ENVIRONMENTAL ASSESSMENT

EA NUMBER 01-24

MENDOTA POOL 2001 EXCHANGE AGREEMENT

FINAL

AUGUST 1, 2001

United States Department of the Interior
South-Central California Area Office
1243 "N" Street
Fresno, California 93721-1813

E N T R I X

ENTRIX, Inc.
590 Ygnacio Valley Road
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BUREAU OF RECLAMATION
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August 1, 2001

Judi Tapia
US Bureau of Reclamation
1243 "N" Street
Fresno, CA 93721-1831

Re: Final Environmental Assessment - Mendota Pool 2001 Exchange Agreement

Dear Ms. Tapia:

Enclosed are 5 copies of the final version of the Environmental Assessment for the Mendota Pool 2001 Exchange Agreement. This document incorporates all the comments received to date.

If you have any questions or need additional copies of the document, then please contact me.

Sincerely,

James D. Tall, for

Theodore E. Donn, Jr.
Senior Consultant

cc:
Marc Carpenter
Glenn Browning

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

FINDING OF NO SIGNIFICANT IMPACT

Exchange Agreements with Mendota Pool Group for 2001 Pumping Program FONSI No. 01-24

In accordance with Section 102 (2)(c) of the National Environmental Policy Act (NEPA) of 1969, as amended, South-Central California Area Office of the U.S. Bureau of Reclamation (Reclamation), has determined that an environmental impact statement is not required for the establishment of Exchange Agreements with the Mendota Pool Group (MPG) for the 2001 Pumping Program. This Finding of No Significant Impact is supported by the Environmental Assessment (EA) entitled "Mendota Pool 2001 Exchange Agreement" (EA) dated August 2001 which is hereby incorporated by reference. The EIR is also incorporated by reference It is also supported by the Final Environmental Impact Reports (EIR) entitled "Conveyance of Nonproject Groundwater from the Mendota Pool Area Using the California Aqueduct" December 1998. The-EIR determined that the long-term (20-year) program would have significant impacts in four resource areas: Groundwater level, land subsidence, groundwater quality and surface water quality. Additional mitigation measures have been incorporated in the 2001 pumping program to reduce these impacts to less than significant as described in the EA for the Mendota Pool 2001 Exchange Agreement. The proposed pumping program also complies with the "Agreement for Mendota Pool Transfer Pumping Project" (Agreement) reached between the Mendota Pool Group and other parties involved in the lawsuit filed after the EIR was finalized. The final EIR and the EA for the Mendota Pool 2001 Exchange Agreement are incorporated by reference. Kenneth D. Schmidt & Associates (KDSA) and Luhdorff & Scalmanini Consulting Engineers (LSCE) have produced two reports that evaluate the environmental impacts of the 1999 pumping project and the 2000 fall pumping plan. These documents entitled "Results of the 1999 Test Pumping Program for Mendota Pool Group Wells" dated May 2000, and "Long-term Impacts of Transfer Pumping by the Mendota Pool Group" dated December 2000, (technical reports) are hereby incorporated by reference as well.

The Mendota Pool Group proposed to introduce up to 31,000 acre-feet, as a group, of nonproject water from groundwater wells into the Pool. Under the proposed project, up to 25,000 acre-feet would be exchanged with Reclamation for an equivalent amount of Central Valley Project (project) water at Check 13 of the Delta-Mendota Canal (DMC) for irrigation of MPG lands. The proposed action is dependent upon: 1) a sufficient amount of project water can be made available, 2) the exchange will have no adverse impact on project water supplies or operations, and 3) Reclamation would make releases to Mendota Pool (Pool) from the DMC for water service contractors without this exchange. The proposed action would occur between May 1, 2001 and November 21, 2001.

Due to concerns expressed by groundwater users to the northeast of the San Joaquin River, Reclamation has decided to limit the scope of this action, pending further data review and discussions among the parties. This FONSI covers the exchange of up to 22,000 acre-feet of nonproject water as described in Table 1 (the abbreviated action). The action addressed by this FONSI specifically excludes any exchange of water pumped from Mendota Pool Group wells located in Farmers Water District. This FONSI only applies to the exchange of water between the date of execution of this document and November 21, 2001.

Reclamation may, with the appropriate environmental documentation, authorize the exchange of water from the Farmers Water District wells, pending satisfactory review of additional data and analyses.

All nonproject water from MPG wells introduced into the Pool for this exchange will be monitored by electrical conductivity (EC) meters and surface and groundwater samples to meet specific water quality criteria. Failure to meet contracted water quantity or quality requirements of the proposed action will result in immediate cessation of the action.

Based on the analyses and conclusions of the EA for the proposed project, an independent Reclamation review of the final EIR, and supporting technical reports, the abbreviated action (Table 1) has independent utility, is neither precedent setting, controversial, nor an action usually requiring an Environmental Impact Statement. In accordance with 40 CFR 1506.3 (516 DM 3.6), Reclamation is adopting the EA and related technical reports. Therefore, the preparation of an Environmental Impact Statement is not required.

This determination is supported by the following findings:

1. Impacts on CVP Operations - CVP operations will be marginally altered as a result of this exchange in that water that would have otherwise been delivered to the Mendota Pool will now be delivered to CVP contractors on the San Luis Canal.

2. Land Use - There will be no changes in land use patterns, nor will additional lands be placed into production. Land subsidence was determined to be significant in the EIR. The adjustments to the 2001 pumping plan including decreasing the total pumping volume and adjusting the location and timing of the deep well pumping on the west side of the Pool have reduced impacts from those found in the EIR. The EA determined that the significance criteria for land subsidence would be subsidence greater than 0.005 ft per year at the Yearout Ranch and Fordel, Inc. extensometers. The modeling for the current pumping scenario predicts subsidence due to the proposed action to be less than 0.005 ft. Since the models do not project impacts greater than the significance threshold, the impacts due to land subsidence are insignificant.

3. Biological Resources - There will be no impacts to threatened or endangered species or other biological resources. The amount of water within the canals, river and pool system will be constant as the exchange is equal. Also no terrestrial biological impacts are predicted

from the pumping into the Pool and the movement of an equivalent amount of surface water. Furthermore, there will be no exceedances of applicable water quality criteria for the protection of aquatic resources, or terrestrial wildlife. Therefore the effect on biological resources will be insignificant.

4. Archeological and Cultural Resources - There will be no impacts to cultural resources from the proposed action. No additional surface preparation or disturbance is planned.

5. Indian Trust Assets - There are no Indian Trust Assets in the project area that would be impacted by the proposed action.

6. Environmental Justice - There are no minority or disadvantaged communities that would be impacted by the proposed action. The action is consistent with Executive Order 12898.

7. Hydrology and Water Quality – The EIR found three resource subareas under this heading to be significant. These were groundwater levels, groundwater quality, and surface water quality. Due to the confinement of the aquifer, the groundwater is potentially impacted at two levels, shallow (approximately 0 to 100 feet below the surface and above the A clay) and deep (approximately 100 feet to 500 feet in the zone between the A Clay and the Corcoran Clay). The proposed pumping program has mitigated for the effects to these resource areas. These resources areas are addressed below:

Groundwater levels: Part of the pumping plan includes the stipulation that there will be complete recovery of the groundwater depletion attributable to this proposed action during the subsequent winter months.

The EA determined the significance criteria for shallow groundwater levels to be any increase in pumping costs in wells offsite of the Mendota Pool Group lands that is attributed to drawdown from Mendota Pool Group transfer pumping. As part of the Agreement, the Mendota Pool Group has agreed to mitigate this effect by compensating well owners for increased power and other costs attributable to Mendota Pool Group transfer pumping. Therefore the effect on nearby well owners is not significant.

Groundwater quality: The EA measured the water quality of both the shallow and deep zone wells in the area.

Shallow – The shallow wells that will be pumped are on the west and southern end of the Fresno Slough branch of the Pool in an area where the hydraulic gradient is from the southwest to the northeast. This gradient has the potential to bring higher salinity groundwater into the westside of the pool area. The water quality of the shallow wells in the area [as measured by parameters Electrical Conductivity (EC), Total Dissolved Solids (TDS), chloride (Cl), sulfate (SO_4), boron (B) and selenium (Se)] have remained relatively constant between 1999 and the most recent 2001 data. The proposed pumping volume of 19,000 acre-feet of shallow groundwater over the six and one-half month period will cause a small cone of depression and therefore not accelerate the hydraulic gradient and flow of low quality groundwater into the area. Since the shallow groundwater will remain as found in the historic background or improve, there will be no significant impact to the shallow groundwater quality.

Deep –The EA evaluated the effects of deep zone groundwater pumping from wells both to the west and east of the Pool. The wells to the west of the Pool along Fresno Slough are of moderate water quality (measured by the parameters listed in shallow groundwater quality) as compared to wells to the east of the Pool. The 1999 to 2001 data study showed no change in water quality in deep zone wells. The pumping volume of 12,000 acre-feet (which is inclusive of the up to 3,000 acre-feet of water for exchange) over the six and one-half month period will cause a small cone of depression and therefore not accelerate the hydraulic gradient and flow of lower quality groundwater into the area. Lateral movement of the deep groundwater due to all pumping activities is estimated to be less than 170 feet. The proposed pumping program will not cause any additional drinking water wells to fail to meet water quality standards. The hydrologic analysis for the pumping program determined that there would be no measurable change in the quality of the deep zone wells and therefore there will be no significant impacts.

The abbreviated pumping program will exclude use of the deep wells in Farmers Water District for exchange. Therefore, the influence of the deep wells on water quality will be decreased.

Surface water quality: Due to the slow southerly movement within the pool, impacts to surface water can be different in the north end of the Pool (which could potentially impact SJR quality and the quality of water delivered to the contractors who take delivery of their water from the pool) and the south end of the pool (which borders the Mendota Wildlife Refuge (MWR) and where surface water quality could potentially impact wildlife and plants).

North – Surface water flow in the Fresno Slough branch of the Pool is predominantly to the south during the pumping season. Northerly flows did not occur during the 1999 or 2000 pumping programs. Surface water quality impacts observed during 1999 and 2000 were small and isolated and this is again expected to be the case in 2001. Historic patterns have shown that EC measurements at the Exchange Contractors intakes track very closely to the EC measured in the outfall of the DMC. In order to ensure that this impact will be less than significant, this issue was addressed in the recent technical understanding between the MPG and the San Joaquin River Exchange Contractors (SJREC) and Newhall Land Farming (NLF). The MPG agreed to: 1) only pump its wells along the Slough when flow in the Slough is to the south, and 2) shut off some of the wells if the EA measurements at the canal intakes exceed that of the DMC by 90 micromhos/cm for a period of three days or more. If the MPG wells are shut off for this reason, they will not be turned back on until the EC at the canal intakes returns to a level that is no more than 30 micromhos/cm above the DMC inflow. These mitigation measures will reduce this impact to a less than significant level.

South – The EA included an evaluation of water quality impacts in the southern portion of the Pool due to selenium and salinity as measured by Total Dissolved Solids (TDS) inputs by the Mendota Pool Group wells. The analysis determined that the applicable water quality criteria for irrigation water deliveries and protection of aquatic life will be met. The significance criterion for selenium is 2 µg/L and corresponds to criteria set by the Regional Water Quality Control Board and the U.S. Fish and Wildlife Service for the protection of aquatic resources and wildlife. The analysis presented in the EA (Section 4.2.5, and Appendix D) indicates that the Mendota Pool Group pumping will not cause exceedances of the criterion for selenium. Current water quality analyses presented in Appendix D of the EA suggest that selenium concentrations in the Pool may actually decrease due to the pumping program. The analyses presented in Section 4.2.5 of the EA indicate that the TDS concentration would average 385 mg/L for the year, and would not exceed 530 mg/L. The TDS concentrations would meet applicable criteria for irrigation water deliveries to the Mendota Wildlife Area.

Other agency approvals required:
None Required

Reclamation conducted an informal consultation procedure with the U.S. Fish and Wildlife Service (USFWS). The draft EA was reviewed by USFWS who determined that the action was not likely to affect special status species. The USFWS would not object to the project proceeding with the following conditions:

- Formal consultation would be undertaken on any similar future actions, and
- Monitoring data from the 2000 and 2001 programs is provided to USFWS.

Summary of Environmental Assurances and Monitoring:

1. Implement monitoring plan as outlined in Appendix B of the EA over the period of the proposed action including:

- Monitor pumpage of Mendota Pool Group wells on a weekly basis;
- Measure groundwater levels on a bimonthly basis (July, September, and November) in 2001;
- Conduct sampling for groundwater quality analyses in June and October, 2001
- Obtain data from EC recorders located at the DMC and Exchange Contractors intakes;
- Conduct surface water sampling and analyses as specified;

- Conduct sediment sampling at the eight locations specified in summer 2001 and spring 2002;
- Have an adequate quality assurance/quality control program to verify accuracy of data.

2. Implement pumping plan as outlined in the EA including:

- Water pumped by Farmers Water District wells is not included for exchange under this FONSI;
- Pumping no more than 21,688 acre-feet for exchange between May 1 and November 21;
- Pumping no more than 2,687 acre-feet from the deep wells on the west of Fresno Slough.

3. Implement the following mitigation measures:

- Only pump wells along the Fresno Slough when flow in the Fresno Slough is to the south, and
- Shut off wells if EC measurements at the canal intake exceed that of the DMC by 90 micromhos/cm for a period of three days or more. If the MPG wells are shut off for this reason, they will not be turned back on until the EC at the canal intakes returns to a level that is no more than 30 micromhos/cm above the DMC inflow.

4. Provide required data to Reclamation to verify full implementation of pumping and monitoring plan.

The EA entitled "Mendota Pool 2001 Exchange Agreement" (EA number 01-24) prepared pursuant to the National Environmental Policy Act, the draft and final EIR entitled "Conveyance of Nonproject Groundwater from the Mendota Pool Area Using the California Aqueduct," prepared pursuant to the California Environmental Quality Act, and the technical reports are on file at the South-Central California Area Office, Bureau of Reclamation, 1243 "N" Street, Fresno, California 93721 Phone (559) 487-5116. Questions about this FONSI may be directed to Judi Tapia, Bureau of Reclamation, Mid-Pacific Region, South-Central California Area Office, 1243 "N" Street, Fresno, California 93721, Phone (559) 487-5179.

Recommended: Jedi Tapia 8/6/01

Environmental Specialist — Date

South-Central California Area Office

Concur: Kathy Wood 8/6/01

Chief, Resource Management Division — Date

South-Central California Area Office

Approved: for Michael Paul Jackson August 6th, 2001

Area Manager — Date

South-Central California Area Office

Table 1.Mendota Pool Group Transfer Pumping Program for 2001 Covered by this FONSI

Period	No. of Days	Location	Depth Zone	Capacity (cfs)	Percent of Capacity	Rate (cfs)	Total Pumped (af)	Total for Period (af)
May 1 – June 15	46	Fresno Slough (north)	Shallow	13.6	90.0	12.2	1,118	
		Fresno Slough (south)	Shallow	35.9	90.0	32.3	2,944	
		Fresno Slough (north)	Deep	55.2	20.0	11.0	1,008	
		Fresno Slough (south)	Deep	29.5	10.0	2.9	269	5,339
June 16 – Sept. 15	92	Fresno Slough (north)	Shallow	13.6	100.0	13.6	2,483	
		Fresno Slough (south)	Shallow	35.9	100.0	35.8	6,540	
		Fresno Slough (north)	Deep	55.2	0.0	0.0	0	
		Fresno Slough (south)	Deep	29.5	0.0	0.0	0	9,023
Sept. 16 – Nov. 21	67	Fresno Slough (north)	Shallow	13.6	90.0	12.2	1,628	
		Fresno Slough (south)	Shallow	35.9	90.0	32.3	4,288	
		Fresno Slough (north)	Deep	55.2	19.2	10.6	1,410	
		Fresno Slough (south)	Deep	29.5	0.0	0.0	0	7,326
Totals	205							
		Fresno Slough (north)	Shallow				5,229	
		Fresno Slough (south)	Shallow				13,772	
					Total Shallow		**19,001**	
		Fresno Slough (north)	Deep				2,418	

Fresno Slough (south)	Deep		269
		Total Deep	**2,687**
		Total All Wells	**21,688**

cfs – cubic feet per second

af – acre feet

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As	Arsenic
B	Boron
CCID	Central California Irrigation District
CEQA	California Environmental Quality Act
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CVRWQCB	Central Valley Regional Water Quality Control Board
DFG	California Department of Fish and Game
DMC	Delta-Mendota Canal
DWR	Department of Water Resources (California)
EA	Environmental Assessment
EC	Electrical Conductivity
EIR	Environmental Impact Report
ESA	Endangered Species Act (federal)
FCWD	Firebaugh Canal Water District
FONSI	Finding of No Significant Impact
FWD	Farmers Water District
Jones and Stokes	Jones and Stokes Associates, Inc.
KDSA	Kenneth D. Schmidt and Associates
LSCE	Luhdorff and Scalmanini, Consulting Engineers
MPG	Mendota Pool Group
MWA	Mendota Wildlife Area
NEPA	National Environmental Policy Act
NLF	Newhall Land and Farming
NOP	Notice of Preparation (of EIR)
Reclamation	U.S. Bureau of Reclamation
Se	Selenium
SJREC	San Joaquin River Exchange Contractors
SLCC	San Luis Canal Company
SWP	State Water Project
TDS	Total Dissolved Solids
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WWD	Westlands Water District

This environmental assessment (EA) describes a groundwater conveyance project to be conducted in the late spring, summer, and fall of 2001 in the vicinity of the Mendota Pool in western Fresno and Madera Counties. The project is proposed by a group of farmers with groundwater wells located adjacent to the Mendota Pool. These farmers have come together as an unincorporated association known as the Mendota Pool Group (MPG). A list of the current members of the MPG is provided in Appendix A. The MPG proposes to pump groundwater from their wells into the Mendota Pool and exchange it with water from the Central Valley Project (CVP) which is administered by the U.S. Bureau of Reclamation (Reclamation).

The project proponents propose to pump up to 31,000 acre-feet of non-CVP groundwater from wells located adjacent to the Mendota Pool into the Mendota Pool between May 1 and November 15, 2001 to make up for shortfalls in the contracted amounts of water to be delivered via the CVP. This project is referred to as the 2001 pumping program. A maximum of 25,000 acre-feet would be exchanged with Reclamation. This water would be made available to Reclamation in the Mendota Pool to meet existing water contracts. In exchange, Reclamation would make an equivalent amount of CVP water available to the MPG for irrigation purposes at Check 13 of the Delta-Mendota Canal (DMC). The remaining 6,000 acre-feet of water would be delivered directly to Westlands Water District (WWD), to lands within WWD that are presently under irrigation, or traded with other water districts around the Pool. As part of this program, a maximum of 12,000 acre-feet of groundwater would be pumped from deep wells (i.e., screened interval[1] greater than 130 feet deep), with the remaining 19,000 acre-feet coming from shallow wells (i.e., screened interval less than 130 feet deep). As used in this EA, the term "transfer pumping" refers to all water pumped by the MPG into the Mendota Pool for delivery to WWD, exchanges, trades, or sale to others.

1.1 NEED FOR THE ACTION

The purpose of the proposed project is to provide up to 31,000 acre-feet of water to irrigable lands on MPG properties to offset cutbacks in water supplies attributable to the CVPIA, the Endangered Species Act (ESA) listings and regulations, and new Delta water quality rules. Of this, 25,000 acre-feet would be exchanged with Reclamation for water from the DMC at Check 13 (Figure 1-1). The 25,000 acre-feet of non-CVP water to be exchanged constitutes the federal action that is the subject of this EA.

The supply of water to agricultural users in WWD has been substantially curtailed due to the recent regulatory actions described above. WWD has taken numerous steps to obtain additional sources of irrigation water and to ensure that comprehensive water

[1] The screened interval is the perforated portion of a groundwater well through which groundwater can enter. Wells that are screened at different depths tap groundwater from different layers.

conservation practices are being followed. Nevertheless, water supplies are still inadequate to provide reliable and cost-effective irrigation water to historically irrigated lands within WWD's service area. The MPG need to supplement their water deliveries with affordable water at an average cost of $40 to $90 per acre-foot in order to maintain production on historically irrigated lands.

Groundwater has long been an important water source for farmers within the WWD service area. To make up for the shortfall in surface irrigation water, landowners and water users within the district have drilled wells to obtain supplemental water. In 1990, WWD adopted a short-term program of groundwater conveyance through the Mendota Pool for emergency relief. It adopted similar programs in 1991, 1992, 1993, and 1994. These actions did not require environmental evaluation or documentation because, in each case, they were needed to mitigate shortfall conditions unforeseen during the previous year.

1.2 PROJECT OBJECTIVES

The objective of the proposed project is to enable the MPG to maintain production on historically irrigated lands (Figure 1-2) by obtaining sufficient water at cost-effective prices to offset cutbacks in water supplies. The project is not intended to increase the amount of water for farming activities but would replace water lost because of increased environmental regulations that restrict water deliveries. This program would enable project participants to:

- Replace water no longer available because of restrictions on the export of water from the Delta;
- Deliver water to farms for an average cost of $40-$90 per acre-foot; and
- Maintain production on lands with long-term water supply contracts that have previously produced agricultural commodities.

The 2001 pumping program has the following additional mitigation objectives. These objectives were developed as part of the "Agreement for Mendota Pool Transfer Pumping Project" to minimize the potential impacts of the pumping program described in the final EIR and in the Phase 1 and Phase 2 environmental reports (KDSA and LSCE 2000a,b):

- Reduce deep zone drawdowns by reducing MPG deep zone transfer pumping during the period when the majority of irrigation pumping occurs.
- Limit subsidence at the Yearout and Fordel extensometers to less than 0.005 feet over a one-year period by limiting deep zone drawdowns.
- Reduce surface water quality degradation overall and ensure that no degradation occurs at the San Joaquin River Exchange Contractor's canal intakes.

- Ensure that no water quality degradation occurs to water supplies to the Mendota Wildlife Area.

- Minimize groundwater quality degradation.

1.3 Scope of this Environmental Assessment

This EA analyzes the environmental effects of the 2001 pumping program (proposed project) on the quantity and quality of groundwater and surface water resources in the Mendota Pool and surface water resources delivered to users via the Pool. This EA focuses on potential effects to four resource areas identified as significant in previous environmental documents: groundwater level, land subsidence, groundwater quality, and surface water quality. The EA addresses impacts within the zone of influence of the Mendota Pool Group wells, a radius of approximately 2.5 to 3 miles from the Pool, and within the 1-year period of the action. The groundwater levels are anticipated to recover during the subsequent winter due to natural infiltration, therefore no effects are anticipated beyond the 1-year period.

This EA is based on the analyses presented in the draft and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) and the Phase 1 and Phase 2 technical reports (KDSA and LSCE 2000a,b) (Section 1.3.2) that are incorporated in the "Agreement for Mendota Pool Transfer Pumping Project." Since the data and interpretation provided in the Phase 1 and Phase 2 reports are more recent and detailed, they are used in preference to information provided in the draft and final EIRs. Since these earlier documents did not address the issue of potential impacts due to selenium concentrations in groundwater, additional analyses are performed in this EA to address the issue.

1.3.1 Background

The farms owned or operated by the MPG lie within the WWD, which is located on the west side of the San Joaquin Valley. WWD receives water from the CVP through the DMC and the San Luis Canal, which are administered by Reclamation. Water from the CVP is delivered directly to lands in WWD or stored temporarily in San Luis Reservoir for later delivery.

WWD has water service contracts with Reclamation to receive 1.15 million acre-feet per year of water from the CVP. The water is used to irrigate lands in Priority Areas I and II of the WWD service area. The WWD water supply consists of 900,000 acre-feet per year of water under a 1963 contract with Reclamation and 250,000 acre-feet per year of provisional supply. The provisional supply resulted from the judgment in the Barcellos lawsuit, which reaffirmed the validity of the 1963 contract and directed the federal government to provide 250,000 acre-feet per year at cost-of-service rates.

Prior to 1988, irrigation needs in the WWD were satisfied by the water that Reclamation delivered from the Sacramento-San Joaquin River Delta, as well as by water transfers and groundwater extracted by farmers for use on their own lands. However, between 1988 and 2000 several regulatory decisions, such as the biological opinions for winter-run

Chinook salmon and Delta smelt, have imposed conditions on exports from the Delta and have influenced reservoir storage and supply operations, thereby reducing the water available from the Delta and San Luis Reservoir. As a result, future allocations from the CVP have become more uncertain. The future WWD water supply depends on the allocation of contract water from Reclamation.

Total exports from the Delta have been reduced from an average of 3.3 million acre-feet per year prior to 1988 to an average of 2.5 million acre-feet per year after 1988, or a reduction of approximately 25 percent (L. Johnson 2001, pers. comm.). However, these reductions are not apportioned equally among all users. Currently, allocation of CVP water follows a hierarchical structure in which agricultural water service contractors are provided water only after all other obligations (approximately 1.5 million acre-feet) are met. As a result, cutbacks in water availability primarily affect agricultural users, while other users receive their full allocation. For example, 1993 was hydrologically a wet year with rainfall at 150% of normal, yet Reclamation allocated only 50% of the contracted water to WWD. Runoff in 1994 was expected to be about 50% of normal, but Reclamation only allocated about 490,000 acre-feet of contracted supplies to WWD, or about 35% of its CVP allocation.

Even at the full contract amount, WWD supplies would still be inadequate and district water users would require supplemental irrigation water supplies. If a suitable source of supplemental water is not found, currently farmed lands would have to be removed from production, or crops with lower water needs grown.

Estimates of future federal water supply range from 0% to as much as 80% of WWD's contracted amounts of 1.15-million acre-feet per year from Reclamation, depending on precipitation and export constraints from the Delta. Assuming that WWD had access to a long-term average of 60% of the maximum water supply or 690,000 acre-feet per year, and had a sustainable groundwater yield of 200,000 acre-feet per year, the district would still be approximately 610,000 acre-feet per year short of the 1.5 million acre-feet per year required to water its irrigable area. Even if WWD's full allocation could be obtained, additional water would be needed to meet the irrigation needs within the district.

1.3.2 History of the Planning

This section describes the development of the proposed project starting with the initial efforts to develop a long-term solution to reductions in water deliveries. Numerous changes in the scope and duration of the program have been made since a groundwater pumping program was originally conceived. In 1995, the MPG and WWD completed a draft EIR entitled "Conveyance of Nonproject Groundwater from the Mendota Pool Area Using the California Aqueduct" (Jones and Stokes 1995); and in December 1998, a Final Environmental Impact Report (FEIR) was completed (Jones and Stokes and LSCE 1998). The FEIR outlined a mitigated project which would allow the MPG to pump up to a total of 620,000 acre-feet over a 20-year period for transfer to WWD, or an average of 31,000 acre-feet per year.

After the FEIR was certified by WWD (the lead agency for the project), the San Joaquin River Exchange Contractors Water Authority (SJREC) and Newhall Land and Farming (NLF) filed a lawsuit against WWD and the MPG alleging that the FEIR failed to comply with the requirements of the California Environmental Quality Act (CEQA). The SJREC also filed a lawsuit against the MPG and others alleging that MPG pumping created a nuisance for the SJREC. The SJREC is a group of four water districts and companies located primarily north of Mendota; these are the Central California Irrigation District (CCID), the Firebaugh Canal Water District (FCWD), the Columbia Canal Company, and the San Luis Canal Company (Figure 1-3). NLF operates the 12,500 acre New Columbia Ranch north of the San Joaquin River.

During the spring of 1999, representatives from the SJREC and NLF met with representatives from the MPG and agreed to delay the lawsuits pending the result of a test pumping program conducted in 1999 to determine the impacts of MPG transfer pumping on the SJREC and NLF. This study was conducted jointly by LSCE of Woodland, consultants to the MPG, and Kenneth D. Schmidt and Associates (KDSA) of Fresno, consultants to the SJREC and NLF. In addition to determining the impacts of the proposed MPG transfer pumping, the consultants were to make recommendations for mitigation measures to reduce these impacts as appropriate. The initial study involved a test-pumping period during 1999 when the MPG wells were pumped at approximately the same rate as proposed in the FEIR for a normal year. Monitoring of groundwater levels, surface water quality, and compaction was conducted prior to, during, and after this test-pumping period. Groundwater sampling was also conducted during the test-pumping period. The monitoring program was designed to allow determination of the following impacts of pumping the MPG wells:

- water-level declines in other wells in the area, especially the NLF wells, and other wells along the San Joaquin River branch of the Pool;
- groundwater quality changes;
- changes in water quality at the SJREC intakes from the Mendota Pool; and
- land surface subsidence.

