New Melones Reservoir to changes in San Joaquin River conditions

Table 4-63
Summary of Effects of Alternative C: 130,000 Acre-Feet

Affected Resource and Area of Potential Effect		CEQA	NEPA
New Melones Reservoir Operation	Water Development	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Refuges	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Agriculture	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	Out-of-Basin	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
Delta Supply	Water Development	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Refuges	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	All Water to Agriculture	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures
	Out-of-Basin	Potentially significant adverse impact, mitigatable to less than significant with transfer approval process measures	Negative effect, mitigatable to minimal with transfer approval process measures

4.2.4.5 CVP/SWP Delta Water Supply

The analyses illustrate that the CVP/SWP Delta water supply would be affected by the development and transfer of water, to varying degrees, sometimes positively and sometimes negatively. These effects would have little, if no effect on the amount of water exported from the Delta, the exports currently being primarily limited by export constraints as opposed to Delta supply. The effect of the modeled changes in inflow from the San Joaquin River would practicably be unnoticeable within day-to-day Delta operations. Nonetheless, during periods of control in the Delta the effects are a potential impact to the CVP/SWP, likely manifesting as a change in releases from upstream reservoirs.

The calculated effect to the CVP/SWP Delta water supply is only known after-the-fact based on a post-analysis of the transfer and the hydrology that actually occurred during the year. This

calculated effect would then manifest as reduced storage available within the determination of the subsequent year's water supply allocations.