After the impact analysis for the 1999 transfer pumping program was complete, modifications were made to the program in 2000 to reduce these impacts. Transfer pumping in 2000 was conducted from June 6 to October 31, and approximately 19,000 acre-feet was pumped during this period. Impacts of the 2000 pumping program are still being analyzed by LSCE and KDSA.

During the planning process, several different future pumping programs were proposed and evaluated. A summary of the different pumping programs is provided in Table 1-1. The original project proposed in the draft EIR consisted of the transfer pumping of 78,000 acre-feet of water annually into the Mendota Pool. Transfer pumping was to proceed at a rate of 6,000 to 8,000 acre-feet per month throughout the year. A 54,000 acre-foot per year and a 45,000 acre-foot per year option were also evaluated.

In the final EIR, the pumping program was modified through the incorporation of three additional mitigation actions, and a reduced average pumping rate of 31,000 acre-feet per year. In addition, the pumping period was reduced to a five-month period in a normal rainfall year. During a "dry" year, transfer pumping could be increased to 60,000 acre-feet over a ten-month period.

Based on discussions between the MPG, NLF, and SJREC, a 10-year pumping program was developed as described in the "Agreement for Mendota Pool Transfer Pumping Project". The 10-year program assumed that MPG transfer pumping would vary from year to year depending on whether the year is classified as normal, wet, or dry. The MPG will determine the classification of each year before the start of each irrigation season based on the expected level of surface water deliveries. The total quantity of water to be transferred under this program is expected to average 27,000 acre-feet per year over a 10-year period. Based on the typical climatic pattern, this 10-year period is expected to include six "normal" years during which 31,600 acre-feet would be pumped for transfer, two "dry" years during which transfer pumping could increase to 40,000 acre-feet per year, and two "wet" years when no transfer pumping would occur. The mitigated 10-year program would reduce deep zone pumping compared to that proposed in the FEIR, because the groundwater level and subsidence impacts are considered to be due almost entirely to pumping below the A-clay layer. The MPG would be able to make up for some of the deep zone pumpage reductions by increasing pumpage above the A-clay.

The "2001 pumping program" is based on the "normal" year scenario as defined in the 10-year program. The "2001 pumping program" is the subject of this EA and is described in detail in Section 2.2.2.

1.3.3 Related Environmental Documents

The following environmental documents and studies were prepared as part of the evaluation of the original (78,000 acre-feet per year) and subsequent pumping programs.

1.3.3.1 Notice of Preparation of EIR

WWD published a Notice of Preparation on August 24, 1994 describing the intent of the original project. To continue the conveyance program as a long-term solution to managing water supplies, DWR requested that WWD prepare an EIR on the effects of the project. DWR legal and technical staff assisted in determining the scope of the EIR. Eleven comment letters were received during the NOP process.

1.3.3.2 Draft EIR

Based on the initial study responses and comments generated during the NOP process, the EIR focused on three key technical areas: (1) groundwater resources, including subsidence issues, water levels, groundwater quality, and groundwater overdraft; (2) surface water quality; and (3) biological resources. The draft EIR (Jones and Stokes 1995) for this project was submitted for public review in October 1995. That EIR described the proposed project and five project alternatives.

1.3.3.3 Final EIR

The final EIR (Jones and Stokes and LSCE 1998) was released in December 1998. Based on comments received on the draft EIR, the final EIR identified three mitigation measures:

F-1 Reduction of pumpage to an average of 31,000 acre-feet per year.

F-2 Maintain water quality at Exchange Contractors' intakes.

F-3 No introduction of groundwater into the California Aqueduct.

Subsequent to the release of the Final EIR and the decision to proceed with the project, the SJREC and the NLF filed suit in California Superior Court to stop implementation of the project. Representatives of SJREC and NLF met with the MPG to develop a mutually agreeable alternative to the pumping program in the final EIR. The "Agreement for Mendota Pool Transfer Pumping Project" describes the agreed upon pumping program and mitigations and incorporates the findings of the Phase 1 and Phase 2 technical reports described below.

1.3.3.4 1999 Test Pumping Program

As a result of the legal challenges to the final EIR, a joint study was initiated in 1999 to determine the impacts of proposed MPG pumping on the SJREC and NLF. The 1999 test program consisted of two MPG pumping periods (July 19 to October 1 and November 1 to 16). Monitoring of water levels, water quality, and compaction of subsurface deposits was conducted before, during, and after these pumping periods. This test-pumping program resulted in the preparation of the following reports:

- Results of 1999 Test Pumping Program for Mendota Pool Group Wells (Phase 1 report; KDSA and LSCE 2000a)
- Long-Term Impacts of Transfer Pumping by the Mendota Pool Group (Phase 2 report; KDSA and LSCE 2000b)

The Phase 2 report contains recommended mitigation measures to reduce the impacts observed in 1999. Some of these measures were incorporated into the 2000 pumping program, which was conducted while negotiations proceeded with the SJREC and NLF on a long-term agreement. These reports and subsequent negotiations resulted in the development of the 2001 pumping program for the MPG. The 2001 pumping program is the focus of this EA.

1.3.3.5 2000 Transfer Pumping Program

The 2000 transfer pumping program continued into the fall, which meant that the MPG needed an exchange agreement with Reclamation to receive credit for the water. In November 2000, Reclamation issued a Finding of No Significant Impact for the pumping program that was conducted during fall 2000 (September 19 to January 1, 2001). That

FONSI allowed the MPG to pump for a three and a half-month period while the monitoring program and negotiations between the parties continued.

1.3.4 Issues Studied in Detail

The FEIR identified the following significant impacts from the original project.

Significant Impacts

The FEIR determined that under the original project the following significant impacts would occur:

- Contribution of groundwater pumping to regional groundwater overdraft and depletion of groundwater resources;
- Potential operational problems in nearby wells caused by water-level drawdowns from pumping of project wells;
- Potential degradation of groundwater quality because of altered groundwater flow patterns;
- Potential surface water quality degradation of the California Aqueduct from Lateral 7 discharges containing blended waters (78,000 Acre-feet Subalternative: predicted TDS levels); and
- Potential operational problems in nearby wells caused by cumulative water-level declines.

Significant and Unavoidable Impacts

The FEIR determined that under the original project the following impacts may be significant and unavoidable:

- Potential damage to structures caused by subsidence in the upper aquifer system above the Corcoran Clay;
- Loss of canal freeboard and water from canals as a result of subsidence; and
- Acceleration of salinity increases in wells due to local changes in groundwater gradient in the upper aquifer, and reduction of recharge to local groundwater.

These potentially significant impacts may be grouped into four resource areas:

- changes in groundwater level,
- land subsidence,
- degradation of groundwater quality, and

- degradation of surface water quality.

Because these are the only resource areas that were considered to be subject to significant impacts, and the 2001 pumping program was developed to mitigate these impacts, they form the focus of this evaluation. In addition, concerns have recently been raised regarding measured concentrations of selenium in the groundwater and the potential impacts of selenium on aquatic and terrestrial receptors in and near the Mendota Pool. Therefore, the results of additional groundwater and surface water modeling are discussed in Section 4, Environmental Consequences.

1.4 REQUIRED DECISIONS

This EA is intended to provide the information required by Reclamation to make a decision as to whether the proposed 2001 pumping program would have a significant effect on the groundwater and surface water resources in the vicinity of the Mendota Pool. This would allow Reclamation to determine whether to negotiate exchange agreements between the MPG members and Reclamation for the 2001 water year.

Therefore, the following questions need to be addressed in this EA:

1. Does the proposed 2001 pumping program result in a significant lowering of groundwater levels?

2. Does the proposed 2001 pumping program result in a significant reduction in groundwater quality in wells of the MPG or of other users?

3. Will the proposed 2001 pumping program result in significant subsidence of the land surface?

4. Will the proposed 2001 pumping program result in a significant reduction in the quality of the surface water within Mendota Pool, downstream sections of the San Joaquin River, or in the surface water delivered to other users?

If any of the above questions are answered affirmatively for the 2001 pumping project, then the project would be considered to significantly impact the environment. Relevant significance criteria are defined in Section 4 of this report.

1.5 APPLICABLE REGULATORY REQUIREMENTS AND REQUIRED COORDINATION

Acting as lead agency under CEQA, the WWD approved the FEIR for the original project. The draft and final EIR for the original project were reviewed by various state and local agencies to help them make decisions on granting permits and evaluating compliance with statutory and regulatory requirements.

Following approval of the FEIR, the actions described above necessitated the establishment of an exchange agreement among Reclamation and the MPG for the water transfer. This EA is intended to meet the requirements under NEPA for Reclamation to enter into the exchange agreement. The following agencies are anticipated to use this EA:

- Westlands Water District,
- California Department of Water Resources,
- California Department of Fish and Game,
- California Department of Health Services,
- U.S. Fish and Wildlife Service, and
- U.S. Bureau of Reclamation.

This list is not all-inclusive; other agencies may use the EA for their permitting processes.

Reclamation conducted an informal consultation procedure with the U.S. Fish and Wildlife Service (USFWS). The draft EA was reviewed by USFWS who determined that the action was not likely to affect special status species. The USFWS would not object to the project proceeding with the following conditions:

- Formal consultation would be undertaken on any similar future actions, and
- Monitoring data from the 2000 and 2001 programs is provided to USFWS.

Table 1-1. Proposed Mendota Pool Group Pumping Programs.

Proposal	Annual Volume (acre-feet)	Pumping Period	Duration (years)	Total Volume (acre-feet)	Mitigation Actions
Draft EIR (Jones and Stokes 1995)	78,000	year round	20	1.56 million	1) Various
Final EIR (Jones and Stokes and LSCE 1998)	31,600 - normal year (12) 60,000 - dry year (4) 0 - wet year (4)	5 months 10 months -	20	620,000	1) Reduce pumpage to average of 31,000 af/y 2) Maintain water quality at SJREC intakes 3) No introduction of water to California Aqueduct
10 -year Mitigated Pumping Program (KDSA and LSCE 2000b)	31,600 - normal year (6) 40,000 - dry year (2) 0 - wet year (2)	9.5 months 10 months -	10	269,600	1) Reduce pumpage to average of 27,000 af/y 2) Reduce and schedule deep zone pumping 3) Maintain water quality at SJREC intakes 4) No introduction of water to California Aqueduct 5) Reimbursement for increased pumping and other costs 6) Limit total subsidence to 0.05 ft at Yearout Ranch
2001 Pumping Program	31,000	6.5 months	1	31,000	1) Reduce pumpage to 31,000 af/y 2) Reduce and schedule deep zone pumping 3) Maintain water quality at SJREC intakes 4) No introduction of water to California Aqueduct 5) Reimbursement for increased pumping and other costs 6) Limit subsidence to 0.005 ft/y at Yearout and Fordel extensometers

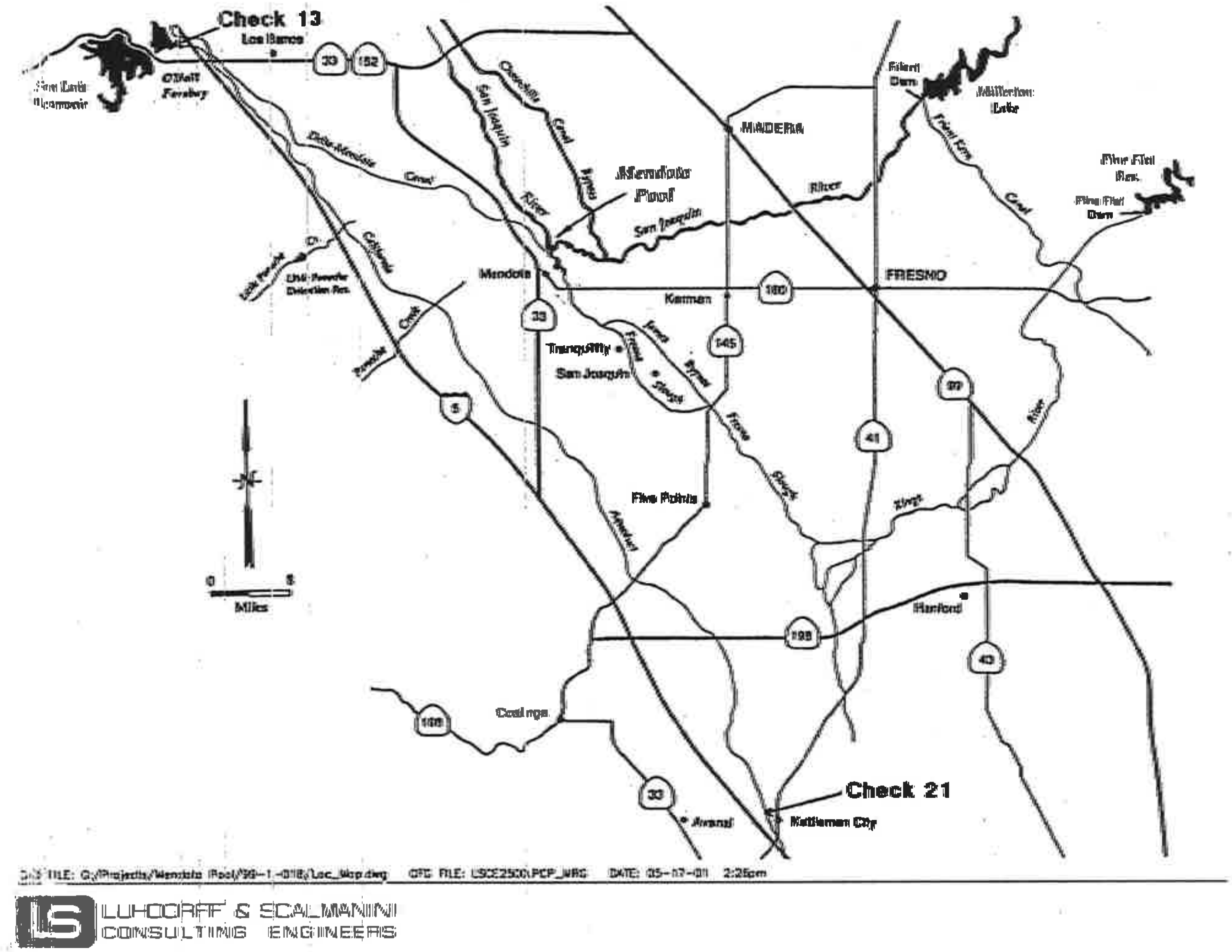


Figure 1-1. Location Map

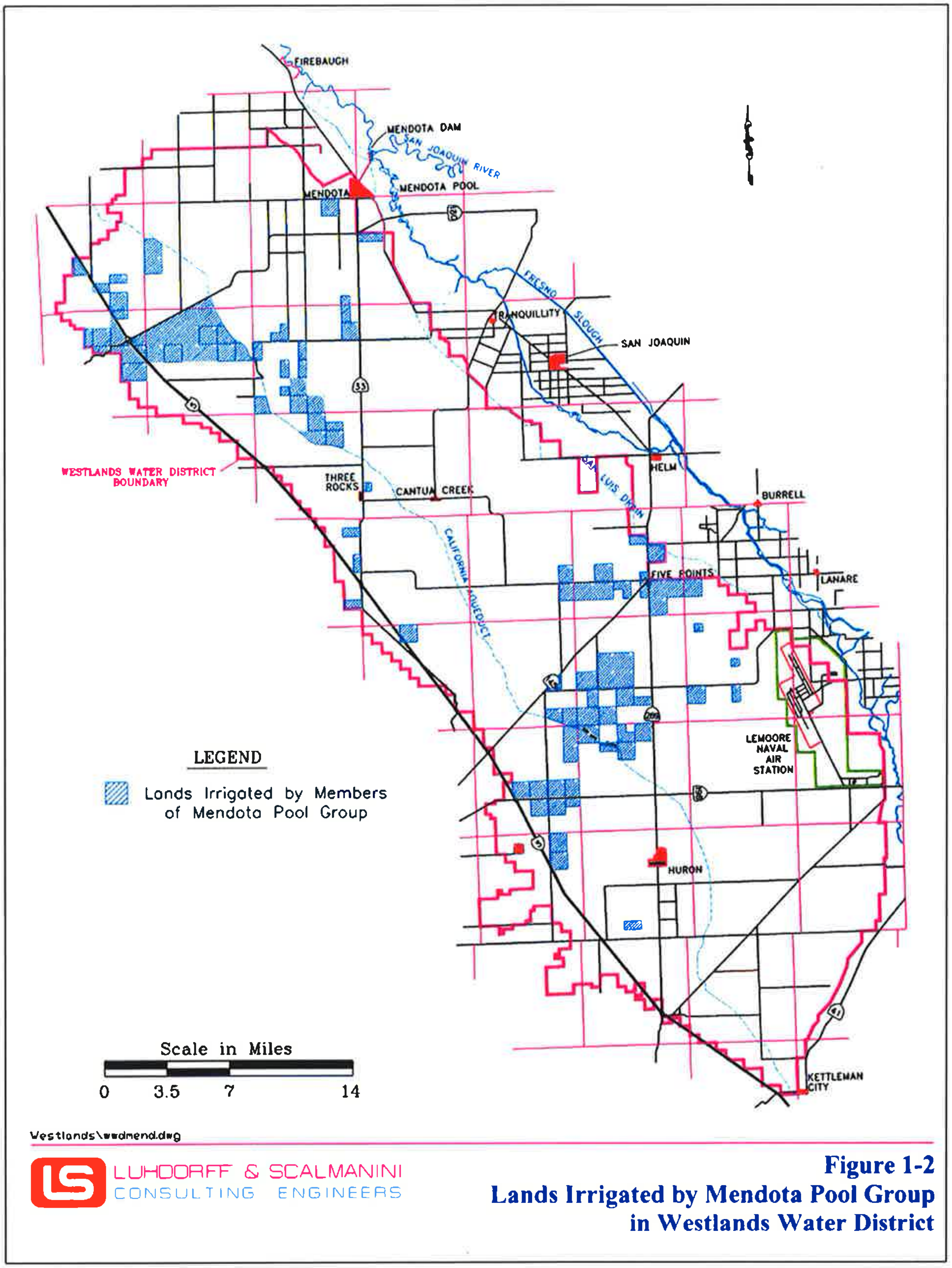


Figure 1-2. Lands Irrigated by Mendota Pool Group in Westlands Water District

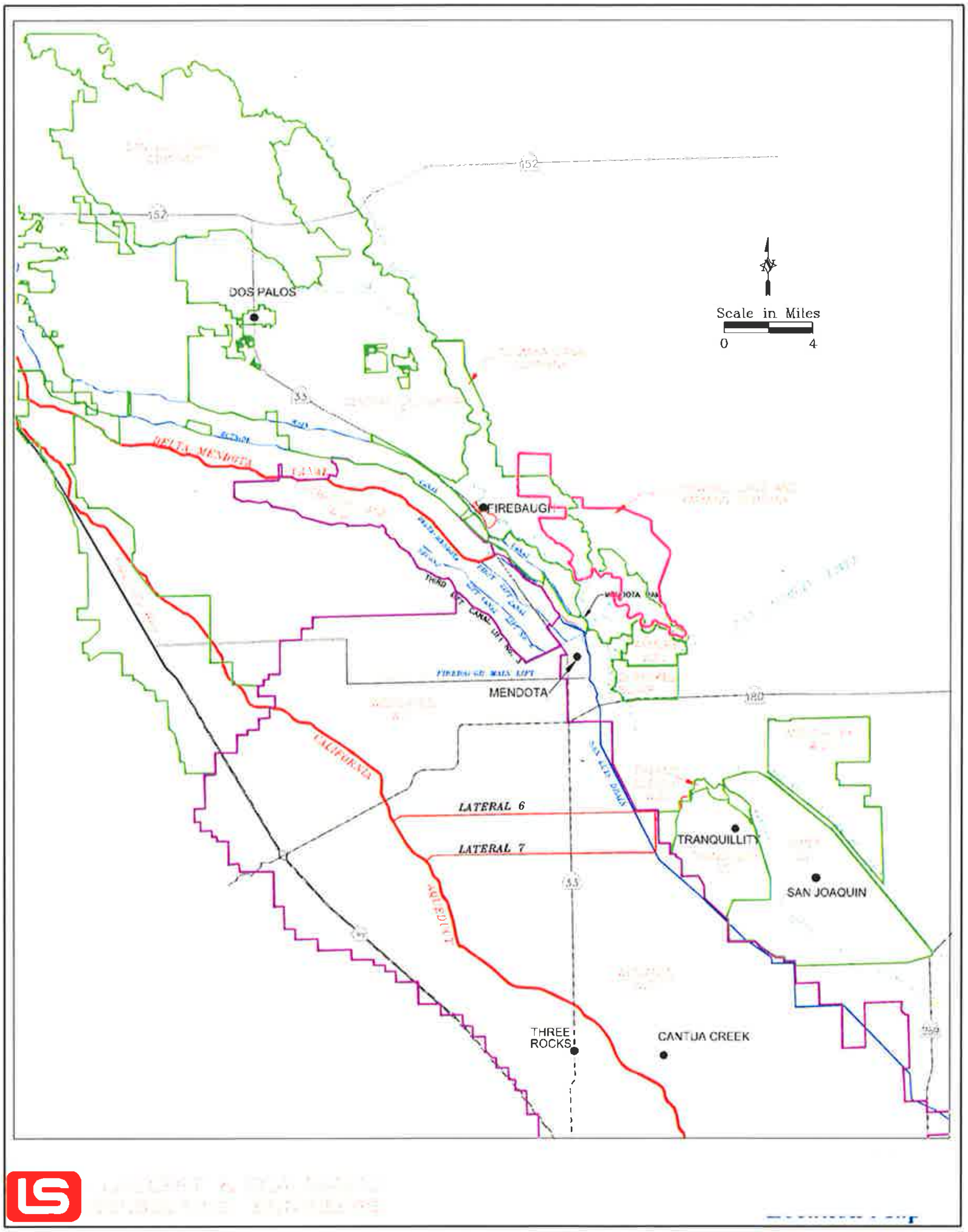


Figure 1-3. Neighboring Water Districts

2.1 INTRODUCTION

Discussions concerning the nature and magnitude of the transfer pumping of groundwater have been ongoing at least since 1994. Five alternatives to the original project were evaluated in detail in the FEIR (Jones and Stokes and LSCE 1998). Additional negotiations have been undertaken between the interested parties since the release of the FEIR. The "Agreement for Mendota Pool Transfer Pumping Project" augmented the FEIR and incorporated the results of subsequent field testing and monitoring efforts (KDSA and LSCE 2000a,b). The project presented here, the "2001 pumping program", is the result of these discussions.

2.2 DESCRIPTION OF PROPOSED ALTERNATIVES

This section provides a brief description of the No Action and Proposed Action alternatives for the project. Other alternatives considered in the FEIR (Jones and Stokes and LSCE 1998) but eliminated from further consideration are described in Section 2.4.

2.2.1 NO ACTION ALTERNATIVE

The No-Action Alternative assumes that Reclamation does not allow the proposed introduction of groundwater into the Mendota Pool for exchange with water taken from the DMC at Check 13 (Figure 1-1). Without an agreement, members of the MPG would be unable to convey the full amount of water needed to their lands in the WWD.

The No-Project Alternative assumes the continuation of WWD's efforts to secure water transfers and its conservation program. Some level of groundwater pumping by farmers and others in the region would remain without the project. The amount would depend on the amount of water available from existing contracts with Reclamation, cropping patterns, and amount of land retired or fallowed.

2.2.2 PROPOSED ACTION: "2001 PUMPING PROGRAM"

The proposed action consists of the "2001 pumping program" that was developed to mitigate the potential long-term impacts on groundwater and surface water identified with the pumping programs described in the draft and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998). The 2001 pumping program would be conducted between May 1 and November 21, 2001.

The MPG has determined that 2001 will be classified as a normal rainfall year with a total pumping volume of 31,000 acre-feet. Up to 25,000 acre-feet of this water would be exchanged with Reclamation for an equivalent amount of CVP water that would be made available to the MPG at Check 13 on the DMC. As used in this EA, the term "transfer pumping" refers to all water pumped by the MPG into the Mendota Pool for delivery to WWD, exchanges, trades, or sale to other users.

The pumping program was designed to reduce the potential for subsidence due to cumulative drawdowns by reducing the rate of deep zone groundwater pumping during the irrigation period when other users are pumping. In addition, the pumping program is designed to ensure that the surface water quality criterion for selenium is not exceeded within the Pool, primarily by adjusting the rate of shallow zone pumping and deep zone pumping in the southern half of the MPG well field along the Fresno Slough.

The 2001 pumping program consists of a transfer pumping period of 6½ months (May 1 through November 21) divided into three pumping periods. A summary of the 2001 pumping program is presented in Table 2-1 and described in detail below.

1. During the spring period (May 1 to June 15), the shallow MPG wells would pump at 90 percent of capacity, the deep wells in the northern half of the well field along the Fresno Slough would pump at 30 percent of capacity, the deep wells in the southern half of the well field would pump at 10 percent of capacity, and the MPG wells in FWD would pump at about 75 percent of capacity. Total transfer pumping during this period would be approximately 9,130 acre-feet.

2. During the summer period (June 16 to September 15), the shallow MPG wells would pump at 100 percent of capacity for a total of approximately 9,020 acre-feet. The deep MPG wells would not pump for transfer during this period to minimize drawdowns during the peak of the irrigation season.

3. During the fall period (September 16 to November 21), the shallow wells would pump at about 90 percent of capacity, the deep wells in the northern half of the well field along the Fresno Slough would pump at 19 percent of capacity, the deep wells in the southern half of the well field would not pump, and the wells in FWD would pump at about 75 percent of capacity. Total transfer pumping during this period would be approximately 12,850 acre-feet.

   Numerous users have historically required water deliveries through the Pool during the fall months (October to December). The largest of these users is the Mendota Wildlife Area (MWA), which uses the water to provide wildlife habitat. Water deliveries to users taking water from the southern end of the Pool were 13,600 acre-feet in 1999 (2 months) and 14,190 acre feet in 2000 (3 months) (San Luis Delta-Mendota Water Authority 2001). It is anticipated that there would be similar demand in 2001.

There are five MPG wells located in Madera County, adjacent to the East and West Loops of the San Joaquin River. These five wells (WL-1, WL-2, WL-3, EL-2, and EL-3) will not be pumped for transfer pumping, and will not constitute part of the exchanged waters.

Total transfer pumping from the deep zone would be limited to 12,000 acre-feet for the year. This is a reduction of approximately 5,600 acre-feet per year from the normal-year pumping program proposed in the FEIR. This large reduction in deep zone pumpage is necessary in order to reduce predicted subsidence to less than 0.005 foot per year and would also reduce the rate of groundwater quality degradation that would otherwise occur.

If 12,000 acre-feet of water is pumped from the deep zone, shallow zone pumping would be limited to 19,000 acre-feet in 2001. Other constraints on shallow zone pumpage include the physical limitation of the sustained yield of the shallow MPG wells. This yield is not yet known but is estimated to be approximately 20,000 acre-feet over a 6½-month pumping season based on the capacities of the existing shallow wells during previous years. Whether or not these wells would be able to sustain this yield in successive years has not been determined. Shallow zone pumpage may also be limited due to: (1) the quality of water pumped from these wells, and (2) potential impacts on deep zone groundwater (e.g. overdraft).

Once the water has been pumped into the Mendota Pool, it would be provided to farmlands owned or operated by MPG members in the following three ways (J. Bryner 2001, pers. comm.):

- Direct delivery to irrigated farmlands in WWD through pumping to Lateral 6, and possibly Lateral 7,

- Trade with other water districts, and

- Exchange of up to 25,000 acre-feet with Reclamation for water at Check 13 of the DMC (i.e., the O'Neill Forebay) and conveyed via the California Aqueduct for delivery to WWD. This is the proposed action of this EA.

Water obtained as part of this project would be used on farmlands owned or operated by MPG members within WWD (Figure 1-2). The MPG lands are not drainage impaired. The MPG will not translocate water from the Mendota Pool to the California Aqueduct for transfer to the southern Central Valley or southern California.

The MPG, in discussion with other interested parties, has designed a surface water and groundwater monitoring program to assess the impacts of this project (Appendix B). The monitoring program was initiated in 1999 and has been planned to last for at least 10 years. In addition, the MPG will design and implement a sediment sampling program to assess accumulation of selenium, boron, arsenic, and molybdenum in the sediments of the Pool.

Additional mitigation actions are included in the proposed project. Beginning with the 2001 irrigation season, the MPG has agreed to compensate the other major groundwater pumpers in the Mendota area for increased power and other additional costs due to drawdowns caused by the MPG transfer pumping.

2.3 Alternatives Design, Evaluation, and Selection Criteria

Five potential alternatives were considered in detail in the feasibility screening process conducted as part of the FEIR for the original project: (1) land retirement, (2) interconnection of WWD Laterals 5 through 8 and construction of new storage facilities, (3) construction of new wells within WWD, (4) improved water conservation, and (5) reduced groundwater pumping. Economic and environmental data were considered as screening criteria in the alternative selection.

The following alternative screening process was employed in the FEIR to identify alternatives that might reasonably achieve the water supply and conveyance objectives of the original project. The following criteria determined the feasibility of each of the alternatives:

- On-farm water deliveries must be provided at a cost of $40 to $90 per acre-feet,
- Water must be of suitable quality for row crop irrigation, and
- Potential environmental impacts must be eliminated or substantially reduced even if the estimated costs were slightly higher than the water cost criterion described above.

2.4 Alternatives Considered but Eliminated from Further Consideration

This section provides a brief description of alternatives evaluated in the FEIR (Jones and Stokes and LSCE 1998) and the rationale for their elimination from further consideration.

2.4.1 Land Retirement

Under this alternative to the proposed project, MPG farmers would acknowledge that the available water is insufficient to continue to irrigate all of their agricultural lands that have been previously irrigated. Assuming WWD may not receive more than a long-term average of 65% to 75% of its contractual water allocation from Reclamation in the foreseeable future, these farmers could decide to retire 60 to 65% or more of their landholdings in WWD. Certain farmlands within WWD are considered to be drainage impacted, and are being considered for retirement. A long-term alternative would be to transfer the water rights from the drainage impacted lands to the MPG or other farmers within WWD.

A reduction of 1 acre-foot of irrigation water would require the retirement of 0.44 acre of irrigated farmland. To save the equivalent amount of water as would be pumped in the original program (78,000 acre-feet) approximately 23,600 acres would have to be taken out of production. When the cost of the retired lands and income lost from the sale of crops are factored in, this alternative would increase the cost of irrigation water to approximately $173 per acre-foot (Jones and Stokes 1995) which far exceeds the target cost of water.

Under the current project, not pumping the 31,000 acre-feet of water would be equivalent to following approximately 13,600 acres of land for the year. This land has already been planted for 2001 and cannot be followed without large financial losses.

2.4.2 Interconnection of WWD Laterals 5 through 8 and New Storage Facilities

This alternative involves altering the WWD irrigation distribution system. Installing new pipelines to interconnect the existing system could allow increased flexibility in moving water throughout the district. In particular, connecting Laterals 5 through 8 would provide members of the MPG with additional flexibility for introducing water into the WWD distribution system, as well as flexibility in distributing water to lands within the district. This alternative could allow WWD to improve its ability to serve farmers by constructing additional facilities capable of storing 13,500 acre-feet, and north-south distribution facilities to accept groundwater pumped by the MPG. Members of the MPG would pump groundwater into the Mendota Pool from September to May. WWD would then pump this water, by means of the existing distribution system, into storage basins. The stored water would then be released to meet irrigation demands in WWD, with credits being given to members of the MPG.

Total costs for constructing the required infrastructure were estimated to be about $22.3 million in the draft EIR (Jones and Stokes 1995). These costs do not include the long-term indirect costs due to the loss of approximately 1310 acres of productive farmland that would be converted to storage basins. Furthermore, because the pumping rate would be essentially the same as under the 78,000 acre-foot project, this alternative would not alleviate potential environmental impacts including reductions in groundwater quality and subsidence.

This alternative is not feasible to implement in place of the 2001 pumping program, as these facilities are not in place, nor have they been designed.

2.4.3 Construction of New Wells

Under this alternative, the need for new storage facilities would be eliminated by the construction of new wells within WWD by members of the MPG to meet average and peak water demands. The landholdings of members of the group (Figure 1-2) generally lack water of adequate quantity and quality for agricultural purposes; therefore, new wells would have to be constructed on lands owned or leased by other farmers within WWD (Jones and Stokes 1995). In addition, placement of new wells near the California Aqueduct could cause localized subsidence and potential damage to the California Aqueduct.

Most of the water demand on the part of members of the MPG occurs during June, July, and August. Since the volume of pumping would be similar to the proposed project, impacts to groundwater level and quality would also be similar. Impacts on subsidence would be larger because these wells would have to be completed below the Corcoran Clay.

The economic analysis performed in the draft EIR (Jones and Stokes 1995) indicated that the cost of water under this alternative would be in excess of $108 per acre-foot. This value is significantly more than the targeted cost range.

This alternative is not feasible to implement in place of the 2001 pumping program due to the time and cost required to locate and develop the new wells.

2.4.4 Improved Irrigation Efficiency

Increased water conservation was considered as a project alternative. Under this alternative, pumping would continue to the extent that water could be used directly.

WWD already has an active water conservation program, which the MPG members participate in. This program includes assistance to farmers and development of new irrigation technologies. Because the conservation program is part of the WWD operations, conservation improvements would continue without the project. On-farm irrigation efficiency in the WWD is high, ranging 75-80%, which is greater than the DWR target of 73-75%. Increased water conservation measures would not achieve a large quantity of water savings, therefore, increased water conservation is not a feasible project alternative.

2.4.5 Reduced Groundwater Pumping Alternative

An alternative that consisted of reduced groundwater pumping of 45,000 acre-feet per year, and conveyed through Laterals 6 and 7 was considered. The features described for the original project would remain the same but would involve less water. Therefore, impacts to groundwater, surface water, and land subsidence would be reduced relative to the original 78,000 acre-feet per year alternative. This smaller amount of water could be pumped by operating the existing wells for a shorter time or by operating a smaller number of wells.

This alternative was the environmentally preferred alternative in the FEIR (Jones and Stokes and LSCE 1998) as it minimized the potential impacts. This alternative served as the basis for the development of the "2001 pumping program". The 2001 pumping program, however, extracts less water (31,000 acre-feet) over a 6½ month period and has stricter controls on pumping from the deep aquifer.

2.5 Description of Past, Present, and Reasonably Foreseeable Future Actions Not Part of the Proposed Project but Related to Cumulative Effects

Historically, other similar groundwater conveyance programs were operated on an interim basis during the 1989-1994 drought period, when the CVP and State Water Project (SWP) water supplies to federal and state contractors were reduced. The CVP and SWP have accepted well water into the aqueduct and granted credit to their water users for future use as a means of managing and distributing scarce water supplies.

Because surface water supplies are currently limited and are expected to remain limited, most farmers in the region are expected to continue to pump groundwater to irrigate their fields. In addition, municipal users obtain at least a portion of their water supply by extracting groundwater. The cumulative impact of all the pumping is to lower the groundwater levels on a local basis thereby increasing the groundwater gradient during the pumping season. The increased groundwater gradient may result in continued degradation of groundwater quality in the Mendota area by accelerating the flow of lower quality groundwater.

Currently, farmers in the Mendota area pump groundwater for agricultural uses primarily during the irrigation season (May to September). The groundwater table is allowed to recover during the winter months. However, if full groundwater recovery does not occur, progressive long-term lowering of the groundwater table could occur. Both groundwater elevation and groundwater quality effects are addressed in this analysis. The monitoring program designed for this project includes periodic determination of groundwater levels. Pumping by the MPG would be curtailed if groundwater overdraft is indicated, or likely to occur.

Should future events further limit the ability of the CVP and SWP to meet their water contracts, additional demands may be placed on groundwater supplies.

Other influences on groundwater quality include seepage from Spreckels Sugar Co. wastewater evaporation ponds, and City of Mendota sewage treatment facilities.

Although this EA focuses on a one-year exchange agreement, the MPG has proposed a 10-year groundwater pumping program. A separate NEPA document for the 10-year program would be prepared in the near future. The design and extent of the 10-year program would be dependent on the results of the 2001 pumping and monitoring program.

Table 2-1. Mitigated MPG Transfer Pumping Program for 2001

Period	No. of Days	Location	Depth Zone	Capacity (cfs)	Percent of Capacity	Rate (cfs)	Total Pumped (af)	Total for Period (af)
May 1 – June 15	46	Fresno Slough (north)	Shallow	13.6	90.0	12.2	1,118	
		Fresno Slough (south)	Shallow	35.9	90.0	32.3	2,944	
		Fresno Slough (north)	Deep	55.2	20.0	11.0	1,008	
		Fresno Slough (south)	Deep	29.5	10.0	2.9	269	
		Farmers Water District	Deep	55.4	75.0	41.6	3,791	9,129
June 16 – Sept. 15	92	Fresno Slough (north)	Shallow	13.6	100.0	13.6	2,483	
		Fresno Slough (south)	Shallow	35.9	100.0	35.8	6,540	
		Fresno Slough (north)	Deep	55.2	0.0	0.0	0	
		Fresno Slough (south)	Deep	29.5	0.0	0.0	0	
		Farmers Water District	Deep	55.4	0.0	0.0	0	9,023
Sept. 16 – Nov. 21	67	Fresno Slough (north)	Shallow	13.6	90.0	12.2	1,628	
		Fresno Slough (south)	Shallow	35.9	90.0	32.3	4,288	
		Fresno Slough (north)	Deep	55.2	19.2	10.6	1,410	
		Fresno Slough (south)	Deep	29.5	0.0	0.0	0	
		Farmers Water District	Deep	55.4	75.0	41.6	5,522	12,848
Totals	205	Fresno Slough (north)	Shallow				5,228	
		Fresno Slough (south)	Shallow				13,772	
					Total Shallow		19,000	
		Fresno Slough (north)	Deep				2,418	
		Fresno Slough (south)	Deep				269	
		Farmers Water District	Deep				9,313	
					Total Deep		12,000	
					Total All Wells		31,000	

3.1 INTRODUCTION

This section provides an overview of the environmental resources that may be affected as a result of the 2001 pumping program. This discussion was derived from the draft EIR for the original project (Jones and Stokes 1995) and from subsequent technical reports on the project (i.e., the Phase 1 and Phase 2 reports; KDSA and LSCE 2000a,b). The following discussion concentrates on local environmental conditions relevant to the 2001 pumping program. Detailed discussion of regional conditions can be found in the draft EIR.

3.2 AFFECTED RESOURCES

The proposed project involves the pumping of groundwater resources into a surface water body (the Mendota Pool), with subsequent transfer to irrigated farmland and wildlife habitat. Therefore, the potentially affected resources in the project vicinity include groundwater, surface water, and biological resources. These three resources are discussed in this section. No data are available with which to assess sediment quality in the Mendota Pool. Sediment quality issues will be addressed in the monitoring program (Section 4.4).

3.2.1 REGIONAL GROUNDWATER SYSTEM

The San Joaquin Valley encompasses the southern two-thirds of the Central Valley, a structural trough about 400 miles long and 50 miles wide. This trough is filled with thousands of feet of unconsolidated continental and marine sediments, the top 2000 feet of which includes the aquifers penetrated by almost all water wells in the area (Jones and Stokes 1995). The sediments are thickest along the axis of the valley near the Mendota Pool and Fresno Slough. Sediments derived from the Sierra Nevada to the east are largely comprised of sands, whereas sediments derived from the Coastal Ranges to the west contain a large proportion of silts and clays. Theses two sediment types interfinger extensively in the western half of the basin.

3.2.1.1 Aquifer Systems

Corcoran Clay Member of the Tulare Formation

As the sediments in the groundwater basin accumulated, the San Joaquin Valley occasionally contained large lakes or seas that resulted in the deposition of laterally extensive clay layers. The most extensive of these is the Corcoran Clay, which occurs throughout all but the eastern and western margins of the San Joaquin Valley at about 300 feet below sea level (corresponding to depths of 300 to 800 feet below the land surface). The clay is 20 to 100 feet thick in most areas and divides the groundwater basin vertically into a lower, confined aquifer system and an upper, semi-confined aquifer system.

In addition to the clay layers centered around the bed of Tulare Lake, the central axis of the groundwater basin is capped by surficial flood-basin deposits created by geologically recent flooding along the San Joaquin River and Fresno Slough. Although these deposits are generally only 5 to 35 feet thick, their fine texture and low permeability greatly restrict downward movement of water, including seepage from overlying surface water bodies such as the San Joaquin River, Fresno Slough, and the Mendota Pool (Jones and Stokes 1995). Most of the wells in the Mendota area are completed above the Corcoran Clay, therefore almost all of the groundwater pumped in the Mendota Pool area is from above this clay.

Mendota Pool Area

Several other clay layers of sufficient thickness and continuity to substantially impede vertical movement of groundwater were found at various depths in the general vicinity of the Mendota Pool. The layer that probably creates the greatest limitation on vertical groundwater flow is a shallow, subsurface clay layer usually 10 to 15 feet thick that is found frequently in the logs of wells near the Mendota Pool. This layer has been termed the A-clay and it acts as a confining bed between the shallow and deep portions of the aquifer overlying the Corcoran clay. In the Mendota Pool area, the A-clay occurs at between 70 to 100 feet in depth. This clay is locally missing in some areas such as the City of Mendota's Bass Avenue well field. It is commonly present in two layers in the area east of the Fresno Slough. The A-clay pinches out to the west near the Mendota Airport and to the east, east of San Mateo Road.

Wells primarily completed in strata above the A-clay, or the equivalent depth of this clay (generally less than 130 feet), are termed "shallow" in this EA. Wells completed in strata below the A-clay, or the equivalent depth, but above the Corcoran Clay, have been termed "deep". The majority of the MPG wells along the Fresno Slough branch of the Pool are shallow. In the absence of pumping, groundwater flows in both the shallow and deep aquifers are generally to the east to northeast (KDSA and LSCE 2000b).

The potential for interconnection between surface water in the Mendota Pool and groundwater differs between the Fresno Slough branch and the San Joaquin River arm of the Pool. Since at least the late 1980's, an unsaturated zone has been present beneath the Fresno Slough branch of the Pool and was initially caused by drought conditions as well as geologic factors (Woodward-Clyde Consultants, 1994). These factors include the presence of a clay layer beneath the Pool and the accumulation of silts and other fine sediments on the bottom of the Pool.

The shallow clay layer observed near the Fresno Slough branch by earlier investigators (Jones and Stokes 1995) could limit the percolation rate of water from the Slough and reduce the effect of groundwater pumping on percolation. Furthermore, the Slough also has probably accumulated a bed of clay and silt since Mendota Dam was constructed in 1863 that would also limit percolation (Jones and Stokes 1995). Much of the silt may have been carried in from the DMC after its construction in 1951. Contour maps of shallow groundwater levels produced by KDSA and LSCE (2000a) also indicate a uniform water-level gradient from southwest to northeast, with no evidence of a water table mound beneath the pool. Shallow MPG pumping helps to maintain the unsaturated zone beneath the Fresno Slough branch of the Pool. The lack of a direct hydraulic connection between surface water and groundwater means that seepage from the Pool occurs at a constant rate and does not increase as a result of groundwater pumping.

In contrast, the shallow groundwater contour maps suggest that a direct connection between surface and groundwater likely exists beneath the San Joaquin River arm of the Pool. This is partially the result of summer flows in this portion of the San Joaquin River in 1999 and 2000. There are no shallow MPG production wells along this branch of the Pool to induce additional seepage. Data from two shallow monitoring wells installed near the Pool in 1999 by NLF indicate that shallow groundwater levels are largely unaffected by deep zone pumping within NLF and FWD. Therefore, MPG transfer pumping from wells within FWD would not be expected to significantly increase seepage from the Pool.

3.2.1.2 Groundwater Quality

The draft EIR (Jones and Stokes 1995) characterized water quality in the aquifers in the project vicinity as quite variable, and the patterns evident in the data were consistent with regional and local patterns described by previous investigators. Groundwater near the San Joaquin River at the eastern end of the Fresno shough branch of the Pool had the lowest concentrations of dissolved solids and the isotopically lightest water. These data provide evidence of ongoing recharge from the San Joaquin River.

Previous studies (Woodward Clyde Consultants [Woodward Clyde] 1994) cited in the draft EIR, indicated that there was a local pattern in groundwater quality. Groundwater in wells away from the San Joaquin River and the Mendota Pool were, on average, about twice as saline as groundwater near the Pool, which was in turn about twice as saline as groundwater near the river (mean total dissolved solids [TDS] concentrations of 1,756 mg/L, 777 mg/L, and 294 mg/L, respectively) (Jones and Stokes 1995). Among the regional wells, groundwater near the southern end of the Pool was more saline than groundwater near the northern end. The composition of shallow groundwater near the Pool was chemically and isotopically intermediate between that of regional groundwater and groundwater near the river. This pattern indicates that some water percolates from the Pool and mixes with the shallow groundwater.

Groundwater was periodically sampled during 1999 and 2000 at MPG wells and upgradient monitoring or reference wells as part of the monitoring program conducted by the MPG, the SJREC, and NLF (KDSA and LSCE 2000a,b). These data are tabulated separately for the shallow (above the A-clay) and deep (below the A-clay) aquifers in Tables 3-1 and 3-2, respectively.

Water quality parameters of particular interest include salinity (as measured by EC or TDS), boron, selenium, arsenic, and molybdenum (A. Gordus 2001 pers. comm.).

Salinity and boron concentrations are of interest due to their potential impacts on vegetation. Selenium levels are of interest due to potential impacts on wildlife, particularly birds. Arsenic and molybdenum levels are of interest because of potential impacts on drinking water quality in the lower San Joaquin River.

Limited water quality data are available from the shallow MPG wells in 1999 and 2000 (Table 3-1). Wells located along the northern portion of the Fresno Slough generally have better water quality than wells located further south. TDS concentrations in one of the MPG wells at Fordel ranged between 320 and 780 mg/L. The MPG wells in the southern end of the Fresno Slough (Coelho/Gardner/Hanson, Meyers Farming, Five Star, and Coelho West) had TDS concentrations ranging from 440 to 2130 mg/L. The highest value is comparable to the lowest concentrations in the upgradient USGS monitoring wells (1830 to 5750 mg/L). The wells at Spreckels Sugar Company, located east of the Fresno Slough, exhibited concentrations between 735 and 2500 mg/L. The higher TDS concentrations at Spreckels Sugar Co. are the result of seepage from Spreckels' wastewater ponds.

The sodium adsorption ratio (SAR) of irrigation water provides an indication of the influence of salts in the water on soil permeability (Stromberg, undated). The SAR was calculated for the groundwater samples summarized in Table 3-1. The SAR in the shallow wells ranged from 2.5 (Fordel, Inc. well M-2, 8/4/99) to 68.8 (Spreckels Sugar Co. well MW-1, 3/8/94). With the exception of the samples from the Spreckels' well MW-1, the remaining SAR values were generally less than 20. For a given well, the SAR values were relatively consistent over time, but varied widely between wells. Water from the majority of wells sampled generally exceeded a SAR value of 6, indicating that impacts to crops could occur if the water was directly applied to the farmland.

Selenium concentrations in shallow wells are highest in the USGS monitoring wells, with concentrations of up to 540 μg/L detected in well 10A2, located several miles upgradient. Concentration in MPG wells located close to the Fresno Slough range from <2 to 4 μg/L at CGH-5. The monitoring wells on Meyers Farm, located a short distance from the southern portion of the Fresno Slough, range from <2 to 10 μg/L. Selenium concentrations in the northernmost wells (i.e., Fordel) were all below the detection limit (i.e., <2 μg/L).

Boron concentrations in the shallow wells ranged from 0.2 to 8.3 mg/L with the highest concentrations present in the upgradient USGS and Meyers Farm monitoring wells. Arsenic was generally not detected in the recent monitoring efforts, or detected at just above the detection limits (i.e., 2 μg/L). The highest reported arsenic concentration was 20 μg/L at USGS monitoring well 10A2.

Water quality in the deep wells is generally better than in the shallow wells (Table 3-2). TDS concentrations in the MPG wells along the northern portion of Fresno Slough (Fordel, Terra Linda, and Conejo West) range between 580 and 880 mg/L with the lowest values recorded at Fordel. The MPG wells in the southern end of the Fresno Slough (Silver Creek Packing Company and Meyer's Farming) had TDS concentrations ranging 1600 to 2110 mg/L. Upgradient wells (USGS and Hansen Farms) located west of the

Slough exhibited TDS concentrations ranging from 2370 to 7000 mg/L. Based on limited data, TDS concentrations in deep monitoring wells at Spreckels Sugar Company, located east of the Fresno Slough, ranged between 900 and 1200 mg/L. These concentrations may not be typical of other areas at Spreckels Sugar Company. Based on reported EC values, TDS concentrations at Newhall Land and Farming wells, located north and east of the Pool, are about half of concentrations observed at Spreckels Sugar.

SAR values in the deep wells ranged from 2.5 in USGS monitoring well 10A4 (9/28/99) to 36.8 in Spreckels' monitoring well MW-11 (December 1988) (Table 3-2). In general, the lowest SAR values were observed in CCID wells, which ranged from 3.6 to 6.0. The highest SAR values were generally measured in the USGS monitoring well 31J5 (15.3 to 29.4), and in the wells at Silver Creek Packing (23.7 to 25.4) and Meyers Farming (20.5 to 24).

Selenium concentrations in the deep wells were generally below detection limits with the exception of MPG wells at Silver Creek Packing Company, which reached concentrations of 4 μg/L (well SC-5 in August 1999). The highest selenium concentrations (30 to 50 μg/L) were detected in the upgradient well at Hansen Farms (7C1). However, the USGS well 10A4, located further west, had a maximum concentration of 5 μg/L. The maximum arsenic concentration was 2 μg/L in USGS monitoring well 10A4.

Boron concentrations in the deep wells ranged from 0.03 to 5.2 mg/L with the highest concentrations present in the upgradient wells, 10A4 and 7C1. Arsenic was generally not detected in the recent monitoring efforts, or was detected at concentrations of 3 μg/L or less. The highest reported arsenic concentration was 10 μg/L at well 7C1.

3.2.2 Surface Water

The following discussion of surface water resources addresses the major components of the water storage and delivery system in the project area, the volumes of water moving into and out of the Mendota Pool, and the water quality of the Mendota Pool and adjoining canals.

3.2.2.1 Water Delivery and Distribution

Reclamation has contracts to deliver approximately 1.9 million acre-feet per year of water to users on the western side of the Central Valley. WWD's contract with Reclamation is for 900,000 acre-feet per year, or approximately 47 percent of the total contracted amount. WWD began receiving CVP water in 1968 when the San Luis Canal was completed. WWD also receives 250,000 acre-feet per year of litigation settlement water from the resolution of the Barcellos lawsuit. In most years, however, these deliveries are reduced to a fraction of the maximum contracted amounts because of drought conditions and, more recently, the federal ESA, the CVPIA, and environmental concerns in and upstream of the Delta.

Surface water features in the southern Central Valley include Millerton Reservoir, San Luis Reservoir, the San Luis Canal, the DMC, the Mendota Pool, the San Joaquin River, Fresno Slough, James Bypass, Kings River, and Chowchilla Bypass. These water bodies are discussed in detail in the draft EIR (Jones and Stokes 1995). The San Luis Reservoir, DMC, Mendota Pool, and the WWD distribution system are key components of the proposed project.

3.2.2.1.1 San Luis Reservoir

The San Luis Reservoir is an offstream storage reservoir, with a gross storage capacity of 2,028,000 acre-feet. It receives exports of Delta water from the CVP and SWP systems. The San Luis Reservoir increases the operational flexibility of the CVP and SWP pumping plants, which are restricted from pumping during certain periods because of fishery and water quality concerns. During winter and early spring, water is pumped to the San Luis Reservoir from the DMC for storage and later release during the irrigation season. During the irrigation months, water continues flowing down the DMC without being pumped into the reservoir. The O'Neill Forebay is also referred to as Check 13. Reclamation monitors water quality in the O'Neill Forebay on a monthly basis (B. Moore 2001, pers. comm.). It is not anticipated that water from the MPG wells would be pumped to the San Luis Reservoir for storage (J. Bryner 2001, pers. comm.).

3.2.2.1.2 Delta-Mendota Canal

The DMC is a CVP facility that conveys water from the Delta to the Mendota Pool and is the primary source of water to the Pool. Water from the Delta is diverted at the CVP Tracy Pumping Plant and conveyed 117 miles south to the Mendota Pool (Jones and Stokes 1995). The original design capacity of the DMC is 4,600 cfs at the Delta and 4,200 cfs at O'Neill Forebay, decreasing to 3,200 cfs at the DMC terminus at the Pool. Current actual capacities are 4,600 cfs, 4,150 cfs, and 2,950 cfs, respectively.

Water in the DMC is used to irrigate lands along the west side of the San Joaquin Valley and to replace riparian diversions from the San Joaquin River that have been eliminated by the construction of Friant Dam. WWD does not normally divert water from the canal directly.

3.2.2.1.3 Mendota Pool

The Mendota Dam is a non-federal facility owned and operated by the Central California Irrigation District (CCID). The dam is located just downstream of the confluence of the San Joaquin River and Fresno Slough and forms the Mendota Pool (Figure 3-1). The Pool is generally considered to extend to the south past the Mendota Wildlife Area (MWA) to the terminus of the James Bypass. In the San Joaquin River branch, the Pool extends almost to San Mateo Avenue. The Pool is generally less than 10 feet deep (G. Browning 2001, pers. comm.), and averages about 400-feet wide. The total capacity of the Pool is about 8,500 acre-feet (J. Martin 2001, pers. comm.).

The San Luis Delta-Mendota Water Authority maintains the water level in the Mendota Pool so that its contractors and prior water right diverters may redivert water imported via the DMC. Reclamation has contracts to deliver 936,631 acre-feet per year of water through the Pool. Pool water is diverted to the users by canals, pumping plants, and downstream releases to the San Joaquin River. Up to 700,000 acre-feet per year is used to replace San Joaquin River water that is diverted at Friant Dam. Reclamation also delivers water through the Mendota Pool to satisfy the prior rights of James Irrigation District (45,000 acre-feet per year), Tranquility Irrigation District (34,000 acre-feet per year), and MWA (30,000 acre-feet per year), as well as a portion of the water contract for WWD (Jones and Stokes 1995). WWD typically receives 50,000 acre-feet per year from the Mendota Pool.

Most of the diversions from the Pool occur in the northern portion of the Fresno Slough north of Transect A-A' (Figure 3-1). Transect A-A' is an artificial dividing line located at a bend in the Slough east of the Firebaugh Intake Canal and separates the intake canals from the outlets of the northernmost MPG wells along the Fresno Slough. Flow direction in the Slough was monitored at this location in 1999. The Pool is drained approximately every other year by CCID to allow maintenance on Mendota Dam. The Pool was drained in late November 1999 by CCID and remained dry until it was refilled in January 2000 (G. Browning 2001, pers. comm.). It is anticipated that the Pool would be drained from late November 2001 until mid-January 2002.

3.2.2.1.4 WWD Distribution System

WWD supplies CVP water to farmers in the district through a 1,034-mile system of underground pipes varying from 10 inches to 96 inches in diameter. WWD maintains all equipment and facilities. Conveyance losses are minimal because of the closed system and intensive preventive maintenance: all meters are tested at least once every 4 years. All water deliveries are measured by meters at the DMC or the Mendota Pool, at various laterals, and at each field outlet. Water is delivered to farmers based on water orders placed 24 hours in advance. At the scheduled time, a farmer opens the valve at the delivery point to obtain the approved flow (Jones and Stokes 1995).

The irrigation practices in the WWD are highly efficient (Jones and Stokes 1995). Farmers were surveyed in 1994 to determine the types of on-farm irrigation systems used. The result of a 1994 survey of farmers indicated that approximately one-third of the district is irrigated by surface systems (furrows 34% and border strips 4%). The remaining farms use pressure systems (sprinklers 15%, drip irrigation 5%, and sprinkler furrow 42%) or a combination of pressure and surface systems. The survey also revealed that 65% of the surface-irrigated fields used tailwater (surface runoff) recovery systems and that, on one-third of those fields, no water was allowed to leave the fields with recovery systems (Jones and Stokes 1995).

3.2.2.2 Water Budget

Water quality conditions in the Mendota Pool are the result of the interaction between the quantity and quality of the various inflows and outflows of water from the Delta (via the DMC), and intermittent inputs from the San Joaquin River, Fresno Slough, James Bypass, Panoche Creek, and seasonal groundwater pumping to the Pool.

A water budget for 1997 through 2000 for the Mendota Pool was prepared as part of the Phase I study report (KDSA and LSCE 2000a). The major inflows and outflows considered in the water budget are shown in Figure 3-2. As can be seen, inputs to the Mendota Pool consist of the DMC, San Joaquin River, and the MPG wells. The primary input to the southern end of the Fresno Slough is the James Bypass. The James Bypass shunts water from the Kings River to the southern end of Fresno Slough. The dominant water inputs to the Mendota Pool during this three-year period came from the DMC and the James Bypass, which accounted for over 80 percent of the total inflows.

Flows through the Mendota Pool show clear seasonal trends and occur primarily during the summer months, although the timing and magnitude of the flows varies between years (Figure 3-3 a and b). The seasonal pattern is particularly evident in the northern portion of the Pool. Inflows to the northern Pool generally peak at approximately 3,000 cfs during the June-September time period. Outflows from the northern Pool were generally less than the inflows, with the exception of winter 1997 and spring 1998 when substantial inputs from the James Bypass into the southern Pool caused a northward flow in the Pool. Similarly, outflows from the southern Pool were generally greater than inflows throughout most of the year.

During MPG pumping events, inflows from the MPG wells generally comprised less than 8 percent of the total inflows to the Pool. During the test pumping event in November 1999, inflows from the MPG wells comprised over 10 percent of the total inflows to the Pool.

Water budgets for the 1997 through 2000 irrigation seasons (May to September) are presented in Table 3-3. Seepage was estimated from measurements made over a 2-day period in November 1999, and is assumed to be constant In 1997, 1999, and 2000, inflows into the northern portion of the Pool exceeded outflows to the irrigation canal intakes, indicating that more water was entering this portion of the Pool than leaving. In contrast, outflows were greater than inflows in the southern portion of the Pool. These data indicate that during the irrigation season, flow in the Pool is to the south. An exception occurred during the first half of 1998 which was an unusually wet year with sufficient surface water available for irrigation purposes.

3.2.2.3 Water Quality

Water quality has been monitored at several locations throughout the Pool for numerous parameters, especially electrical conductivity (EC) and selenium (Figure 3-1). Applicable water quality criteria and guidelines are discussed in Sections 4.2.4 and 4.2.5, and are summarized in Table 4-1.

EC has been monitored using continuous recorders at Check 21 on the DMC and at the intakes to the CCID Main Canal, CCID Outside Canal, Columbia Canal, Firebaugh Intake Canal, and the SLCC Arroyo Canal. The daily mean, minimum, and maximum EC values at the terminus of the DMC for the period from January 1999 through December 2000 are plotted in Figure 3-4. The daily mean EC ranged between 285 and 1256 μmhos/cm, and averaged 452 μmhos/cm. The spike observed between 14 and 16

January 2000 appears anomalous; no other EC values exceeded 764 μmhos/cm. EC measurements tend to be lowest during the early summer (June – July) and to increase steadily through the fall, likely in response to decreasing flows of freshwater into the Delta throughout the summer. The daily range in EC measurements varied from 2 to 735 μmhos/cm, and averaged 151 μmhos/cm.

Figure 3-5 shows the mean EC concentrations at each of the five SJREC canal intakes for the period from February 2000 to December 2000. Variation between the intakes averages 99 μmhos/cm, and ranges from 3 to 414 μmhos/cm. This variation is greatest in the spring months. Throughout most of the summer and fall months, differences between average EC concentrations at the various intakes is relatively small. Water quality at the canal intakes generally track concentrations in the DMC.

Selenium concentrations were monitored by Reclamation at Check 21 on the DMC on a monthly basis since 1994, and in the CCID Main Canal and CCID Inside Canal throughout 1999 and 2000 (B. Moore 2001, pers. comm.). Data for 1999 and 2000 are presented in Figure 3-6. Selenium concentrations in surface water ranged from 0.5 to 3.2 μg/L. Selenium concentrations at the CCID Main Canal reached 7.2 μg/L on January 4, 2000 when the Pool was being refilled. With this one exception, selenium concentrations at the three locations tracked each other fairly consistently over the two-year period.

The MPG, in conjunction with NLF and SJREC, has monitored water quality at 12 points in Mendota Pool and at the outlet canals during periods when the MPG was actively pumping into the Pool in 1999 and 2000 (Figure 3-1). The data presented in this evaluation were obtained from the monitoring program for 1999 and 2000 (G. Browning, LSCE 2001, pers. comm.). Table 3-4 presents the minimum (min), maximum (max), and median value for each constituent or water quality parameter at each sampling location for both years (a table summarizing all of the data is provided in Appendix C). Selenium data are presented only for 1999 on Table 3-4 due to elevated detection limits in 2000 (10 μg/L versus 2 μg/L in 1999). The sampling locations are generally listed in geographical order from northeast to south. Where the concentration of a chemical constituent was below the analytical reporting limit, the value was reported as less-than the reporting limit (e.g., <2 μg/L).

Boron was generally detected at all sampling locations (Table 3-4) at concentrations ranging from 0.1 to 0.4 mg/L. There does not appear to be a geographic pattern in the reported concentrations.

No pattern is evident in selenium concentrations within the Pool. Overall, detectable concentrations of selenium were present in eleven of the 73 samples for which the analytical detection limit was 2 μg/L. The following sampling stations had detectable selenium concentrations in samples with the lower reported detection limit: Columbia Canal (1 of 9 samples), Main Canal (3 of 12 samples), Outside Canal (1 of 12 samples), Firebaugh Intake Canal (3 of 12 samples), and SLCC Arroyo Canal (3 of 8 samples). Selenium was detected at all of these five locations in April 1999 at concentrations ranging from 2 to 4 μg/L. Selenium was always less than the detection limit of 2 μg/L at the Mendota Dam and MWA, located in the northern and southern portions of the Fresno

Slough. Analytical data for selenium from the following stations were either not reported, or were reported only with the higher detection limit 10 μg/L): West of Fordel, Etchegoinberry, and Mowry Bridge (one non-detect sample, reported <10 μg/L).

Both total dissolved solids (TDS) and conductivity (EC) vary widely, with the greatest TDS and EC concentrations measured in samples collected from the southern end of the Pool. The sodium adsorption ratio (SAR) was calculated for those surface water samples in which sodium, calcium, and magnesium were measured. In the northern portion of the Pool, maximum SAR values were approximately 2.5, and the median values were around 1.5. This is indicative of good quality irrigation waters that would not adversely impact crops (Stromberg, undated). In portions of the Pool south of Whites Bridge, the maximum SAR values ranged between 4.5 and 6.4, whereas the median values ranged between 3.8 and 4.7. SAR values less than 6 are generally considered to be indicative of no problems with either sodium or permeability (Stromberg, undated). Only 3 of the 25 SAR values determined for locations south of Whites Bridge were equal to, or greater than 6 (Appendix C). The data are too limited in both space and time to determine whether the higher SAR values are concurrent, or are widespread.

3.2.3 Biological Resources

California Department of Fish and Game (DFG) and U.S. Fish and Wildlife Service (USFWS) personnel reviewed the notice of preparation of the draft EIR and offered comments. DFG's comment letter on the notice of preparation indicated that the project could adversely affect special-status wildlife species that may be present on WWD lands, especially the San Joaquin antelope squirrel, giant kangaroo rat, and burrowing owl (Jones and Stokes 1995). Specifically, DFG suggested that the project could affect these special-status species and their habitats through plowing of fallowed agricultural fields that may have been recolonized and through regional land subsidence. DFG refuge managers also expressed concerns about the possible adverse effects of reduced water quality from the Mendota Pool on wetland wildlife habitats at MWA (Jones and Stokes 1995).

USFWS's comment letter identified a diversity of listed and proposed endangered, threatened, and candidate species that may occur throughout Fresno County (Jones and Stokes 1995). Because the list was intended to cover a large geographical area, it included many montane species that are not found on WWD lands and species whose ranges include the lowlands and foothills of the western San Joaquin Valley.

DFG personnel identified the MWA and wetland habitats near Mendota Pool and elsewhere along Fresno Slough as the primary areas of concern that could be affected by this project (Jones and Stokes 1995). Also of concern are fallowed agricultural lands scattered throughout WWD that could be recolonized by special-status plants and animals (Jones and Stokes 1995).

3.2.3.1 Mendota Wildlife Area

The 12,425-acre MWA is the largest publicly owned and managed wetland in the San Joaquin Valley. The refuge is bisected by Fresno Slough and is adjacent to the 900-acre Alkali Sink Ecological Reserve.

Approximately 8,300 acres of wetlands are maintained on the refuge, including almost 6,800 acres of seasonal wetlands. Surface waters near this refuge may or may not support wetland or riparian habitat depending on the type of channel (i.e., lined or unlined), maintenance activities, hydrologic conditions, and adjacent land use activities (Jones and Stokes 1995). Vegetation at MWA is primarily managed to encourage production of native plants that provide food for waterfowl.

Originally, the vegetation near Fresno Slough was predominantly tule marsh and alkali sink scrub (Jones and Stokes 1995). Today, much of this vegetation has been eliminated by conversion to agriculture, but tule marsh persists around the margins of Fresno Slough and fragments of alkali sink scrub remain at the Alkali Sink Ecological Reserve. Other native communities at MWA are valley sink scrub, valley sacaton grasslands, and heavily grazed scalds and vernal pools.

During 1987-1989, the refuge provided an annual average of 2.3 million use-days by ducks and geese and 300,000 use-days by other water birds. Green-winged teals, northern pintails, and northern shovelers constitute approximately 70% of the migratory duck population. As many as 100,000 shorebirds can be observed at the refuge during winter and spring.

3.2.3.1.1 Special-Status Species

Several special-status wildlife species have been recorded at MWA: giant garter snakes, white-faced ibis, Swainson's hawks, and tricolored blackbirds. Fresno kangaroo rats have been recorded at the adjacent Alkali Sink Ecological Reserve. Palmate-bracted bird's-beak is a special-status plant that has been recorded at MWA and also occurs at the Alkali Sink Ecological Reserve, along with the rare plants heartscale and Hoover's eriastrum.

3.2.3.1.2 Water Source and Quality

Seasonal wetlands and grain crops are irrigated with CVP water delivered via the Mendota Pool. WWD facilities, including Laterals 4 and 6, provide water to MWA for domestic use. Groundwater is not used for irrigation at the MWA. All wells at MWA have been sealed because of excess boron in groundwater (Jones and Stokes 1995). In general, water use at the refuge varies seasonally, with most water diversions occurring during the fall for migrating waterfowl. An average of 16,553 acre-feet/year of water was delivered to the refuge during 1997-2000. The MWA has contracted for 27,584 acre-feet for the 2001-2002 water year. Of this, 13,400 acre-feet are scheduled for delivery between September and November 2001. Water from the MWA is returned to the Pool in the spring (March-April) for reuse (R. Huddleston 2001, pers. comm.).

3.2.3.2 Mendota Pool

The Mendota Pool is formed by a dam that is owned, operated, and maintained by CCID. The dam backs up water in the Fresno Slough to the James Bypass and in the San Joaquin River almost to San Mateo Avenue. The Pool is surrounded by areas of intensive agriculture and consequently has limited wildlife habitat value. The margins of the Mendota Pool support some areas of emergent vegetation dominated by cattails and tules; a few cottonwoods and willows grow above the water line. Open water habitat may attract migratory ducks such as mallards, gadwalls, and ruddy ducks. Emergent vegetation provides limited habitat for marsh-dwelling species such as rails, herons, and various songbirds.

Most of the Mendota Pool is less than 10 feet deep, with the deepest areas no more than 20 feet deep. Inflows and outflows from the Pool are balanced so that the Pool remains at a relatively constant depth. The Pool must remain above 14.5 feet at the Mendota Dam gage for users at the southern end of the Pool (i.e., MWA) to be able to draw water (Huddleston 2001, pers. comm.). However, the Pool is drained occasionally by CCID to allow dam maintenance and repair activities to be carried out, as occurred between November 1999 and January 2000 and is anticipated for November 2001. Frequent, abrupt changes in water level, however, can reduce the overall fish and wildlife habitat values of the Pool.

3.2.3.2.1 Special-Status Species

Several special-status wildlife species have been recorded at the Mendota Pool including giant garter snakes, Swainson's hawks, yellow-billed cuckoos, and bank swallows. Swainson's hawks may be the only special-status wildlife species remaining at the pool. Yellow-billed cuckoos have not been sighted there since the 1950s, and giant garter snakes and bank swallow have not been detected since 1976 and 1980, respectively (Jones and Stokes 1995). Sanford's arrowhead is apparently the only special-status plant species that has been recorded at the Mendota Pool (Jones and Stokes 1995).

3.2.3.3 Fallow Agricultural Lands in WWD

A variety of row, orchard, and vine crops are produced in WWD, and the proportions represented by different crops vary each year. Similarly, the amount of fallow land varies annually, and may range from 16,340 acres as in 1984 to 125,082 acres as in 1991. Fallow lands are temporarily removed from production and are a normal part of agricultural processes in the San Joaquin Valley. In contrast, idle lands are areas that are removed from production for extended periods and generally remain unmanaged (i.e., unplowed). Very little arable land in WWD remains idle (Bryner, pers. comm.). Idle lands near known special-status populations have a higher probability of being recolonized with endangered species than fallow lands that are part of normal farm operations.

While it is true that land idled near native habitat may become occupied by threatened or endangered species, it is also true that land is idled and fallowed and subsequently brought back into agricultural production for reasons not related to this action. Extended drought, lowered prices for commodities, and increased power costs, plus routine rotation of crops are all causes for lands to be fallowed or idled, and later planted. Fallowed land is routinely disced for weed control, and idled land is usually brought back into production in years when water is abundant. WWD is receiving less than 50 percent of its water supply in 2001. Water provided by this action will be needed to maintain existing crops, not to put additional lands into production.

3.2.3.3.1 Special-Status Species

Because of the large size of WWD, numerous special-status wildlife species have been observed within its boundaries, including Swainson's hawks, prairie falcons, burrowing owls, San Joaquin antelope squirrels, San Joaquin pocket mice, giant Kangaroo rats, Fresno kangaroo rats, Tipton kangaroo rats, San Joaquin kit foxes, and blunt-nosed leopard lizards (Jones and Stokes 1995). Many of these sightings were made in remnant habitat areas along levees and along the margins of roads and fields. Some of these species, including many of the rodents, were originally present in the area but have may been largely eliminated from their former habitat areas. Special-status plants that have been recorded in the WWD are Lost Hills crownscale and San Joaquin woolythreads.

Table 3-1. Summary of Ground-Water Quality Laboratory Results (Shallow Wells)

								Cations				Anions								Inorganics							
Well Owner	Well ID	Sample Date	Lab[1]	EC µmhos/cm	pH	TDS mg/l	SAR mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	SO_4 mg/l	Cl mg/l	HCO_3 as HCO_3 mg/l	CO_3 as CO_3 mg/l	OH as OH mg/l	Total Alkalinity as $CaCO_3$ mg/l	NO_3 as NO_3 mg/l	F mg/l	Se mg/l	B mg/l	Cu mg/l	Fe mg/l	Mn mg/l	Zn mg/l	Ba mg/l	As mg/l
USGS[2]	31J4	11/21/1985	USGS	3290	8.0	1960	19.9	31	29	640	3	370	720	262	-	-	-	<0.4	-	<0.001	1.0	-	0.25	0.21	-	-	<0.001
	31J4	04/23/1987	USGS	3270	8.4	1830	16.9	34	30	560	3	360	670	273	-	-	-	2	-	<0.001	1.0	-	0.2	0.02	-	-	0.001
	31J4	08/02/1999	FGL	5740	7.0	3700	16.5	95	99	960	7	930	1360	260	<10	-	-	<0.4	-	0.005	1.4	-	0.83	1.0	-	-	<0.002
	31J4	09/28/1999	FGL	5970	6.7	3670	15.6	102	108	950	9	870	1290	280	<10	-	-	0.6	-	<0.002	1.6	-	1.14	1.37	-	-	<0.002
	31J4	08/25/2000	FGL	5890	6.7	3730	16.4	98	101	970	7	840	1240	250	<10	<10	200	<0.8	0.6	<0.01	1.4	<0.01	0.83	1.22	<0.02	-	-
	10A2	08/03/1999	FGL	6750	7.5	5590	4.7	640	230	540	3	2130	930	110	<10	-	-	770	-	0.54	3.7	-	0.57	1.23	-	-	0.02
	10A2	09/28/1999	FGL	6960	7.2	5750	4.7	670	270	570	5	2140	970	120	<10	-	-	762	-	0.41	4.1	-	<0.25	1.11	-	-	0.002
Fordel, Inc. (MPG)	M-2	08/04/1999	FGL	509	6.8	320	2.5	25	10	58	2	42	51	200	<10	-	-	<0.4	-	<0.002	0.2	-	5.8	0.7	-	-	<0.002
	M-2	09/27/1999	FGL	627	6.7	370	2.8	33	14	75	3	59	65	210	<10	-	-	<0.4	-	<0.002	0.3	-	7.5	1.0	-	-	0.003
	M-2	08/23/2000	FGL	1350	6.7	780	8.1	35	15	226	4	201	174	190	<10	<10	160	<0.4	0.2	<0.01	0.5	<0.01	8.12	1.21	<0.02	-	-
Meyers Farming[2]	MS-1	03/22/1999	BSK	4100	-	2700	-	-	-	-	-	-	1100	-	-	-	-	-	-	<0.002	0.69	-	-	-	-	-	-
	MS-1	03/23/1999	TL	-	-	2800	-	-	-	-	-	-	970	-	-	-	-	-	-	<0.002	0.62	-	-	-	-	-	-
	MS-2	03/22/1999	BSK	3900	-	2500	-	-	-	-	-	-	890	-	-	-	-	-	-	0.003	0.68	-	-	-	-	-	-
	MS-2	03/23/1999	TL	-	-	2600	-	-	-	-	-	-	790	-	-	-	-	-	-	<0.002	0.63	-	-	-	-	-	-
	MS-3	03/22/1999	BSK	2800	-	1900	-	-	-	-	-	-	620	-	-	-	-	-	-	<0.002	0.72	-	-	-	-	-	-
	MS-3	03/23/1999	TL	-	-	2000	-	-	-	-	-	-	530	-	-	-	-	-	-	<0.002	0.66	-	-	-	-	-	-
	MS-4	03/22/1999	BSK	2300	-	1600	-	-	-	-	-	-	440	-	-	-	-	-	-	<0.002	0.73	-	-	-	-	-	-
	MS-4	03/23/1999	TL	-	-	1700	-	-	-	-	-	-	390	-	-	-	-	-	-	<0.002	0.7	-	-	-	-	-	-
	P-1	08/03/1998	BSK	4000	-	2500	-	-	-	-	-	-	790	-	-	-	-	-	-	0.002	0.89	-	-	-	-	-	-
	P-1	01/04/1999	BSK	3500	-	2400	-	-	-	-	-	-	690	-	-	-	-	-	-	<0.002	1.0	-	-	-	-	-	-
	P-1	04/01/1999	BSK	3800	-	2500	-	-	-	-	-	-	830	-	-	-	-	-	-	<0.002	0.88	-	-	-	-	-	-
	P-1	08/05/1999	FGL	4620	7.6	2920	15.0	82	85	810	5	760	870	360	<10	-	-	<0.4	-	0.003	0.9	-	0.12	0.7	-	-	0.003
	P-2	08/03/1998	BSK	6000	-	4000	-	-	-	-	-	-	1300	-	-	-	-	-	-	0.003	0.84	-	-	-	-	-	-
	P-2	01/04/1999	BSK	6000	-	4300	-	-	-	-	-	-	1500	-	-	-	-	-	-	<0.002	0.8	-	-	-	-	-	-
	P-2	04/01/1999	BSK	5800	-	4100	-	-	-	-	-	-	1400	-	-	-	-	-	-	<0.002	0.89	-	-	-	-	-	-
	P-3	08/03/1998	BSK	5500	-	3500	-	-	-	-	-	-	1100	-	-	-	-	-	-	0.003	1.2	-	-	-	-	-	-
	P-3	01/04/1999	BSK	5000	-	3600	-	-	-	-	-	-	1100	-	-	-	-	-	-	<0.002	1.2	-	-	-	-	-	-
	P-3	04/01/1999	BSK	5300	-	3600	-	-	-	-	-	-	1200	-	-	-	-	-	-	<0.002	1.1	-	-	-	-	-	-
	P-4	08/03/1998	BSK	9000	-	5800	-	-	-	-	-	-	2300	-	-	-	-	-	-	0.006	1.5	-	-	-	-	-	-
	P-4	01/04/1999	BSK	8200	-	5900	-	-	-	-	-	-	2100	-	-	-	-	-	-	<0.002	1.3	-	-	-	-	-	-
	P-4	04/01/1999	BSK	8900	-	6200	-	-	-	-	-	-	2600	-	-	-	-	-	-	<0.002	1.2	-	-	-	-	-	-
	P-5	08/03/1998	BSK	6200	-	4000	-	-	-	-	-	-	1200	-	-	-	-	-	-	0.004	1.1	-	-	-	-	-	-
	P-5	01/04/1999	BSK	5300	-	4000	-	-	-	-	-	-	1100	-	-	-	-	-	-	0.0034	1.3	-	-	-	-	-	-
	P-5	04/01/1999	BSK	6000	-	4200	-	-	-	-	-	-	1300	-	-	-	-	-	-	<0.002	1.0	-	-	-	-	-	-
	P-6	08/03/1998	BSK	37000	-	32000	-	-	-	-	-	-	8800	-	-	-	-	-	-	0.99	6.5	-	-	-	-	-	-
	P-6	01/04/1999	BSK	31000	-	31000	-	-	-	-	-	-	7600	-	-	-	-	-	-	0.85	8	-	-	-	-	-	-
	P-6	04/01/1999	BSK	35000	-	32000	-	-	-	-	-	-	8600	-	-	-	-	-	-	0.86	8.3	-	-	-	-	-	-
	S-1	08/03/1998	BSK	6100	-	4300	-	-	-	-	-	-	1400	-	-	-	-	-	-	0.003	1.2	-	-	-	-	-	-
	S-1	01/04/1999	BSK	7200	-	5600	-	-	-	-	-	-	1900	-	-	-	-	-	-	0.0052	1.3	-	-	-	-	-	-
	S-1	04/01/1999	BSK	7200	-	5200	-	-	-	-	-	-	2000	-	-	-	-	-	-	<0.002	1.1	-	-	-	-	-	-
	S-1	08/05/1999	FGL	7470	6.7	5100	17.3	150	168	1300	11	1380	1610	230	<10	-	-	<0.4	-	<0.002	1.4	-	3.4	2.2	-	-	<0.002
Meyers Farming[2]	S-2	08/03/1998	BSK	6500	-	4900	-	-	-	-	-	-	960	-	-	-	-	-	-	0.006	3.4	-	-	-	-	-	-
	S-2	01/04/1999	BSK	5900	-	4600	-	-	-	-	-	-	1000	-	-	-	-	-	-	<0.002	3.4	-	-	-	-	-	-
	S-2	04/01/1999	BSK	6300	-	4600	-	-	-	-	-	-	1200	-	-	-	-	-	-	<0.002	2.4	-	-	-	-	-	-
	S-2	08/05/1999	FGL	7410	6.9	5560	19.8	160	142	1430	16	2460	890	360	<10	-	-	<0.4	-	0.01	7.7	-	0.2	1.6	-	-	<0.002
	S-3	08/03/1998	BSK	4400	-	3100	-	-	-	-	-	-	910	-	-	-	-	-	-	<0.002	0.97	-	-	-	-	-	-
	S-3	01/04/1999	BSK	4500	-	3000	-	-	-	-	-	-	1000	-	-	-	-	-	-	<0.002	1.0	-	-	-	-	-	-
	S-3	04/01/1999	BSK	4200	-	2800	-	-	-	-	-	-	960	-	-	-	-	-	-	-	0.75	-	-	-	-	-	-
	S-3	08/05/1999	FGL	5300	7.0	3280	15.8	98	93	910	6	740	1090	350	<10	-	-	<0.4	-	0.01	0.9	-	1.4	1.5	-	-	0.002
	S-3	09/29/1999	FGL	5610	6.9	3540	15.1	108	99	900	7	770	1180	380	<10	-	-	1.0	-	0.008	1.0	-	3.3	1.6	-	-	<0.002
	E-1	10/27/2000	TL	1700	-	1100	-	-	-	-	-	-	200	-	-	-	-	-	-	<0.005	0.24	-	-	-	-	-	-
	E-2	10/27/2000	TL	1700	-	1000	-	-	-	-	-	-	220	-	-	-	-	-	-	<0.005	0.27	-	-	-	-	-	-
Coelho West (MPG)	CW-3	08/24/2000	FGL	1570	8.1	920	18.2	13	8	338	1	204	156	340	10	<10	300	<0.4	0.2	-	0.5	<0.01	0.73	0.12	<0.02	0.04	-
Coelho/Gardner/Hanson (MPG)	CGH-5	08/03/1999	FGL	3630	8.0	2130	16.4	49	20	540	4	280	860	290	<10	-	-	<0.4	-	0.004	0.7	-	0.2	0.3	-	-	<0.002
Five Star (MPG)	FS-5	08/04/1999	FGL	765	7.4	470	4.3	24	13	105	3	98	93	190	<10	-	-	<0.4	-	<0.002	0.3	-	0.6	0.4	-	-	<0.002
	FS-5	09/27/1999	FGL	698	7.4	440	4.1	24	13	101	2	63	94	190	<10	-	-	<0.4	-	<0.002	0.3	-	0.6	0.3	-	-	<0.002

Table 3-1. Summary of Ground-Water Quality Laboratory Results (Shallow Wells) (continued)

								Cations				Anions								Inorganics							
Well Owner	Well ID	Sample Date	Lab[1]	EC µmhos/cm	pH	TDS mg/l	SAR mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	SO_4 mg/l	Cl mg/l	HCO_3 as HCO_3 mg/l	CO_3 as CO_3 mg/l	OH as OH mg/l	Total Alkalinity as $CaCO_3$ mg/l	NO_3 as NO_3 mg/l	F mg/l	Se mg/l	B mg/l	Cu mg/l	Fe mg/l	Mn mg/l	Zn mg/l	Ba mg/l	As mg/l
Spreckels Sugar Co.[2]	MW-1	~11/15/1982	BCL	1480	9.2	890	52.0	2.5	0.51	345	2	93	206	389.8	23.9	-	-	<0.4	0.84	-	0.44	-	0.06	0.02	-	-	<0.01
	MW-1	05/05/1983	BCL	1400	8.6	973	52.4	2.9	0.6	375	1.2	120	203	428	29	-	-	<0.1	-	-	-	-	0.05	0.03	-	-	<0.01
	MW-1	05/22/1984	BCL	1780	8.8	1083	50.2	3	1.1	400	0.9	145	230	424	30.7	-	-	<0.4	-	-	-	-	0.08	0.04	-	-	-
	MW-1	04/21/1987	BCL	1530	7.8	935	47.9	2.4	1	350	0.7	101	192	473	-	-	-	0.4	-	-	-	-	0.06	0.03	-	<0.1	-
	MW-1	03/28/1988	BCL	1280	8.9	830	45.7	1.9	0.9	305	0.7	85	153	345	43.4	-	-	<0.4	-	-	-	-	<0.05	0.01	-	<0.1	-
	MW-1	04/11/1990	BCL	1510	8.9	940	43.5	2.6	1.4	350	5	134	257	291	28.1	-	-	<0.4	-	-	-	-	<0.05	0.021	-	<0.1	0.005
	MW-1	06/10/1991	BCL	2400	8.8	1320	-	-	-	-	0.8	-	384	406	25.6	-	-	-	-	-	-	-	-	-	-	<0.1	-
	MW-1	02/24/1992	BCL	2700	8.6	1570	54.0	4.8	2.3	575	0.5	384	267	632	11.1	-	-	<0.4	0.66	-	0.56	-	<0.05	0.024	-	<0.1	-
	MW-1	10/19/1992	BCL	3600	8.5	2110	58.0	8	4	805	1.7	355	380	948	41	-	-	3.1[2]	0.64	-	0.63	-	<0.05	0.036	-	<0.1	-
	MW-1	03/03/1993	BCL	3900	8.5	2270	60.4	8.7	5.2	912	2	310	344	1230	79.5	-	-	<0.4[2]	0.55	-	0.8	-	0.059	0.046	-	<0.1	-
	MW-1	03/08/1994	BCL	4050	8.4	2580	68.8	7.6	5.1	999	2.1	450	444	1270	26.5	-	-	<0.4[2]	0.74	-	0.45	-	4.15	2.32	-	0.2	-
	MW-1	09/19/1994	BCL	4050	8.4	2630	59.3	10.5	5.4	948	2.6	505	438	1090	27.4	-	-	1.3[2]	0.38	-	0.86	-	<0.05	0.046	-	<0.1	-
	MW-1	03/15/1995	BCL	4000	8.4	2580	66.9	8.5	4.9	989	2.7	489	493	1100	29.9	-	-	5.8[2]	0.44	-	0.86	-	<0.05	0.021	-	<0.1	-
	MW-1	04/02/1996	BCL	4300	8.4	2590	56.1	11.5	7.4	992	2.6	440	520	1280	<2.6	-	-	<0.4[2]	0.6	-	1.0	-	<0.05	0.085	-	<0.1	-
	MW-1	09/30/1996	BCL	3660	9.0	2300	59.4	8.2	5.6	901	2.2	336	445	1070	50.5	-	-	8.9[2]	0.54	-	1.0	-	<0.05	0.067	-	<0.1	-
	MW-1	06/02/1997	BCL	2340	8.6	1440	54.4	3.8	2.4	550	1.4	186	241	665	47	-	-	<0.4[2]	0.59	-	0.84	-	<0.05	0.037	-	<0.1	-
	MW-1	03/18/1998	BSK	3600	8.3	2200	59.5	9	4.6	880	1.8	<50	410	1342	<1	<1	1100	<25	<2.5	0.002	1.3	-	<0.05	0.07	-	0.06	0.031
	MW-1	08/25/1998	BSK	3300	8.4	2000	57.3	7.8	3.8	780	2.4	210	390	1171	<1	<1	960	<2	<1	-	1.2	-	<0.05	0.06	-	<0.05	-
	MW-1	04/20/1999	BSK	2800	8.4	1800	58.4	6.1	3.1	710	2	370	490	952	<1	<1	780	<6	<3	-	1.0	-	<0.05	0.04	-	<0.05	-
	MW-1	11/14/1999	BSK	3800	8.2	2400	55.8	10	5.1	870	2	190	430	1708	<1	<1	1400	<10	<5	-	1.2	-	<0.05	0.08	-	0.05	-
	MW-1	05/21/2000	BSK	3400	8.2	2200	60.3	8.9	4.4	880	<2	210	400	1342	<1	<1	1100	<8	<4	-	1.2	-	<0.05	0.07	-	0.05	-
	MW-1	12/19/2000	BSK	3900	8.2	2500	60.7	7.6	4	830	2	220	440	1586	<1	<1	1300	<10	<5	-	1.2	-	<0.05	0.06	-	<0.05	-
	MW-1	12/1988	BCL	1330	8.8	925	49.0	2	1	340	1	136	230	282	32	-	-	<0.4	-	-	-	-	<0.05	0.01	-	-	-
	MW-1	4/1999	BSK	2800	8.4	1800	59.1	6	3	710	2	370	490	780	<1	-	-	<0.2	-	-	1.0	-	<0.05	0.04	-	-	-
	MW-1	11/1999	BSK	3800	8.2	2400	49.7	15	5	870	2	190	430	1400	<1	-	-	<0.2	-	-	1.2	-	<0.05	0.08	-	-	-
	MW-1	12/19/2000	BSK	3900	8.2	2500	60.7	7.6	4	830	2	220	440	-	<1	-	1300	<10.0	<5.0	-	1.2	-	<0.05	0.06	-	<0.05	-
	MW-3	12/1988	BCL	1325	7.3	735	5.5	51	17	176	14	15	150	533	0	-	-	<0.4	-	-	-	-	<0.05	0.3	-	-	-
	MW-3	4/1999	BSK	2300	7.1	1400	9.8	98	30	430	22	<50	200	970	<1	-	-	<0.2	-	-	0.4	-	0.14	1.3	-	-	-
	MW-3	11/1999	BSK	2500	7.8	1500	6.9	150	42	370	26	75	260	950	<1	-	-	<0.2	-	-	0.4	-	0.3	2.2	-	-	-
	MW-3	12/19/2000	BSK	2500	7.1	1400	7.7	110	35	360	24	<60	240	-	<1	-	1000	<6.0	<3.0	-	0.4	-	<0.05	1.4	-	0.12	-

1. Laboratory Abbreviations: USGS - U.S. Geological Survey; FGL - Fruit Growers Laboratory, Santa Paula; TL - The Twining Laboratories, Inc.; BCL - BC Laboratories, Bakersfield; BSK - BSK Analytical Laboratories, Fresno; JML - JM Lord, Fresno (Selenium analyses by South Dakota State University)
2. Nitrate & Nitrite as NO_3

Table 3-2. Summary of Ground-Water Quality Laboratory Results (Deep Wells)

								Cations				Anions								Inorganics							
Well Owner	Well ID	Sample Date	Lab[1]	EC µmhos/cm	pH	TDS mg/l	SAR mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	SO_4 mg/l	Cl mg/l	HCO_3 as HCO_3 mg/l	CO_3 as CO_3 mg/l	OH as OH mg/l	Total Alkalinity as $CaCO_3$ mg/l	NO_3 as NO_3 mg/l	F mg/l	Se mg/l	B mg/l	Cu mg/l	Fe mg/l	Mn mg/l	Zn mg/l	Ba mg/l	As mg/l
USGS[2]	31J5	11/20/1985	USGS	4040	7.9	2450	29.4	49	6	820	5	420	990	248	-	-	-	<0.1	-	<0.001	0.9	-	0.22	0.34	-	-	0.001
	31J5	11/06/1991	USGS	5200	7.7	2780	20.4	130	19	940	9	520	990	-	-	-	-	<0.1	-	<0.001	0.72	-	0.91	0.46	-	-	0.001
	31J5	08/02/1999	FGL	9410	7.4	6550	15.3	380	140	1370	16	1580	2440	290	<10	-	-	<0.4	-	<0.002	2.3	-	1.66	3.69	-	-	<0.002
	31J5	09/28/1999	FGL	10100	7.4	6700	16.2	425	178	1580	19	1660	2400	320	<10	-	-	<0.4	-	0.004	3.1	-	2.34	4.0	-	-	<0.002
	31J5	08/25/2000	FGL	10300	7.3	7000	17.8	395	174	1690	17	1630	2360	280	<10	<10	230	<0.8	<0.2	<0.01	2.8	<0.01	2.18	3.28	<0.02	-	-
	10A4	09/28/1999	FGL	2820	7.5	2370	2.5	221	167	200	3	1370	129	160	<10	<10	130	5.5	-	0.005	2.1	-	<0.25	0.16	-	-	0.002
Hansen Farms	7C1	08/03/1999	FGL	8860	7.8	5700	18.2	216	140	1400	8	1020	2380	320	<10	-	-	7	-	0.03	3.9	-	0.32	0.28	-	-	0.01
	7C1	09/28/1999	FGL	9510	7.6	6130	18.1	250	173	1520	10	1270	2370	310	<10	-	-	21	-	0.05	5.2	-	<0.05	0.38	-	-	0.004
Fordel, Inc. (MPG)	M-1	08/03/1999	FGL	923	8.5	580	-	4	<1	167	2	97	134	180	<10	-	-	<0.4	-	<0.002	0.5	-	<0.05	<0.03	-	-	<0.002
	M-1	09/27/1999	FGL	1040	8.2	620	-	5	<1	200	2	118	148	190	<10	-	-	<0.4	-	<0.002	0.5	-	<0.05	0.04	-	-	<0.002
	M-1	08/23/2000	FGL	1020	7.8	610	-	6	<1	210	2	106	137	180	<10	<10	150	<0.4	0.4	<0.01	0.5	<0.01	<0.05	0.04	<0.02	-	-
Terra Linda Farms (MPG)	TL-5	08/03/1999	FGL	1430	8.5	880	-	8	<1	259	3	135	251	210	<10	-	-	<0.4	-	<0.002	0.6	-	<0.05	<0.03	-	-	<0.002
	TL-5	09/27/1999	FGL	1370	8.4	810	-	7	<1	270	3	126	238	230	<10	-	-	<0.4	-	<0.002	0.6	-	<0.05	0.02	-	-	<0.002
Silver Creek Packing (MPG)	SC-5	08/06/1999	FGL	3010	8.0	1730	24.6	38	9	650	10	330	630	240	<10	-	-	<0.4	-	0.004	0.6	-	<0.05	0.1	-	-	<0.002
	SC-5	09/27/1999	FGL	3380	8.0	1940	23.7	42	4	600	8	260	770	270	<10	-	-	<0.4	-	0.002	1.0	-	0.08	0.1	-	-	<0.002
	SC-5	08/23/2000	FGL	3770	7.6	2110	25.4	52	6	726	7	280	800	240	<10	<10	200	<0.4	0.2	<0.01	1.0	<0.01	0.11	0.16	0.06	-	-
Meyers Farming (MPG)	MS-5	03/15/1999	BSK	2600	-	1600	-	-	-	-	-	-	610	-	-	-	-	-	-	0.004	0.9	-	-	-	-	-	-
	MS-5	03/22/1999	BSK	2800	-	1700	-	-	-	-	-	-	650	-	-	-	-	-	-	<0.002	0.87	-	-	-	-	-	-
	MS-5	03/23/1999	TL	-	-	1700	-	-	-	-	-	-	600	-	-	-	-	-	-	<0.002	0.82	-	-	-	-	-	-
	MS-5	08/05/1999	FGL	2940	8.3	1710	24.0	26	12	590	3	220	570	390	<10	-	-	<0.4	-	0.002	0.8	-	<0.05	0.09	-	-	<0.002
	MS-5	09/27/1999	FGL	3060	5.2	1750	23.8	27	11	580	3	250	620	410	<10	-	-	<0.4	-	<0.002	0.9	-	<0.05	0.1	-	-	<0.002
	MS-5	08/24/2000	FGL	2890	8.0	1670	20.5	28	16	548	2	300	450	390	10	<10	340	<0.4	0.2	<0.01	0.8	0.02	0.08	0.12	0.16	-	-
Coelho/Coelho (MPG)	Conejo West	08/03/1999	FGL	1460	8.3	880	-	8	<1	263	4	132	268	200	<10	-	-	<0.4	-	<0.002	0.6	-	<0.05	<0.03	-	-	<0.002
	Conejo West	09/28/1999	FGL	1470	8.3	870	-	8	<1	280	4	136	270	230	<10	-	-	<0.4	-	0.005	0.7	-	<0.05	0.03	-	-	<0.002
Farmers Water Dist. (MPG)	R-11	08/24/2000	FGL	808	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CCID	5A	08/04/1999	FGL	688	7.9	450	6.0	16	5	107	2	97	85	150	<10	-	-	<0.4	-	<0.002	0.3	-	0.05	0.03	-	-	0.002
	5A	09/29/1999	FGL	587	7.7	350	4.0	23	8	88	2	70	79	140	<10	-	-	<0.4	-	<0.002	0.2	-	0.6	0.3	-	-	<0.002
	28B	08/04/1999	FGL	1400	6.9	940	3.9	70	32	157	5	310	153	200	<10	-	-	<0.4	-	<0.002	0.4	-	11.4	1.5	-	-	0.003
	28B	09/29/1999	FGL	1410	6.7	960	3.6	76	36	152	6	326	162	210	<10	-	-	<0.4	-	<0.002	0.4	-	0.05	0.01	-	-	<0.002
	32B	08/04/1999	FGL	2120	7.1	1480	4.9	120	40	242	6	630	204	210	<10	-	-	<0.4	-	<0.002	1.3	-	0.8	2.8	-	-	<0.002
	32B	09/29/1999	FGL	1450	7.2	1010	3.6	88	33	156	5	362	152	210	<10	-	-	<0.4	-	<0.002	0.7	-	0.9	3.0	-	-	<0.002
	32B	08/23/2000	FGL	2270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Locke Ranch	No. 8	08/04/1999	FGL	1210	8.1	800	10.1	25	3	200	2	276	110	170	<10	-	-	<0.4	-	<0.002	0.5	-	0.11	0.17	-	-	<0.002
	No. 8	09/29/1999	FGL	633	8.3	420	10.4	6	2	115	<1	85	72	140	<10	-	-	<0.4	-	<0.002	0.2	-	0.1	0.1	-	-	<0.002
Spreckels Sugar Co.[2]	MW-11	12/1988	BCL	1460	8.3	940	36.8	6	1	370	1	6	113	797	17	-	-	<0.4	-	-	-	-	<0.05	0.02	-	-	-
	MW-11	4/1999	BSK	1600	7.7	1000	15.4	41	6	400	2	<40	180	700	<1	-	-	<0.2	-	-	0.2	-	<0.05	0.4	-	-	-
	MW-11	11/1999	BSK	1800	7.8	1000	14.7	40	5	370	2	<40	180	620	<1	-	-	<0.2	-	-	0.2	-	<0.05	0.4	-	-	-
	MW-11	12/19/2000	BSK	1900	7.5	1200	14.2	40	5.4	360	<2	<40	220	-	<1	-	680	<4.0	<2.0	-	0.2	-	<0.05	0.37	-	0.11	-
	MW-14	3/1988	BCL	1660	8.1	1000	12.2	39	8	320	3	196	277	301	0	-	-	0.4	-	-	-	-	<0.05	0.2	-	-	-
	MW-14	4/1999	BSK	1600	8.0	920	12.2	44	7	330	3	160	230	310	<1	-	-	<0.2	-	-	0.2	-	<0.05	0.2	-	-	-
	MW-14	11/1999	BSK	1500	7.9	900	10.8	39	5	270	1	210	300	330	<1	-	-	<0.2	-	-	0.2	-	<0.05	0.2	-	-	-
	MW-14	12/19/2000	BSK	1500	7.7	910	7.8	49	9.9	230	4	120	180	-	<1	-	330	<3.0	<1.5	-	0.2	-	<0.05	0.34	-	0.07	-
City of Mendota	No. 3	08/06/1999	FGL	2490	7.7	1570	13.0	70	13	450	6	440	410	270	<10	-	-	<0.4	-	0.002	1.0	-	0.4	0.6	-	-	<0.002
	No. 3	09/29/1999	FGL	2500	7.8	1540	11.8	73	14	420	6	440	390	280	<10	-	-	<0.4	-	<0.002	1.1	-	0.4	0.6	-	-	<0.002
	No. 3	01/06/2000	BSK	2300	7.6	1500	13.9	67	12	470	6	460	380	244	<1	-	200	<1	<2.0	0.008	-	<0.05	0.4	0.5	<0.05	0.07	0.002
	No. 3	02/03/2000	BSK	2400	-	1500	-	-	-	-	-	430	350	-	-	-	-	-	-	-	-	-	0.41	0.48	-	-	-
	No. 3	03/02/2000	BSK	2500	-	1500	-	-	-	-	-	430	380	-	-	-	-	-	-	-	-	-	0.39	0.47	-	-	-
	No. 3	04/06/2000	BSK	2300	7.9	1500	12.3	66	11	410	4	410	360	244	<1	<1	200	<1	<2.5	0.008	-	<0.05	0.37	0.48	<0.05	0.06	0.002
	No. 3	06/01/2000	BSK	2300	-	1500	-	-	-	-	-	390	360	-	-	-	-	-	-	-	-	-	0.35	0.46	-	-	-
	No. 3	11/01/2000	BSK	2800	-	1700	-	-	-	-	-	530	430	-	-	-	-	-	-	-	-	-	0.43	0.53	-	-	-
	No. 3	11/09/2000	BSK	2900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. 3	11/16/2000	BSK	2600	-	1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. 3	11/21/2000	BSK	2700	-	1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. 3	11/30/2000	BSK	2600	-	1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3-2. Summary of Ground-Water Quality Laboratory Results (Deep Wells) (continued)

								Cations				Anions								Inorganics							
Well Owner	Well ID	Sample Date	Lab[1]	EC µmhos/cm	pH	TDS mg/l	SAR mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	SO_4 mg/l	Cl mg/l	HCO_3 as HCO_3 mg/l	CO_3 as CO_3 mg/l	OH as OH mg/l	Total Alkalinity as $CaCO_3$ mg/l	NO_3 as NO_3 mg/l	F mg/l	Se mg/l	B mg/l	Cu mg/l	Fe mg/l	Mn mg/l	Zn mg/l	Ba mg/l	As mg/l
	No. 3	12/07/2000	BSK	2900	7.6	1800	13.5	97	17	550	6	580	390	244	<1	<1	200	-	-	-	-	<0.05	0.5	0.67	<0.05	-	-
	No. 3	12/15/2000	BSK	2600	-	1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. 3	12/21/2000	BSK	2700	-	1600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	No. 4	08/06/1999	FGL	2450	7.7	1650	8.2	120	32	390	5	590	290	320	<10	-	-	<0.4	-	<0.002	1.3	-	0.6	1.0	-	-	<0.002
	No. 4	09/29/1999	FGL	2600	7.6	1710	8.4	118	27	390	6	650	320	320	<10	-	-	<0.4	-	0.004	1.5	-	0.8	1.0	-	-	<0.002
	No. 5	08/06/1999	FGL	2150	7.5	1420	11.5	70	8	380	5	559	246	200	<10	-	-	<0.4	-	<0.002	1.1	-	0.4	0.4	-	-	<0.002
	No. 5	09/29/1999	FGL	1950	7.9	1260	10.1	63	8	320	5	479	217	210	<10	-	-	<0.4	-	<0.002	1.0	-	0.4	0.4	-	-	<0.002
	No. 5	06/01/2000	BSK	1800	-	1200	-	-	-	-	-	280	130	-	-	-	-	-	-	-	-	-	0.35	0.34	-	-	-
Newhall Land and Farming	No. 53	4/1997	BSK	600	8.3	-	-	-	-	-	-	78	74	-	-	-	-	4	-	ND	0.2	-	-	-	-	-	-
	No. 53	7/1997	BSK	600	8.3	-	-	-	-	-	-	108	64	177	-	-	-	14	-	<0.0008	0.1	-	-	-	-	-	-
	No. 53	9/1997	BSK	500	8.2	-	-	-	-	-	-	97	57	110	-	-	-	4	-	<0.002	0.1	-	-	-	-	-	-
	No. 53	3/1998	BSK	565	8.3	-	-	-	-	21	1	97	83	-	-	-	-	<2	-	<0.0005	0.1	-	-	-	-	-	-
	No. 53	9/1998	BSK	610	8.3	-	-	-	-	-	-	97	64	-	-	-	-	3	-	<0.0005	0.1	-	-	-	-	-	-
	No. 53	3/1999	BSK	570	8.1	-	-	-	-	-	-	122	57	134	-	-	-	6	-	<0.0005	0.1	-	-	-	-	-	-
	No. 53	9/1999	BSK	600	8.2	-	-	-	-	-	-	110	71	153	-	-	-	3	-	0.0012	0.1	-	-	-	-	-	-
	No. 53	03/21/2000	JML	530	8.1	-	6.4	22	2	117	-	56	105	-	-	-	122	2	-	<0.0004	0.03	-	-	-	-	-	-
	No. 53	10/03/2000	JML	520	8.2	-	5.5	27	2	110	-	54	71	-	-	-	121	-	-	<0.0004	0.08	-	-	-	-	-	-
	No. 53	03/21/2001	JML	540	8.2	-	5.6	19	3	99	-	49	75	-	-	-	115	-	-	<0.0004	0.07	-	-	-	-	-	-
	No. 74	4/1997	BSK	1000	8.2	-	-	-	-	-	179	-	128	-	-	-	-	5	-	ND	0.6	-	-	-	-	-	-
	No. 74	7/1997	BSK	1000	8.4	-	-	-	-	-	218	-	96	214	-	-	-	15	-	<0.0008	0.7	-	-	-	-	-	-
	No. 74	9/1997	BSK	1000	8.0	-	-	-	-	-	209	-	89	153	-	-	-	9	-	<0.002	0.7	-	-	-	-	-	-
	No. 74	3/1998	BSK	964	8.0	-	-	2	<1	-	198	-	118	-	-	-	-	1	-	<0.0005	0.6	-	-	-	-	-	-
	No. 74	9/1998	BSK	1070	8.3	-	-	-	-	-	205	-	124	-	-	-	-	4	-	<0.0005	0.6	-	-	-	-	-	-
	No. 74	3/1999	BSK	950	7.9	-	-	-	-	-	248	-	92	159	-	-	-	5	-	0.001	0.7	-	-	-	-	-	-
	No. 74	9/1999	BSK	1050	8.0	-	-	-	-	-	243	-	138	171	-	-	-	2	-	<0.0005	0.6	-	-	-	-	-	-
	No. 74	03/21/2000	JML	920	7.9	-	-	7	<1	227	-	123	171	-	-	-	135	2	-	<0.0004	0.5	-	-	-	-	-	-
	No. 74	10/03/2000	JML	930	7.8	-	-	12	<1	230	-	145	140	-	-	-	202	-	-	<0.0004	0.68	-	-	-	-	-	-
	No. 74	03/21/2001	JML	950	8.0	-	20.5	6	1	206	-	126	155	-	-	-	136	-	-	<0.0004	0.59	-	-	-	-	-	-
	No. 78	4/1997	BSK	400	8.5	-	-	-	-	74	-	-	39	-	-	-	-	3	-	ND	0.2	-	-	-	-	-	-
	No. 78	7/1997	BSK	400	8.4	-	-	-	-	106	-	-	43	177	-	-	-	14	-	<0.0008	0.1	-	-	-	-	-	-
	No. 78	9/1997	BSK	400	8.5	-	-	-	-	94	-	-	32	110	-	-	-	8	-	<0.002	0.1	-	-	-	-	-	-
	No. 78	3/1998	BSK	396	8.5	-	-	<1	<1	88	-	-	75	-	-	-	-	<2	-	<0.0005	0.1	-	-	-	-	-	-
	No. 78	9/1998	BSK	480	8.5	-	-	-	-	94	-	-	39	-	-	-	-	5	-	<0.0005	0.2	-	-	-	-	-	-
	No. 78	3/1999	BSK	410	8.5	-	-	-	-	120	-	-	43	122	-	-	-	11	-	<0.0005	0.2	-	-	-	-	-	-
	No. 78	9/1999	BSK	500	8.2	-	-	-	-	117	-	-	46	146	-	-	-	3	-	0.0014	0.2	-	-	-	-	-	-
	No. 78	03/21/2000	JML	400	8.5	-	-	3	<1	109	-	38	58	-	-	-	113	3	-	<0.0004	0.05	-	-	-	-	-	-
	No. 78	10/03/2000	JML	450	8.3	-	-	7	<1	121	-	51	55	-	-	-	116	-	-	<0.0004	0.15	-	-	-	-	-	-
	No. 78	03/21/2001	JML	450	7.4	-	-	1	<1	99	-	44	54	-	-	-	109	-	-	<0.0004	0.13	-	-	-	-	-	-
Newhall Land and Farming	No. 94	4/1997	BSK	500	8.6	-	-	-	-	90	-	-	53	-	-	-	-	4	-	ND	0.3	-	-	-	-	-	-
	No. 94	7/1997	BSK	400	8.5	-	-	-	-	108	-	-	43	177	-	-	-	19	-	<0.0008	0.2	-	-	-	-	-	-
	No. 94	9/1997	BSK	400	8.6	-	-	-	-	92	-	-	32	110	-	-	-	11	-	<0.002	0.2	-	-	-	-	-	-
	No. 94	3/1998	BSK	403	8.3	-	-	<1	<1	92	-	-	59	-	-	-	-	0	-	<0.0005	0.2	-	-	-	-	-	-
	No. 94	9/1998	BSK	450	8.6	-	-	-	-	92	-	-	35	-	-	-	-	11	-	<0.0005	0.2	-	-	-	-	-	-
	No. 94	3/1999	BSK	380	8.6	-	-	-	-	113	-	-	32	134	-	-	-	14	-	<0.0005	0.2	-	-	-	-	-	-
	No. 94	9/1999	BSK	440	8.5	-	-	-	-	108	-	-	35	159	-	-	-	2	-	0.0013	0.2	-	-	-	-	-	-
	No. 94	03/21/2000	JML	410	8.6	-	-	2	<1	123	-	40	21	-	-	-	123	3	-	<0.0004	0.14	-	-	-	-	-	-
	No. 94	10/03/2000	JML	410	8.5	-	-	7	<1	111	-	39	39	-	-	-	129	-	-	<0.0004	0.14	-	-	-	-	-	-
	No. 95	9/1997	BSK	200	8.9	-	-	-	-	57	-	-	14	110	-	-	-	11	-	<0.002	0.1	-	-	-	-	-	-
	No. 95	3/1998	BSK	305	8.7	-	-	<1	<1	70	-	-	3	-	-	-	-	4	-	<0.0005	0.1	-	-	-	-	-	-
	No. 95	9/1998	BSK	310	8.7	-	-	-	-	67	-	-	21	-	-	-	-	10	-	<0.0005	0.1	-	-	-	-	-	-
	No. 95	3/1999	BSK	300	8.6	-	-	-	-	90	-	-	21	128	-	-	-	14	-	<0.0005	0.1	-	-	-	-	-	-
	No. 95	9/1999	BSK	280	8.6	-	-	-	-	7	-	-	18	134	-	-	-	1	-	0.0008	0.1	-	-	-	-	-	-
	No. 95	03/21/2000	JML	240	8.8	-	-	2	<1	78	-	45	21	-	-	-	106	3	-	<0.0004	0.03	-	-	-	-	-	-
	No. 95	10/03/2000	JML	230	8.6	-	-	6	<1	69	-	23	12	-	-	-	105	-	-	<0.0004	0.06	-	-	-	-	-	-

1. Laboratory Abbreviations: USGS - U.S. Geological Survey; FGL - Fruit Growers Laboratory, Santa Paula; TL - The Twining Laboratories, Inc.; BCL - BC Laboratories, Bakersfield; BSK - BSK Analytical Laboratories, Fresno; JML - JM Lord, Fresno (Selenium analyses by South Dakota State University)

Table 3-3. Summary Water Budget for the Mendota Pool (1997-1999)

Drainage	1997		1998[a]		1999		2000	
	Inflow (cfs)	Outflow (cfs)	Inflow (cfs)	Outflow (cfs)	Inflow (cfs)	Outflow (cfs)	Inflow (cfs)	Outflow (cfs)
Northern Pool								
San Joaquin River	116.5		660.8		97.3		43.7	
Delta-Mendota Canal	2004.5		896.4		1945.2		1912.2	
MPG Wells in FWD	22.4		0.0		12.3		27.3	
Exchange Contractors		1336.0		1463.9		1344.0		1275.7
San Luis Canal Co. Arroyo Canal		348.8		417.7		408.0		380.5
San Joaquin River		-0.4		1840.0		2.8		9.7
Newhall Land & Farming		23.9		7.9		4.2		3.0
Evaporation		3.2		2.5		2.8		2.2
Seepage		8.0		8.0		8.0		8.0
Totals for Northern Pool	**2143.5**	**1719.5**	**1557.2**	**3740.0**	**2054.9**	**1769.8**	**1983.2**	**1679.2**
Southern Pool								
MPG Wells Along Fresno Slough	79.7		4.2		51.3		66.6	
James Bypass	0.0		2362.6		0.0		0.0	
Tranquility &Fresno Slough WD	0.0		0.0		0.5		5.9	
James & Tranquility		225.2		115.5		188.8		182.9
Mendota Wildlife Refuge		43.0		27.8		46.2		51.4
Lateral 6&7		46.6		63.2		42.8		22.7
Other		35.5		18.6		13.3		27.2
Evaporation		16.0		12.2		13.7		11.0
Seepage[b]		39.3		39.3		39.3		39.3
Totals for Southern Pool	**79.7**	**405.6**	**2366.9**	**276.5**	**51.9**	**344.1**	**72.6**	**334.6**

[a] 1998 was a wet year. Significant inflows from the San Joaquin River and the James Bypass throughout the irrigation season

[b] Seepage was estimated based on measurements made over a 2-day period in November 1999, and was assumed to be constant

Table 3-4. Concentrations of Selected Inorganic Constituents in Surface Water in Mendota Pool (1999-2000)

Location	Boron (mg/L)			Selenium (μg/L)[a]			Total Dissolved Solids (mg/L)			EC (μmhos/cm @ 25°C)			Sodium Adsorption Ratio (SAR)		
	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
DMC Check 21	0.1	0.3	0.1	<0.4	3.2	1.4	130	300	210	264	623	412	1.1	2.5	1.5
Columbia Canal	0.1	0.3	0.2	<2	2	<2	140	310	200	220	500	348	1.4[b]	1.4[b]	NA
SLCC Arroyo Canal	0.1	0.4	0.2	<2	4	<2	130	300	265	230	641	490	NR	NR	NR
Mendota Dam	0.1	0.2	0.15	<2	<2	<2	170	350	235	228	601	386	1.6	3.5	2.1
CCID Main Canal	<0.1	0.3	0.2	<0.4	7.7	1.5	130	300	200	223	1018	410	1.1	2.4	1.5
Mowry Bridge	0.1[b]	0.1[b]	0.1[b]	NR	NR	NR	170	200	180	266	550	312	NR	NR	NR
CCID Outside Canal	0.1	0.3	0.2	0.6	4	1.4	160	350	200	237	754	410	1.2	2.4	1.4
Firebaugh Intake Canal	0.1	0.4	0.1	<2	3	<2	170	300	200	260	705	400	1.2	2.4	1.4
West of Fordel	NR	NR	NR	NR	NR	NR	210	260	240	285	494	354	NR	NR	NR
Etchegoinberry	NR	NR	NR	NR	NR	NR	230	380	230	364	685	471	NR	NR	NR
Whites Bridge	0.19	0.41	0.28	NR	NR	NR	314	540	442	502	853	721	2.5	4.6	4.0
Mendota Wildlife Area	0.2	0.2	0.2	<2	<2	<2	310	530	400	513	920	706	2.8	6.4	3.8
Lateral 6&7	0.2	0.32	0.25	<2[b]	<2[b]	NA	379	670	474	605	1160	735	2.9	4.5	3.9
James ID	0.25	0.38	0.35	<0.4	4.5	<0.4	449	550	521	710	848	815	4.1	6.4	4.7

[a] Selenium data are reported only for samples whose detection limits were 2 μg/L or less.
[b] Only one value reported
NR - Not Reported
NA - Not Applicable

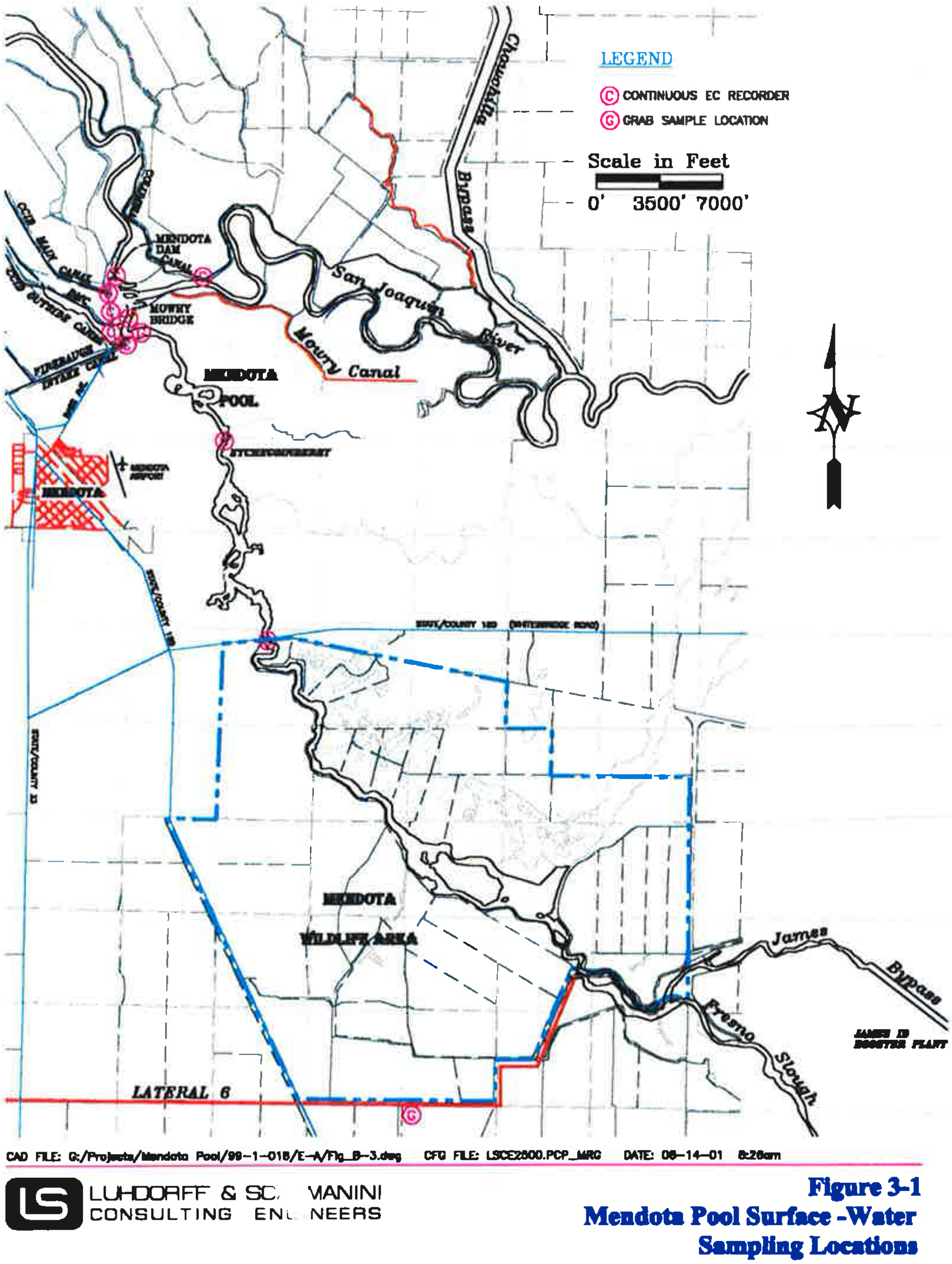
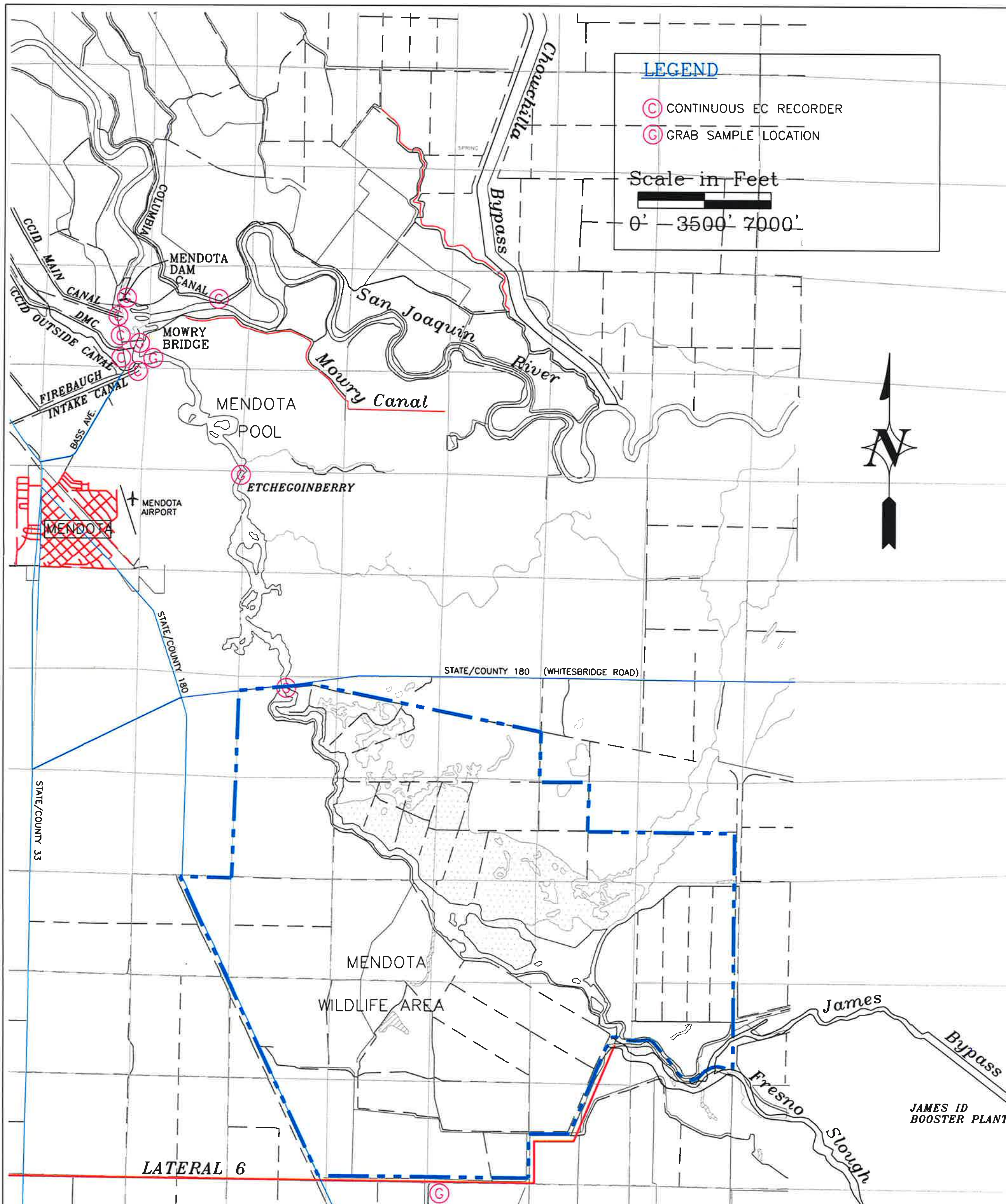


Figure 3-1. Mendota Pool Surface-Water Sampling Locations



CAD FILE: G:/Projects/Mendota Pool/99-1-018/E-A/Fig_B-3.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 06-14-01 8:26am

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Figure 3-1
Mendota Pool Surface -Water Sampling Locations

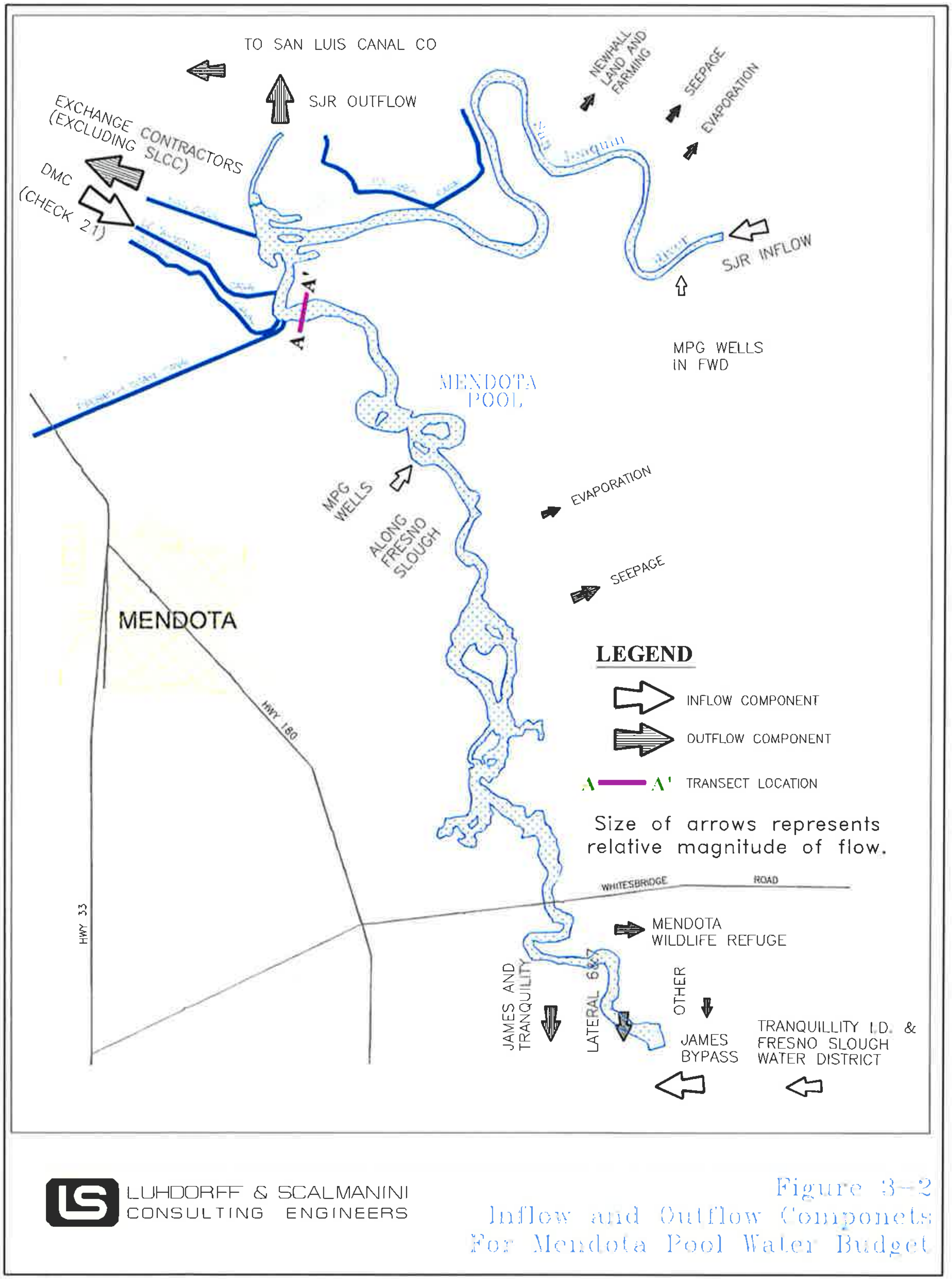

Figure 3-2. Inflow and Outflow Components for Mendota Pool Water Budget.

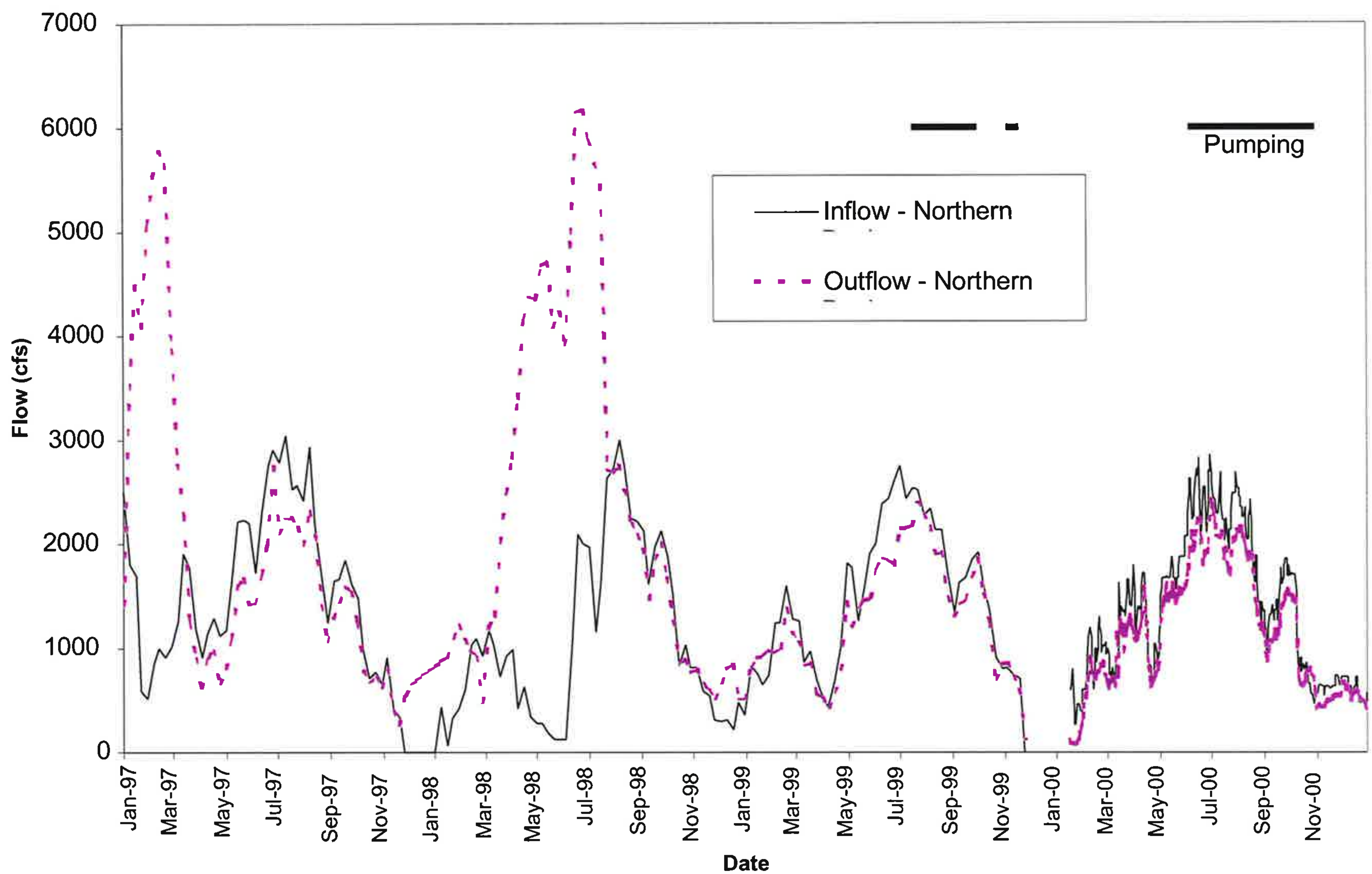

Figure 3-3a. Flows Through the Northern Mendota Pool (1997-2000)

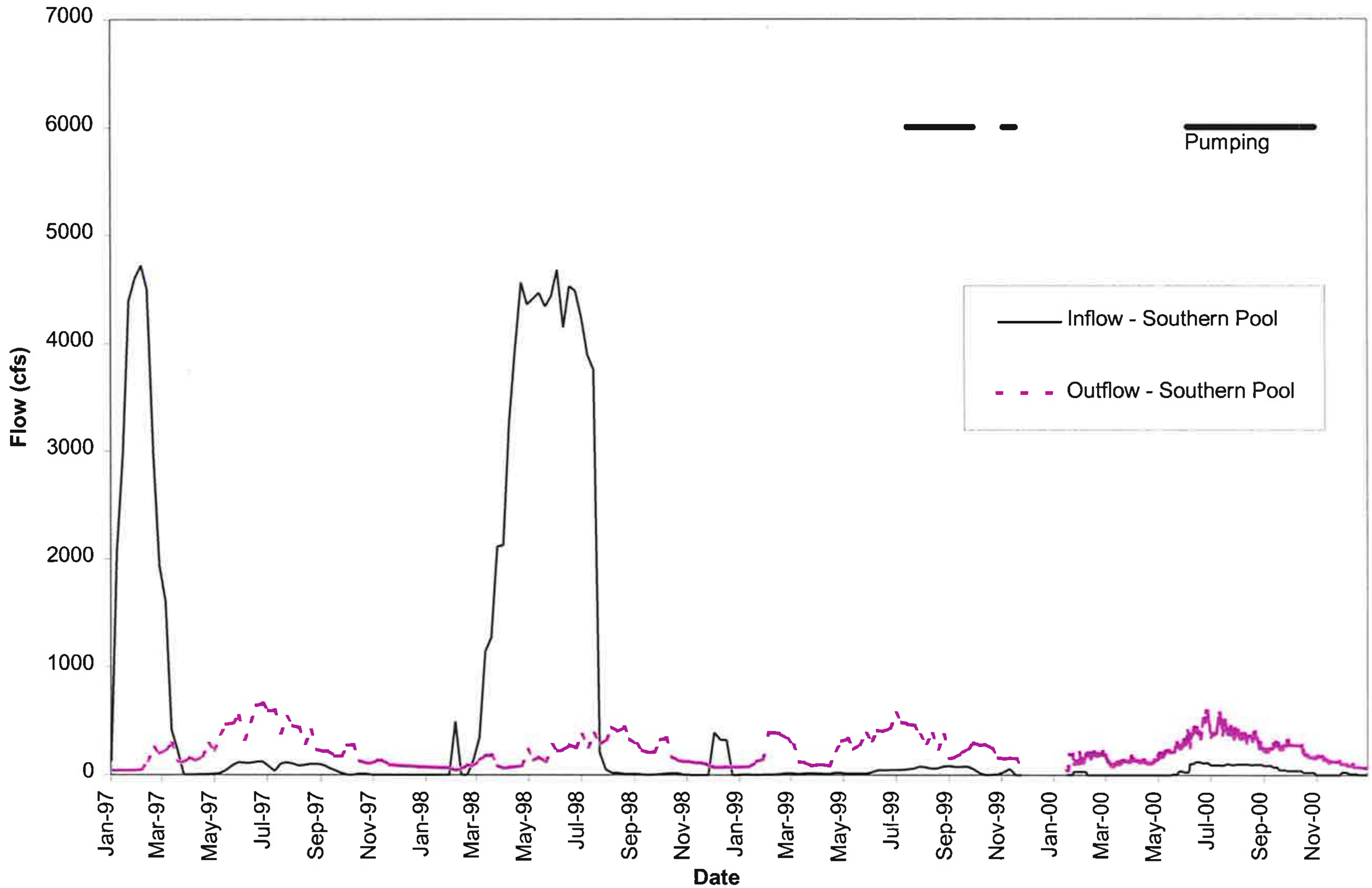

Figure 3-3b. Flows Through the Southern Mendota Pool (1997-2000)

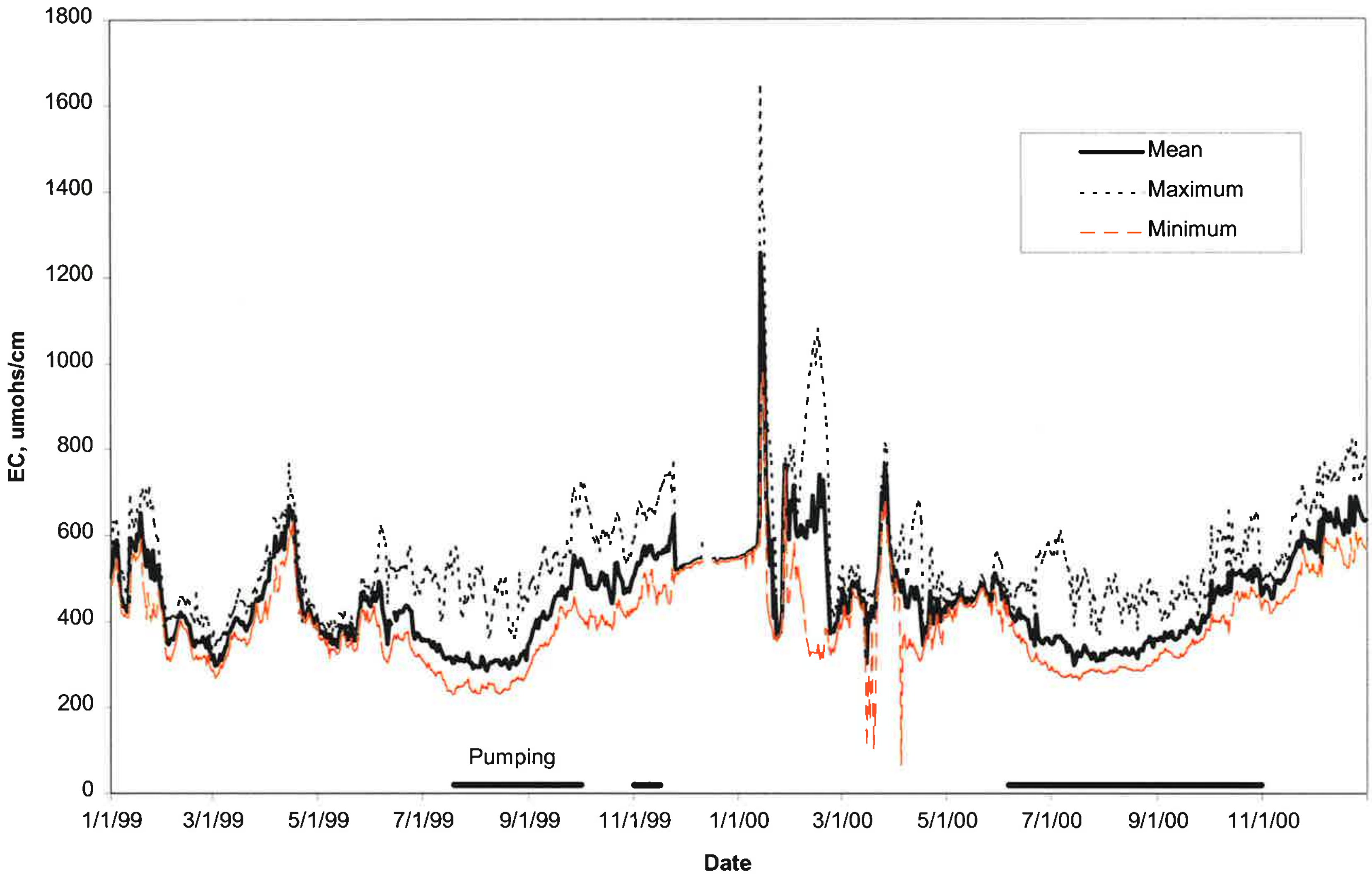

Figure 3-4. Daily Measurements of Electrical Conductivity (EC) at Check 21 on the DMC Terminus

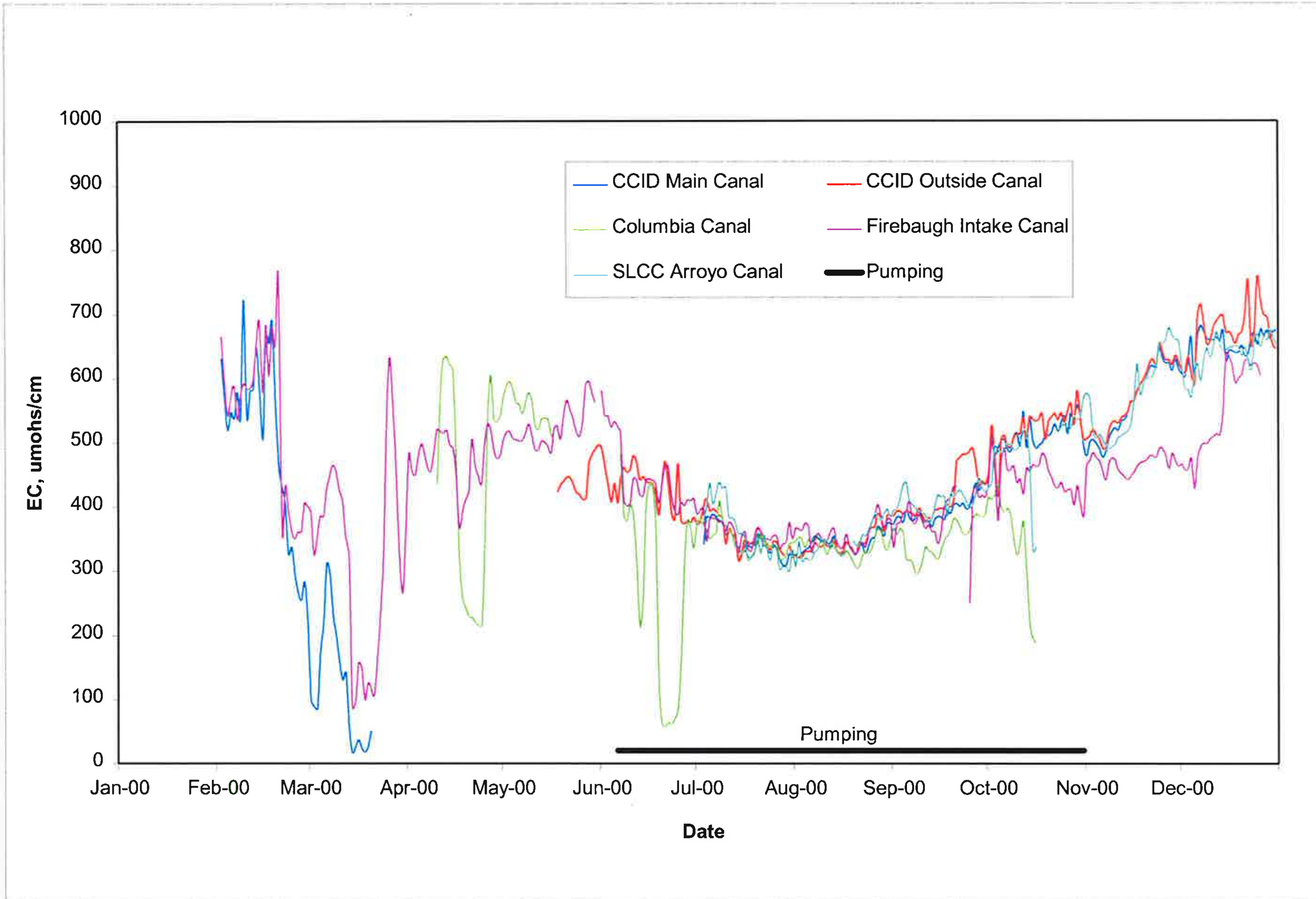

Figure 3-5. **Daily Mean EC (µmhos/cm) at Canal Intakes**

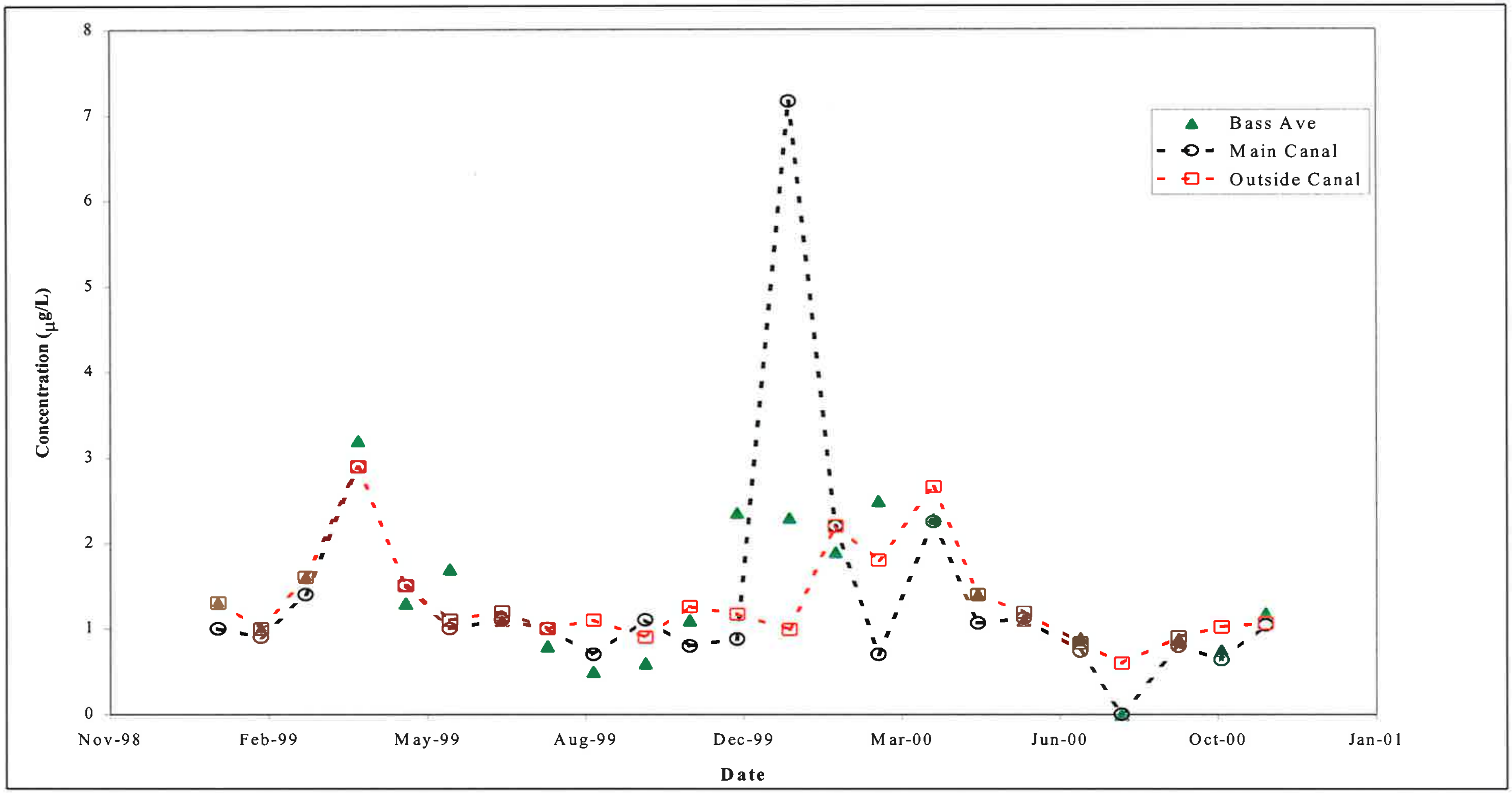

Figure 3-6. **Selenium Concentrations at Bass Avenue (Check 21) on the Delta-Mendota Canal and at Two Outlet Canals (1999-2000) based on Bureau of Reclamation Monitoring Data (B. Moore 2001, pers. comm.)**

4.1 INTRODUCTION

This section addresses the potential for environmental impacts due to the 2001 pumping program (proposed project) relative to each of the four primary resource areas that were identified in the EIR (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) for the original project.

The draft and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) evaluated numerous potential impacts due to the original project. The majority of the potential impacts were determined to be less-than-significant. Subsequent agreements between the interested parties (i.e., the Agreement for Mendota Pool Transfer Pumping) have augmented the findings of the final EIR and have caused implementation of additional mitigation measures. Environmental effects evaluated in the draft EIR and determined to be less-than-significant are not addressed in this EA. The 2001 pumping program was designed to further mitigate the significant effects by reducing the volume of water pumped and adjusting the timing of that pumping. Moreover, the original EIR did not address the potential impacts due to selenium in groundwater or surface water. Therefore, the potential effects of selenium are discussed in this document. This section discusses the potential impacts of the 2001 pumping program on the environmental resources in the project vicinity.

4.2 PREDICTED EFFECTS ON AFFECTED ENVIRONMENTAL RESOURCES

The final EIR (Jones and Stokes and LSCE 1998) determined that the original project could result in adverse environmental impacts in four primary resource areas:

- groundwater level,
- land subsidence,
- groundwater quality, and
- surface water quality.

The proposed project was developed to minimize these potential impacts.

The final EIR did not identify significant impacts to biological resources. Moreover, the potential effects of selenium on biological resources were not addressed in the final EIR. Therefore, they are addressed in this EA. Data are not available to evaluate selenium concentrations in Pool sediments. Therefore, as part of the proposed project, a sediment sampling program will be conducted (see Section 4.4).

Potential impacts to the primary resource areas are closely interrelated. Pumping by the MPG wells and nearby non-project wells would result in a localized lowering of the groundwater levels and the formation of a "cone of depression" in one or both of the shallow or deep layers of the aquifer. The generally lower groundwater elevations result in increased pumping costs in nearby non-project wells. When the groundwater elevations in the aquifer are depressed, then inelastic compression of the clay layers may occur and result in land subsidence. A more pronounced cone of depression would also result in an increase in the hydraulic gradient, thereby increasing the flow of groundwater from outlying areas toward the Pool. If the outlying areas have poorer water quality than that present near the Pool, then water quality degradation could occur. Finally, if the groundwater quality is poorer than the surface water quality, then pumping of this water into the Pool may result in a degradation of the surface water quality.

4.2.1 EFFECTS OF THE NO ACTION ALTERNATIVE

The "no action" alternative assumes that the MPG members would not be allowed to pump groundwater into the Mendota Pool for exchange with Reclamation or trade with other users. The consequences of the reduction, or elimination, of water exchanges could include: (1) increased fallowing of lands presently under irrigation, and (2) the drilling of additional wells on lands owned or leased by members of the MPG. Because the additional wells generally would be inferior in both quantity and quality to the wells proposed for use in the project, members of the MPG would likely shift cropping patterns toward lower value crops that can be dry-farmed or farmed with water of poorer quality. The extent of these impacts would depend on the amount of water available.

The "no action" alternative would not alter the current rate of groundwater flow towards the northeast. Nor would it influence the rates of groundwater pumping for use on adjacent farmland. In general, groundwater quality would continue to degrade throughout the Mendota area.

4.2.2 EFFECTS OF 2001 PUMPING PROGRAM ON GROUNDWATER LEVELS

4.2.2.1 Significance Criteria

Thresholds of significance were developed in the draft EIR and modified for this analysis of the 2001 Mendota Pool project to evaluate potential impacts to lowering of groundwater levels associated with this project. The project would be considered to have a significant effect on the environment if it will:

- lower groundwater levels at a nearby user's wells, thereby increasing pumping and potentially resulting in other costs if modifications to wells or pumps are required;

- indirectly cause crop loss on a neighboring farm because project-related drawdown causes an abrupt decrease in well yield that could not reasonably have been anticipated;

- increase the rate of seepage out of the Mendota Pool so that the availability of surface water or groundwater to other nearby users or for instream uses is substantially diminished.

The draft and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) evaluated the potential impacts of groundwater drawdown on the cost of extracting groundwater. Short-term groundwater drawdown caused by the project could increase the cost of obtaining water by other users. The EIR evaluated this using an economic analysis. The significance threshold relating to pumping costs was included in the original EIR primarily to help local and state decision makers balance localized adverse economic impacts with regional beneficial impacts.

Beginning with the 2001 irrigation season, the MPG has agreed to mitigate this effect by compensating the well owners in the SJREC and NLF service areas for increased power and other costs incurred due to drawdowns caused by the MPG transfer pumping. At the end of each year, consultants to the MPG, SJREC, and NLF will review the water level and pumpage data to determine how much of the drawdown measured at each SJREC and NLF production well is caused by MPG transfer pumping. Compensation will be determined based on this estimated drawdown and actual power costs. Compensation for impacts at wells owned by other pumpers who were not parties to this agreement will be determined similarly through negotiations with the respective well owners.

4.2.2.2 Analysis

The following discussion of potential impacts to groundwater levels is based largely on the analysis presented in the Phase II report "Long Term Impacts of Transfer Pumping by the MPG" prepared by KDSA and LSCE (2000b). A two-layer groundwater model was used to calculate short-term water-level impacts on nearby wells in the Phase II report (KDSA and LSCE 2000b). The two-layer model calculates drawdown above the A-clay using one set of parameters and drawdown between the A-clay and Corcoran Clay using a different set of parameters. The model does not simulate leakage between the layers, but this is considered to be acceptable for short pumping periods (less than one year). In addition to prediction of pumping impacts, the two-layer model was also used to calculate drawdowns for the subsidence estimates.

Each of the identified potential impacts is discussed below.

Impact 1) The 2001 pumping program could decrease groundwater levels at a nearby user's well, thereby increasing pumping and potentially resulting in other costs if modifications to wells or pumps are required.

The draft EIR (Jones and Stokes 1995) determined that this was a less-than-significant impact from the original pumping program (78,000 acre-feet per year). Mitigation specified in the final EIR (Jones and Stokes and LSCE 1998) resulted in considerable reductions in the magnitude and areal extent of drawdown caused by transfer pumping. That mitigation included a reduction in pumping from 78,000 acre-feet per year to an average of 31,000 acre-feet per year.

The 2001 pumping program would extract approximately 31,000 acre-feet over a 6½-month period. The reduced volume would reduce drawdown and therefore minimize cost impacts to other groundwater pumpers in the area compared to the original program. LSCE has analyzed groundwater drawdown due to MPG transfer pumping under the 2001 pumping program. Because MPG pumping would start later than usual in 2001, the maximum deep-zone drawdown due to MPG transfer pumping is expected to occur near the end of the pumping period (i.e., October or November). The maximum predicted drawdown in any non-MPG deep well is expected to occur in October 2001. Furthermore, the MPG has agreed to reimburse other major pumpers for their increased pumping costs. The 2001 pumping program would result in a less-than-significant impact.

There are no shallow water supply wells (except for the MPG wells) within the study area. Therefore, the short-term drawdown of the shallow groundwater will not impact other users. This impact is considered to be less-than-significant.

Impact 2) The 2001 pumping program could indirectly cause crop loss on a neighboring farm because project-related drawdown causes an abrupt decrease in well yield that could not reasonably have been anticipated.

The draft and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) determined that this was a less-than-significant impact from the original pumping program for the following reasons:

- Drawdown caused by the original program would occur gradually over the long-term, giving prudent farmers time to take appropriate corrective action.

- Seasonal fluctuations in groundwater elevation are larger than the anticipated long-term rate of drawdown.

Groundwater levels decline gradually as a result of pumping. Abrupt decreases in well yield are not anticipated. Furthermore, neighboring farmers have been made aware of the proposed pumping program.

The 2001 program discussed in this EA is a short-term, 6½-month program. The volume of water pumped, and the rate of groundwater drawdown due to MPG pumping, would be reduced significantly relative to the original pumping program. Long-term drawdowns are no longer anticipated because the 2001 pumping program is designed to allow groundwater levels to recover over the winter months prior to the next irrigation season. The 2001 pumping program will result in a less-than-significant impact.

Impact 3) The 2001 pumping program could increase the rate of seepage out of the Mendota Pool so that the availability of surface water or groundwater to other nearby users or for instream uses is substantially diminished.

The draft and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) determined that this was a less-than-significant impact for the following reasons:

- Silts and clays have accumulated on the bottom of the Pool thereby impeding natural seepage.

- Pumping only affects seepage rates when a hydraulic connection between the Mendota Pool and groundwater exists.

- A hydraulic connection between the Fresno Slough arm of the Pool and shallow groundwater has not existed for at least 10 years.

Drawdown of the shallow aquifer would be increased under the 2001 pumping program relative to the pumping program discussed in the final EIR because additional transfer pumpage would be shifted from deep to shallow wells. A hydraulic connection between the Fresno Slough branch of the Pool and the shallow aquifer has not existed since the late 1980's. Therefore, seepage from this branch of the Pool is occurring at a constant rate that is unrelated to the magnitude of groundwater pumping.

Data collected in 1999 and 2000 along the San Joaquin River branch of the Pool indicate that a direct hydraulic connection to shallow groundwater exists beneath this area. However, there are no shallow wells near this branch of the Pool to create drawdowns that would induce additional seepage from the Pool. Water level data from shallow NLF monitoring wells indicate that deep zone pumping in NLF and FWD has only a minimal effect on the shallow aquifer, due to the presence of confining layers such as the A-clay. MPG pumping from the deep zone is therefore unlikely to cause significant seepage from the San Joaquin River. Therefore, the 2001 pumping program also would result in a less-than-significant impact.

4.2.2.3 Cumulative Effects on Groundwater Levels

Surface water resources are fully allocated at present. Future regulations may further limit the quantity of surface water available for agricultural uses. Therefore, any additional demands for water, either municipal or agricultural, would likely be met by extracting groundwater. The net effect of these demands would be to further lower groundwater levels on a regional basis. This would increase the cost of groundwater extraction and potentially make current wells non-functional. Because of the geologic conditions within the San Joaquin Valley, overdraft in one area may affect other areas, particularly those that are nearby and immediately upgradient or downgradient. However, groundwater overdraft is not anticipated to occur in the Mendota area.

The proposed action would not increase future demand for groundwater nor limit surface water resources. However, the action would contribute to cumulative short-term drawdown during the irrigation season. The program is designed to allow recovery of groundwater levels during the winter months to the pre-irrigation season levels. Therefore, the 2001 pumping program would not contribute to cumulative long-term overdraft. A monitoring program is in place to ensure that long-term overdraft of the aquifer does not occur. Determination of overdraft conditions would be made based on evaluation of the results from the groundwater monitoring program by the hydrologists representing the MPG, NLF, and SJREC. Furthermore, the MPG has agreed to reduce pumping if there is evidence that long-term overdraft is occurring. The cumulative effects of the proposed project on groundwater levels is less-than-significant.

4.2.3 EFFECTS OF 2001 PUMPING PROGRAM ON LAND SUBSIDENCE

Land subsidence is defined as the lowering of the ground surface over a large area, in this case as a result of lowered groundwater levels due to groundwater pumping. Land subsidence in the San Joaquin Valley has been caused primarily by inelastic compaction of silt and clay layers and is most likely to occur in lacustrine deposits such as the Corcoran Clay. Other deposits such as the Coast Range alluvium (Diablo alluvial fan and flood plain deposits) also contain high percentages of these fine-grained sediments and are relatively compressible. Much less compaction occurs in coarser-grain sediments such as the Sierran sands along the east side of the Valley. This formation contains interbedded silt and clay layers, however sand layers are predominant. Compaction in this formation tends to be primarily elastic and is much less likely to cause irreversible subsidence. Elastic compaction and expansion of the coarse-grained sediments occurs relatively instantaneously in response to water level changes. Inelastic compaction of the silt and clay layers occurs relatively slowly and can continue for years after water levels have stopped declining.

Most subsidence measured in the San Joaquin Valley has occurred due to compaction of lacustrine deposits and Coast Range alluvium in the western and southern parts of the Valley. Most subsidence in the area has been the result of regional pumping from the lower aquifer below the Corcoran Clay. Even though this pumping occurs primarily west, southwest, and northeast of Mendota, it has historically caused water-level declines and compaction in the Corcoran Clay and deeper clays in the Mendota area. Water levels below the Corcoran Clay have generally been recovering in the Mendota area since the late 1960's, when surface water supplies became available from the California Aqueduct and groundwater pumping decreased.

In the Mendota area, the majority of the groundwater pumping is from the aquifers above the Corcoran Clay, which is composed almost entirely of Sierra Nevada floodplain deposits known as Sierran sands. The primarily elastic nature of compaction in this formation is evidenced by historical compaction data collected by DWR between 1966 and 1982 at the Yearout Ranch extensometer, which is located east of San Mateo Avenue in the Spreckels Sugar area. In 1999, the SJREC re-initiated data collection at the Yearout extensometer, and the MPG installed a new extensometer west of the Mendota Airport at Fordel, Inc. Data from both extensometers will be used to monitor subsidence caused by current and future pumping.

4.2.3.1 Significance Criteria

A threshold of significance was developed for this analysis of the Mendota Pool project to evaluate potential land subsidence impacts associated with this project. The project would be considered to have a significant effect on the environment if it will:

- cause land subsidence in excess of 0.005 feet per year at the extensometers at the Yearout Ranch and Fordel, Inc.

In the Phase II report (KDSA and LSCE 2000b), a subsidence threshold of an average of 0.005 foot per year at the Yearout extensometer was identified. This criterion was selected for three reasons: 1) it is the minimum subsidence that could be detected over the given period, 2) the Yearout extensometer is located near FWD (Figure 4-1) in an area likely to experience relatively large drawdowns, and 3) the Yearout extensometer has a relatively long dataset with which to compare current and historic subsidence rates. Data from the Fordel extensometer will also be used to monitor subsidence west of the Fresno Slough.

4.2.3.2 Analysis

The following discussion of potential impacts on land subsidence is based largely on the analysis presented in the Phase II report "Long Term Impacts of Transfer Pumping by the MPG" prepared by KDSA and LSCE (2000b).

Historical data from the Yearout Ranch extensometer were analyzed by KDSA and LSCE (2000b) to determine the correlation between water-level changes and measured compaction that would allow prediction of future compaction at this location. The current pipe extensometer was installed at the Yearout site in 1966 to monitor compaction above the Corcoran Clay, and water levels and compaction were both measured continuously for a 17-year period (1966 to 1982). Most of the monthly data have apparently been lost, but annual compaction values are available from tables in two USGS reports (Ireland et al. 1984; Ireland 1986). Semi-annual depths to water were estimated from graphs included in these reports. The annual rate of compaction shown on the plot was relatively constant from 1966 to 1977 and closely followed the trend of the lowest water levels, which declined from about 70 feet to almost 100 feet during this period. The total inelastic compaction above the Corcoran Clay between 1966 and 1982 was reported to be 0.265 foot, and there is evidence that approximately 0.25 foot of additional compaction above the Corcoran Clay may have occurred at the Yearout site between 1982 and 1999.

Predicted compaction due to all pumping in the Mendota area was calculated in the Phase II report (KDSA and LSCE 2000b). At the Yearout Ranch recorder, the compaction due to MPG transfer pumping and all other pumping were each calculated to be between 0.04 and 0.05 foot over a 10-year period. Drawdown due to MPG pumping is assumed to occur after drawdown due to all other pumping activities has occurred. Although the MPG transfer pumping adds only a small amount of drawdown (less than 10 feet) to the maximum drawdown predicted to occur during the year, it causes a disproportionate amount of subsidence, because the highest rate of compaction occurs when water levels are near or at the lowest levels of the year. The total compaction at the Yearout recorder due to all pumping is predicted to be between 0.08 and 0.10 foot over a 10-year period, or approximately 0.01 foot per year.

Impact 4) The 2001 pumping program could cause land subsidence that indirectly damages or impairs the function of structures such as canals, well casing, or buildings or that substantially alters flooding patterns.

The draft EIR (Jones and Stokes 1995) determined that this was a significant and unavoidable impact from the original pumping program for the following reason:

- Potential for loss of freeboard in SJREC's canals, portions of the California Aqueduct, and other canals, which could result in violation of freeboard standards.

The pumping program proposed in the FEIR (Jones and Stokes and LSCE 1998) reduced this impact considerably, but it was still considered significant for the same reason.

With the 2001 pumping program, this impact has been further reduced and is now considered to be less-than-significant. The majority of the subsidence from drawdowns of less than approximately 35 feet in the aquifer above the Corcoran Clay has already occurred. As a result, compaction due to drawdowns less than 35 feet at Yearout Ranch is thought to be primarily elastic and reversible as the water table recovers each winter. Modeling of data from the Yearout extensometer indicates that the total subsidence caused by the project over a 10-year period would likely be less than 0.05 feet. Subsidence due to the 2001 pumping program is expected to be less than 0.005 feet.

4.2.3.3 Cumulative Effects on Land Subsidence

Subsidence due to MPG pumping is limited to an average of 0.005 foot per year at the Yearout and Fordel extensometers. This is in addition to subsidence caused by all other pumping activities. This criterion is applicable both to the 2001 pumping program and to any long-term pumping program. Because the MPG pumping is considered to be responsible for the last portion of drawdown, it is assumed to have the greatest relative effect on total subsidence. If total drawdowns exceed current levels, MPG pumping would be curtailed to prevent additional subsidence. Furthermore, the 2001 pumping program is designed to allow recovery of groundwater levels during the winter months to the pre-irrigation season levels so that drawdowns in 2002 would not cause groundwater elevations to approach new historical low levels. This would minimize the rate of subsidence on a long-term basis. Therefore, MPG pumping would not contribute significantly to the cumulative effect of drawdown on subsidence.

4.2.4 EFFECTS OF 2001 PUMPING PROGRAM ON GROUNDWATER QUALITY

4.2.4.1 Significance Criteria

Specific thresholds of significance were developed for this analysis of the Mendota Pool project to evaluate potential impacts to groundwater quality associated with this project. The project would be considered to have a significant effect on the environment if it will:

- degrade the quality of groundwater at nearby wells so that potable supply wells no longer meet state drinking water standards or irrigation wells become unusable for existing crop types;

- degrade groundwater quality by changing the direction of movement of degraded groundwater beneath Spreckels Sugar, Co.;

- degrade groundwater quality at MPG wells so that surface water quality is impacted. This impact is discussed in Section 4.2.4.

Groundwater Quality Threshold

The significance of degraded groundwater quality (such as an increase in salinity or selenium concentration) depends on the use of the water. Thus, the significance of a given increase could be different for a potable supply well than for an irrigation well. The impact on water quality could be an increase in the existing rate of deterioration, if water quality at the affected well is already becoming worse because of factors unrelated to the proposed MPG pumping project.

Potential groundwater quality criteria include "maximum contaminant levels" (MCLs) for drinking water, water quality guidelines for irrigation water as defined under California Title 19 rules, and water quality criteria relevant to surface water. Groundwater and surface water screening benchmarks were identified for the following constituents or water quality parameters: arsenic, boron, selenium, TDS, and EC. The benchmarks listed in Table 4-1 were obtained from DWR (1994) and Marshack (2000), and represent conservative (lowest) values reported in the reviewed documents.

4.2.4.2 Analysis

The rate of groundwater quality degradation in the vicinity of the Fresno Slough has increased as a result of historic groundwater pumping. MPG pumping could contribute to this degradation primarily as a result of the following four factors:

1. Pumping of MPG wells along the Fresno Slough (especially deep wells) creates a steeper horizontal gradient, which would accelerate the lateral flow of groundwater west of the Slough toward the MPG well field. The northeasterly gradient exists both with and without MPG pumping, but the pumping steepens the gradient and increases the rate of flow from the west and southwest.

2. Pumping of MPG shallow wells causes the horizontal groundwater flow direction east of the Pool to shift toward the MPG wells. This causes degraded groundwater resulting from seepage from Spreckels Sugar Co. wastewater ponds to change direction and flow toward the MPG wells.

3. Pumping of deep MPG wells along the Fresno Slough increases vertical (downward) gradients. This accelerates the downward flow of groundwater through the A-clay to the deeper aquifer. Near both branches of the Pool, the quality of the shallow groundwater is good due to recharge from the Pool.

However, particularly in areas west of the Slough, the quality of the shallow groundwater is low, and this downward flow could increase water quality degradation below the A-clay.

4. Pumping of MPG wells (especially shallow wells) may intercept good quality recharge that originates as seepage from the Pool. In the absence of MPG pumping, this recharge improves groundwater quality near the Pool and counteracts some of the degradation caused by lateral flow of lower quality groundwater from the west.

Vertical flow between the shallow and deep aquifers is limited by the vertical hydraulic conductivity of the A-clay where it is present. The vertical gradient for flow through the A-clay would increase by approximately 1 ft/ft due to MPG pumping, assuming an average drawdown over five months of 17 feet in the shallow zone and 50 feet in the deep zone. Based on a vertical hydraulic conductivity of 0.024 gpd/ft^2 for the A-clay (KDSA, 1989), the increase in the rate of downward groundwater flow through the A-clay due to MPG pumping would be about 0.5 acre-feet/acre per five months. Over an area of 2,000 acres, for example, this downward flow would be about 1,000 acre-feet in five months.

Along the Fresno Slough branch of the Pool, pumping of the shallow MPG wells has the potential to intercept the majority of the seepage from the adjacent area of the Slough when the wells are operating. Pumping of the deep wells can also result in interception of Pool seepage, although in lesser amounts due to clay layers such as the A-clay which limit vertical flow.

Along the San Joaquin River branch of the Pool, some recharge moves downward to be intercepted by deep wells near the River. The volume of vertical flow in this area is limited by the presence of clay layers and is expected to be small. This is indicated by water-level data which show: 1) relatively minor water level fluctuations in shallow monitoring wells near the River, 2) the presence of a ground-water ridge beneath the River during both pumping and non-pumping periods (see Figures 4-9 and 4-10 in the Phase I report; KDSA and LSCE 2000a), and 3) increased confinement of the deep aquifer in this area.

Interception of recharge is important for two reasons. First, the recharge helps maintain water levels in the shallow, unconfined aquifer above the A-clay. This shallow groundwater provides recharge to the deep aquifer in the Mendota area and also flows laterally toward the Madera area, which is in a state of overdraft. Second, the recharge consists of relatively low salinity water, which acts to maintain the existing quality of the groundwater in the area.

Impact 5) The 2001 pumping program could degrade the quality of groundwater at nearby wells so that potable supply wells no longer meet state drinking water standards or irrigation wells become unusable for existing crop types.

The draft EIR and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) determined that this was a significant impact from the original pumping program for the following reasons:

- Future pumping of MPG wells could accelerate the eastward movement of poor quality groundwater from the southwest.

- Existing salinity levels at upgradient wells were above the upper acceptable limit for existing uses.

Recent measurements (1999 and 2000) of TDS and EC at the City of Mendota municipal supply wells (Table 3-2) indicate that these parameters exceeded MCLs for drinking water (Table 4-1). During this period, TDS ranged from 1200 mg/L to 1800 mg/L in the City's wells. Boron concentrations likewise exceeded MCLs by a factor of 2. However, arsenic concentrations in the City's wells were below the detection limit of 0.002 mg/L and well below the MCL of 0.05 mg/L. Selenium concentrations in these wells in 1999 and 2000 were approximately an order of magnitude lower than the MCLs established for drinking water. Degradation of water quality in these wells was observed prior to initiation of MPG pumping; although, by contributing to groundwater drawdown, MPG pumping has accelerated of the rate of degradation. The limited data available for the City of Mendota's wells (Table 3-2) does not show evidence of degradation in water quality between 1999 and 2000. To obtain better quality groundwater, the City of Mendota is drilling additional wells in areas to the east of Mendota Pool.

The 2001 pumping program would significantly reduce the volume of groundwater pumped (31,000 acre-feet) as compared to the original proposal (78,000 acre-feet), thereby resulting in a shallower groundwater gradient. This would slow the rate of any increase of salinity levels in the groundwater as compared to the original pumping program. In 2001, the change in the horizontal gradient west of the MPG wells is predicted to be relatively small and the change in the flow distance of lower quality groundwater would likewise be small, approximately 170 feet during the year.

Examination of the groundwater quality data collected as part of the monitoring program (Tables 3-1 and 3-2) did not show significant variation between 1999 and 2000 regardless of pumping by the MPG and others during this period. Although some degradation could occur as a result of pumping during 2001, the magnitude of the change is expected to be small and within the range of natural variation in groundwater quality.

Vertical flow between the shallow and deep aquifers is slow due to the presence of clay layers, such as the A-clay. Pumping of deep groundwater would be limited to 12,000 acre-feet in the 2001 pumping program. It is unlikely that vertical flow will be sufficient to result in measurable degradation of the water quality in the deep aquifer. Therefore, over the next year, the impact on water quality is to be small and would not impact current beneficial uses. In the short-term, this impact is considered less-than-significant.

The FEIR did not address potential impacts from selenium concentrations in groundwater. Selenium concentrations in the MPG wells do not exceed either the water quality guidelines for irrigation water set by the DWR, or the drinking water standards (MCLs) (Table 4-1). Although changes in selenium concentrations are expected due to the increased groundwater gradient, these changes are expected to be small during the 2001 pumping season. Therefore, the 2001 pumping program would result in a less-than-significant impact relative to selenium concentrations.

Impact 6) The 2001 pumping program could degrade groundwater quality by changing the direction of movement of contaminated groundwater beneath Spreckels Sugar Co.

The regional groundwater flow direction above the Corcoran Clay is from the southwest to the northeast. MPG pumping of shallow wells along the southern portion of the Fresno Slough would result in a reversal of the groundwater flow direction in the shallow aquifer beneath portions of the Spreckels Sugar Co. property. As a result of this reversal in flow direction, degraded groundwater seeping from Spreckels' factory wastewater ponds would flow southwest toward the MPG wells along the southern Fresno Slough. Elevated concentrations of calcium, magnesium, manganese, ammonia-N, bicarbonate, and total organic carbon are present in the groundwater under these ponds. During periods when the MPG wells are not pumping, the flow returns to a northeasterly direction. There are no other shallow production wells between the wastewater ponds and the MPG wells. A shallow Spreckels Sugar Co. monitoring well located about one-quarter mile northeast of the cluster of shallow MPG wells at Coelho West has experienced groundwater degradation since at least 1999. Although degradation has not yet been observed at the Coelho West wells, it is possible that the degraded groundwater will begin to reach these wells in 2001. Water quality degradation in the shallow production wells is expected to be gradual, and may not become significant for several years. In 2000, water quality in the Coelho West wells was better than the shallow MPG wells located one-half to one mile further north on the western side of the Fresno Slough (the Meyers and CGH wells); and this is not expected to change in 2001. Additional monitoring will be conducted in the Coelho West wells in 2001 and subsequent years, and the wells will be shut off when water quality degradation reaches significant levels.

4.2.4.3 Cumulative Effects on Groundwater Quality

Pumping activities near the Mendota Pool contribute to groundwater drawdown and increase the rate at which lower quality groundwater flows toward the Pool from the southwest and west. In the absence of any pumping near the Mendota Pool, groundwater would continue to flow in a northeasterly direction. As a result, groundwater could continue to degrade in this area due to subsurface drainage from agricultural lands. The vertical flow of groundwater from the shallow to the deep aquifer due to pumping below the A-clay could also result in degradation of the water quality in the deep layer over the long term.

The 2001 pumping program would contribute to the increased horizontal groundwater gradient during the pumping period, thereby increasing the rate of movement of lower quality groundwater toward the Pool. However, lateral flow would be less than 170 feet during 2001. It would also contribute to the increased vertical flow from the shallow to the deep aquifers. The 2001 pumping program is not expected to cause any additional wells to exceed applicable water quality criteria over the course of the program.

Additional MPG wells will be monitored regularly for water quality parameters beginning in 2001. If certain wells are determined to have an unacceptable level of water quality degradation, pumping would be discontinued in those wells.

4.2.5 EFFECTS OF 2001 PUMPING PROGRAM ON SURFACE WATER QUALITY

One of the concerns raised by the SJREC is that water pumped into the Mendota Pool by the MPG wells may, at times, cause degradation of water quality at their canal intakes. This issue is of particular importance in terms of the ability of the SJREC to meet existing and future water quality standards for agricultural drainage discharged to the San Joaquin River. Water quality degradation impacting the SJREC is most likely to occur when there is a northerly direction of flow in the Fresno Slough branch of the Pool during MPG pumping episodes. However, there is also the potential for water from the MPG wells which pump into the San Joaquin River branch of the Pool to affect water quality at the canal intakes (particularly the Columbia Canal intake) under normal conditions when the flow direction in this branch is to the west.

Users at the southern end of the Pool, including the MWA and the James and Tranquillity Irrigation Districts, have also raised concerns about water quality degradation at their intakes. Since the flow direction in the Fresno Slough branch of the Pool is to the south during most of the year, there is the potential that water quality degradation could impact use of the water for irrigation or wild life habitat creation.

4.2.5.1 Significance Criteria

Thresholds of significance were developed for this analysis of the Mendota Pool project to evaluate potential impacts to surface water quality associated with this project. The project would be considered to have a significant effect on the surface water quality if:

- discharge of groundwater to the Mendota Pool would cause water diverted from the Pool for irrigation purposes to exceed recommended constituent levels,

- groundwater discharges increase the frequency or extent of flooding along natural waterways,

- groundwater discharges indirectly result in exceedances of water quality standards for TDS or selenium, in agricultural return drainage flows.

Chronic screening benchmarks for surface water data were identified following an examination of relevant documents. Beneficial uses for which criteria or guidelines were identified included irrigation water, drinking water, and aquatic life. For surface water, the reviewed documents were:

- The Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins (RWQCB 1998),

- Selenium ecological risk guidance provided by Reclamation in "Appendix E2 of the Draft Grassland Bypass Project Environmental Impact Statement and Environmental Impact Report Volume II" (Reclamation 2000),
- The U.S. EPA National Recommended Ambient Water Quality Criteria (AWQC) for freshwater aquatic life protection as reported in Marshack (2000), and
- The preliminary draft water quality criteria for refuge water supplies developed by the Central Valley RWQCB (1995).

Chronic surface water screening benchmarks were identified for the following constituents or water quality parameters: arsenic, boron, selenium, TDS, and EC. The benchmarks listed in Table 4-1 represent the most conservative (lowest) values reported in the reviewed documents. Although the Basin Plan presents a number of values for constituents in surface waters, care was taken to select those screening criteria that are most appropriate for the Mendota Pool area.

4.2.5.2 Analysis

The quality of water at the Exchange Contractor intakes is important in terms of suitability for irrigation, and for consideration in management of subsurface drainage. Continuous recorders have been installed to measure electrical conductivity (EC) of water near the terminus of the DMC and at the SJREC canal intakes since 1993. These include the intakes of the Columbia Canal, CCID's Main and Outside Canals, and the Firebaugh Intake Canal. Another EC recorder is installed at the intake of the San Luis Canal Co. Arroyo Canal, downstream of Mendota Dam. Information from these recorders was evaluated for the 1997 and 1999 MPG transfer pumping episodes, to determine if there were noticeable changes in electrical conductivity due to MPG transfer pumping. In addition, surface water grab samples were collected at ten locations in the Pool for laboratory analysis in 1999. All of these data are summarized in the Phase I report (KDSA and LSCE 2000a). EC data are highly variable over time and appear correlated to the concentrations in the DMC (Figure 3-4 and Figure 3-5). There were no discernable impacts of MPG transfer pumping on water quality at the SJREC canal intakes in 1999, however the EC concentrations at certain canal intakes exhibited short term elevated concentrations as compared to the DMC (Figure 6-6 in KDSA and LSCE 2000a).

Preliminary review of the 2000 data does not show any MPG pumping impacts at the canal intakes. Daily average EC readings at the DMC were subtracted from concurrent daily average readings at the SJREC canal intakes to determine the magnitude of the deviations. The calculated deviations from the DMC concentrations are summarized for both the 2000 pumping period and the non-pumping period in Table 4-2. Negative values indicate that the EC concentration at the canal intake is lower than the EC concentration at the DMC. Both during the MPG pumping period and during the period when the MPG wells were not pumping, the range of deviations at all of the canals bracketed zero. The average deviations for the CCID Main Canal and the Firebaugh Canal showed a slight reduction in water quality during the MPG pumping period, whereas the average deviations for the Columbia Canal and the SLCC Arroyo Canal showed slightly improved water quality, and the CCID Outside Canal showed no difference.

Water budgets summarizing all inflows to and outflows from the Mendota Pool were used to determine the direction of flow in the Fresno Slough branch of the Pool and provide an indication of where surface water quality impacts caused by transfer pumping can be expected to occur. When southerly flow occurs in the Fresno Slough branch, water from MPG wells along the Fresno Slough would generally flow away from the SJREC canal intakes north of the MPG well field. No significant impacts on water quality at the SJREC canal intakes due to pumpage from these wells would be anticipated, although slight impacts at the CCID Outside Canal and the Firebaugh Intake Canal could occur under certain flow conditions. Impacts are also possible at the Columbia Canal intake when the FWD wells are pumping into the San Joaquin River branch of the Pool. Beginning in 2001, the MPG has agreed to cease pumping of certain wells when flows in the Fresno Slough branch of the Pool are to the north, or when EC concentrations at the intakes of the Firebaugh Canal, CCID Outside Canal, or the Columbia Canal exceed the concentrations in the DMC by 90 µmhos/cm or more for a period of three consecutive days.

The following analysis was conducted to assess the potential impacts of MPG transfer pumping on the water quality in the Mendota Pool. This analysis focuses on selenium and TDS transfers from groundwater to surface water. Impacts on other water quality parameters, including chlorides, and sulfates were addressed in the draft EIR for the original program (Jones and Stokes 1995) and found to be less-than-significant. These parameters are closely related to TDS, and would be expected to behave similarly to TDS. Furthermore, since the total volume of water to be pumped has been reduced from 78,000 acre-feet to 31,000 acre-feet, the potential impacts discussed in the draft EIR are expected to be reduced considerably.

Only the southern portion of the Pool is considered in the analysis of selenium and TDS loading to the Pool. Selenium is not considered to be present at detectable levels in groundwater in FWD or NLF, which are located along the San Joaquin River arm of the Pool. Selenium was detected at concentrations between 0.8 and 1.4 µg/L in wells at NLF in only seven of 35 samples collected between 1997 and 2000 (Table 3-2). The detection limit for these samples ranged between 0.4 µg/L and 2 µg/L. Similarly, TDS levels are low in these wells (EC ranged from 200 to 1000 mg/L; Table 3-2).

The available data suggest that TDS concentrations in groundwater change slowly over time (Tables 3-1 and 3-2). Therefore, the current average concentration of TDS was used as the best estimate of the groundwater concentration throughout the pumping period. Selenium was assumed to behave similarly to TDS. Because data were only available for a limited set of wells, the MPG wells along the Fresno Slough were grouped into clusters (Figures 4-1 and 4-2), and the average concentration of selenium or TDS for each cluster determined. The clusters generally contained only one or two wells that had been sampled. Concentrations that were reported as not detected were replaced by one-half the detection limit. Results of repeated sampling from the same well and from nearby wells were averaged to obtain a local estimate of current groundwater selenium and TDS concentrations. Data from the sampled wells were then extrapolated to all wells in the cluster. The results of the expanded groundwater and surface water monitoring program for 2001 will be used to estimate the mobility of both selenium and TDS in the groundwater and to validate the assumptions used to predict surface water concentrations.

The average selenium and TDS concentrations at MPG wells were multiplied by the monthly volume of water pumped by the wells to estimate the amount of selenium or TDS being added to the southern portion of the Pool on a monthly basis (Tables 4-3 and 4-4). A surface water mixing model based on flows in the Pool during 2000 (Table 3-3 and Figure 3-3) was then used to estimate surface water selenium and TDS concentrations and dilutions within the Pool. The volume of water available for dilution of the selenium was estimated to be the total monthly inflow into the Pool minus the outflow from the northern portion of the Pool.

Using selenium data collected in 2000 and earlier, the total selenium inputs to the Pool due to MPG transfer pumping over the 6½-month pumping period are estimated to be 45.8 kg, with 39 kg derived from the shallow wells and 6.8 kg derived from the deep wells. TDS inputs from MPG pumping total 27,700 tons, with 24,400 tons derived from shallow wells and 3,200 tons from the deep wells. Using the surface water mixing model, it is estimated that selenium concentrations would vary from 1.0 µg/L to 2.3 µg/L and average 1.5 µg/L over the full year (Table 4-3). The highest selenium concentrations are predicted to occur during January through April when no MPG pumping is scheduled. Similarly, TDS concentrations are predicted to range from 286 mg/L to 529 mg/L, and average 385 mg/L on an annual basis (Table 4-4). The results from the groundwater and surface water monitoring program in 2001 will be used to validate these predictions and further refine the model.

Groundwater data collected in June 2001 using improved detection limits, suggests that the total selenium load to the Pool may be as low as 5.4 kg (see Appendix D for a discussion of the new selenium results). Concentrations of selenium in the waters of the Fresno Slough may actually decrease as a result of the 2001 pumping program.

***Impact** 7)* The discharge of groundwater to the Mendota Pool in the 2001 pumping program could cause water diverted from the Pool for irrigation purposes to exceed recommended constituent levels or contribute to the frequency, magnitude, or duration of violations of numerical water quality criteria established in the Basin Plan for the Sacramento River and the San Joaquin River Basins (CVRWQCB, 1988).

The 2001 pumping program would result in a less-than-significant impact relative to TDS, chlorides, and sulfates. The 2001 pumping program would discharge no more than 31,000 acre-feet of water into the Mendota Pool. This is considerably less than the 78,000 acre-feet proposed for the original program. Pumping volumes from both the shallow and deep wells have been reduced in the 2001 program, thereby reducing the total mass of salt introduced into the Pool. Because the volume of water is considerably reduced, the impacts due to TDS, chlorides, and sulfates would be reduced. Due to changes in water supply management in upstream areas of the San Joaquin River, summer flows in the San Joaquin arm of the Mendota Pool have resumed, thereby further improving the quality of the water in the northern portion of the Pool during the irrigation season.

Water quality impacts at the SJREC canal intakes will be minimized for two primary reasons. First, the MPG has agreed to pump only when flow in the Fresno Slough branch of the Pool is to the south. Second, the MPG would cease pumping if EC concentrations at the intake canals exceed EC concentrations measured in the DMC by more than 90 μmhos/cm for a period of three consecutive days. As summarized in Table 4-2, EC deviations did not violate this criterion during the 2000 pumping period.

The potential for water quality impacts at the southern end of the Pool have been minimized in the 2001 pumping program in three ways: (1) pumping rates of the southern MPG wells (which have the poorest water quality) have been reduced, (2) increased monitoring of surface water quality in this area has been initiated, and (3) monitoring of the water quality in the southern wells would be increased. As part of previous monitoring programs, water quality sampling has been conducted at Whitesbridge Rd. (7 samples), MWA (7 samples), the Lateral 6 and 7 intake (9 samples), and the James Irrigation District Booster Plant (7 samples) between 1999 and 2001 (see Appendix C). On all occasions, the TDS levels at these southern locations were below the DWR standard for Class I irrigation water of 700 mg/L. Concentrations of all other constituents were also less than applicable standards. Based on these analyses it does not appear that MPG transfer pumping has significantly affected the water quality in the southern end of Mendota Pool in the past.

In addition, the results from the modeling of the TDS concentrations in surface water (Table 4-4) show that TDS concentrations are predicted to range from 286 mg/L to 529 mg/L, with an average value of 385 mg/L. Therefore, the MPG 2001 pumping program is not likely to significantly affect water quality from a salinity perspective.

The draft and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) did not address the potential contribution of selenium to the surface waters. The analysis conducted to evaluate increases in selenium concentrations indicates that the 2001 pumping program would slightly increase selenium concentrations in surface water. The maximum expected increase under the 2001 pumping program is estimated to be 0.3 μg/L in October and all other monthly increases are less than 0.2 μg/L (Table 4-3); this level of increase would not be detectable using standard analytical techniques.

Existing data from 1999 indicate that the measured selenium concentrations in surface water (Table 3-4; Appendix C) are below the applicable water quality criterion of 2 μg/L (Table 4-1). This criterion was developed by the USFWS to be protective of the aquatic and terrestrial plants and the bioaccumulation pathway to wildlife in the Grassland Watershed and in the Kesterson Wildlife Refuge (USFWS 2000). This criterion is also applicable to the MWA at the southern end of the Mendota Pool.

The resulting total concentrations of selenium in surface waters of the Pool (Table 4-3) are also expected to be less than the levels established by the USFWS or identified in the

CVRWCB Basin Plan, and would be much less than the levels established by DWR for irrigation waters (50 μg/L; Table 4-1). Therefore, this impact is considered to be less-than-significant.

Impact 8) The groundwater discharges from the 2001 pumping program could increase the frequency or extent of flooding along natural waterways.

The draft and final EIRs (Jones and Stokes 1995; Jones and Stokes and LSCE 1998) determined that this was a less-than-significant impact from the original pumping program for the following reasons:

- Water pumped into the Mendota Pool would not accumulate in the Pool because the San Luis and Delta-Mendota Water Authority controls the DMC inflow to the Pool in order to maintain a constant stage.

- Land subsidence associated with the pumping program would not alter the flow patterns of streams.

- Small changes in land surface slope due to subsidence would have a negligible effect on the pattern of flooding.

The 2001 pumping program would also result in a less-than-significant impact. The 2001 pumping program would discharge no more than 31,000 acre-feet of groundwater water into the Mendota Pool. Subsidence due to the 2001 pumping program would be small (less than 0.005 foot) and would not alter flood flow patterns.

Impact 9) The groundwater discharges could indirectly result in exceedances of water quality standards for TDS or selenium in agricultural return drainage flows.

Since pumping of the MPG wells along the Fresno Slough will occur only when flows in this branch of the Pool are to the south, MPG pumping is not expected to significantly alter the water quality delivered to users in the northern portion of the Pool. Therefore, MPG pumping will not cause exceedances of water quality standards in agricultural return flows from those users extracting water from the northern portion of the Pool.

Addition of TDS or selenium to surface waters in the southern portion of the Fresno Slough branch of the Pool by MPG wells would increase the concentrations of these parameters in this portion of the Pool. The analyses performed to assess surface water impacts indicate that there is sufficient dilution occurring in the Pool to ensure that the increases would be small and that agricultural water quality standards would be met. Furthermore, during the proposed pumping period, the expected increases in selenium concentrations are less than 0.3 μg/L (Table 4-3) and the total selenium concentrations in the southern portion of the Fresno Slough are expected to meet ambient water quality criteria for aquatic life (Table 4-1). Since the water delivered to the users meets the applicable water quality standards, this impact is considered to be less-than-significant.

4.2.5.3 Cumulative Effects on Surface Water Quality

Water in the Mendota Pool is derived from freshwater runoff, transport from the Delta via the DMC, MPG and other pumping, and potentially some agricultural return water (James Bypass). Water from the MPG wells contributes salts and selenium to the Pool. Due to the high turnover of water within the Pool, the MPG inputs are significantly diluted.

Agricultural users who take water from the northern portion of the Pool generally release their tail water to other water bodies, whereas users in the southern portion of the Pool generally retain their waste waters in evaporation basins. The MWA returns their used water to the Pool, generally in the months of March and April (R. Huddleston 2001, pers. comm.). The Regional Water Quality Control Board is responsible for regulating the quality of the return flows. If the water entering the MWA or agricultural lands is of insufficient quality, then these users may have difficulty in meeting their effluent requirements.

The MPG has instituted a groundwater and surface water quality monitoring program in the Pool to ensure that applicable water quality standards are met. It is unlikely that water quality standards would be exceeded during the 2001 pumping program. Therefore the cumulative impact of the 2001 pumping program is considered to be less-than-significant.

4.2.6 Effects of 2001 Pumping Program on Biological Resources

No significant impacts to biological resources were identified in the draft and final EIRs for the original project (Jones and Stokes 1995; Jones and Stokes and LSCE 1998). Since impacts to biological resources from TDS loading and land subsidence were considered to be less-than-significant in the FEIR for the original project, and the 2001 pumping program would pump less water (31,000 acre-feet/yr as compared to 78,000 acre-feet/yr for the original project), impacts on biological resources from the mitigated program are considered to be less-than-significant.

However, impacts due to selenium concentrations were not evaluated in the EIR for the original project. Therefore, the potential for environmental impacts due to selenium in the 2001 pumping program are addressed in this section.

4.2.6.1 Analysis

Impact 10) The discharge of groundwater to the Mendota Pool in the 2001 pumping program could cause surface water to exceed standards for the protection of aquatic and terrestrial plants and wildlife.

The draft EIR (Jones & Stokes Associates 1995) did not identify any significant impacts to plants, waterfowl, or wildlife, including special status species due to increases in salinity or subsidence. Using data on the physiological responses of fish, plants, and terrestrial wildlife to salinity, the draft EIR did not identify any potential adverse effects due to the TDS concentrations measured in the Pool. Therefore, the proposed action will have no effect to any listed species.

The draft and final EIRs did not evaluate the potential effects of selenium exposures on these species. USFWS (2000) has developed risk-based screening criteria for selenium that are considered to be protective of both aquatic and terrestrial plants and wildlife resources in the Grasslands Watershed and Kesterson Wildlife Refuge. The risk-based guideline for selenium in water is 2 μg/L as a monthly average. This value is also protective of plant and wildlife resources in the MWA. The USFWS guideline has been adopted by the CVRWQCB as the criterion for selenium in surface waters (Table 4-1).

Surface water in the Pool flows south toward the MWA during the pumping season. The analyses discussed in this document indicate that the concentration of selenium in surface water of the Pool is generally below the method detection limit of 2 μg/L with occasional exceptions (e.g., April 1999). Future sampling of groundwater and surface water with improved (i.e., lower) detection limits will be conducted. Furthermore, the addition of selenium to the Pool from the MPG wells has been found to have a small influence on concentrations in surface waters. It is unlikely that plants and wildlife would be exposed to potentially toxic concentrations of selenium as a result of MPG pumping in 2001. Therefore, this impact is considered to be less-than-significant. The proposed project will have no effect on listed species.

Some surface water is released over the Mendota Dam for diversion at the SLCC Arroyo Canal. This water is prevented from flowing further downstream by the Sack Dam. Available monitoring data (Table 3-4, and Appendix C) indicate that neither TDS nor selenium at the Arroyo Canal intake exceed concentrations that are likely to have an adverse effect on plant or wildlife resources.

Data are not available to evaluate selenium concentrations in Pool sediments. Therefore, as part of the proposed project, a sediment sampling program will be conducted. Sediments could provide a long-term source of selenium to aquatic plants in the Mendota Pool. However, aquatic vegetation in the Pool is limited.

4.2.6.2 Cumulative Effects on Biological Resources

Conditions that result in poorer water quality (Section 4.2.4.3) may increase the potential for adverse effects on wetland plants and animals. The surface water quality monitoring program will provide a mechanism to anticipate water quality impacts. These effects are most likely to be seen in the MWA and in other refuges that receive water from the Pool. Due to limited habitat at the Pool itself, it is unlikely that significant adverse effects on biological resources at the Pool will be observed.

The TDS levels in the surface waters of Mendota Pool are expected to be well below the concentrations expected to adversely affect plant or wildlife resources (Jones and Stokes 1995). Selenium concentrations are expected to be below the water quality criterion determined by the USFWS (2000) to be protective of plant and wildlife resources. Therefore, the cumulative effects of the pumping program on biological resources in the

Pool or MWA are considered to be less-than-significant. The proposed project will have no effect on any listed species.

4.2.7 Archeological and Cultural Resources

Cultural resources is a broad term that includes prehistoric, historic, architectural and traditional cultural properties. Land use in the project vicinity is currently agricultural. The project seeks to maintain current land uses. The proposed project does not include a change in any existing land uses or construction of new facilities. There are no effects on archaeological or cultural resources.

4.2.8 Indian Trust Assets

Indian Trust Assets are legal interests in property or rights held in trust by the United States for Indian Tribes or individual Native Americans. Trust status originated from rights imparted by treaties, statues, or executive orders. Such assets cannot be sold, leased or otherwise alienated without federal approval. The distribution of Indian reservations, rancherias, and public domain allotments throughout the project area was reviewed. No Indian lands of any type were found within the study area. There are no significant effects.

4.2.9 Environmental Justice

The February 11, 1994 Executive Order requires federal agencies to ensure that their actions do not disproportionately impact minority and disadvantaged populations. The market for seasonal workers on local farms draws thousands of migrant workers, commonly of Hispanic origin. The population of some small communities typically increases during late summer harvest. Without the exchanged water, some field crops may not be planted or may become stressed. The project would help maintain agricultural production and local employment.

4.2.10 Socio-economic Resources

Agriculture is a very important industry in Fresno and Madera counties. Agriculture takes on additional significance because it is generally considered a "primary" industry (along with mining and manufacturing). A reasonably large portion of activity in non-primary industries can be attributed to support for primary industry activity in an area. Changes in primary industry activity, therefore, usually precipitate additional changes in non-primary, or support, industries.

The Hispanic community makes up a large portion of the regional population. The no action alternative may result in an insignificant drop in employment if there is a reduction in agricultural production. The proposed action would help maintain current levels of employment.

4.3 SUMMARY OF IMPACTS

This assessment has determined that all potential environmental effects would have a less-than-significant impact on the environment due to the 2001 pumping program.

- The 2001 pumping program is anticipated to contribute to lower groundwater levels in other wells in the area. The MPG has agreed to reimburse other groundwater users for any repairs that may be necessary should damage to wells occur due to MPG drawdowns.

- Groundwater quality degradation at nearby wells would not result in additional potable supply wells failing to meet state drinking water standards or in irrigation wells becoming unusable for existing crop types during 2001.

- Drawdowns at nearby user's wells would increase pumping costs and could potentially result in other costs to well owners. The MPG has agreed to reimburse the other major pumpers for costs due to drawdowns.

- The 2001 pumping program would not cause an abrupt decrease in well yield and thereby cause crop loss on a neighboring farm that could not reasonably have been anticipated.

- The rate of seepage out of the Mendota Pool is not anticipated to increase significantly so that the availability of surface water or groundwater to other nearby users or for instream uses is substantially diminished. Because a direct hydraulic connection between the Fresno Slough branch of the Pool and the shallow aquifer does not exist, pumping of the shallow MPG wells would not increase seepage from the Fresno Slough branch of the Pool. A direct hydraulic connection does appear to exist beneath the San Joaquin River arm of the Pool, but pumping of deep wells in this area does not appear to significantly increase seepage.

- Land subsidence would be insufficient to indirectly damage or impair the function of structures such as canals, well casing, or buildings, or substantially alter flooding patterns during 2001.

- The discharge of groundwater to the Mendota Pool in the 2001 pumping program would not cause water diverted from the Pool for irrigation purposes to exceed recommended constituent levels.

- The discharge of groundwater to the Mendota Pool in the 2001 pumping program would not contribute to the frequency, magnitude, or duration of violations of numerical water quality criteria established in the CVRWQCB basin plan during 2001.

- The groundwater discharges from the 2001 pumping program are not anticipated to increase the frequency or extent of flooding along natural waterways.

- Groundwater discharges would not result in increased concentrations of TDS, selenium, or other water quality parameters in agricultural return drainage flows.

- Changes in surface water quality due to MPG transfer pumping would not adversely affect the health or productivity of aquatic and terrestrial plants and wildlife in the Mendota Pool or MWA.

4.4 MONITORING PROGRAM

A detailed monitoring program has been established to determine the long-term influence of MPG pumping on groundwater elevation and quality, surface-water quality, and land subsidence. Complete details of the 2000 monitoring program were provided in the Phase II report (KDSA and LSCE 2000b). Several changes to the monitoring program have been made for 2001. Details of the 2001 monitoring program are provided in Appendix B. This section summarizes the monitoring program for 2001.

The monitoring program has been designed to adequately allow for evaluation of future MPG impacts on groundwater levels and quality, surface-water flow direction and quality, land surface subsidence, and sediment quality. Sampling of MPG groundwater wells (quantity, quality, and elevation), surface water quality, and sediment quality will be conducted by the MPG. In addition, data on groundwater quality, pumpage, and groundwater levels will be obtained from other entities (e.g., SJREC, NLF, Reclamation, and City of Mendota) that are conducting monitoring in the region.

Estimates of groundwater pumpage would be made on a weekly or monthly basis. Water-level measurements would be made by the MPG in approximately 50 wells on a bi-monthly (every other month) frequency. Water level measurements made by other entities would also be obtained and used in the impact analysis.

Two major groundwater and surface water quality sampling events will occur in June and October. Monthly surface water sampling will occur at selected locations. These samples will be analyzed for irrigation water suitability which includes TDS, EC, pH, major cations (calcium, magnesium, potassium, and sodium), major anions (carbonate, bicarbonate, sulfate, chloride, nitrate, and fluoride), and other constituents (boron, copper, iron, manganese, and zinc). The sodium adsorption ratio (SAR) is also calculated for these samples. Selenium, arsenic, and molybdenum have been added to this list beginning in May 2001. Data from the 6 existing continuous EC recorders will also be used in the analysis. At least two additional EC recorders are planned to be installed in 2001.

Compaction and water levels will continue to be monitored continuously at the Fordel and Yearout extensometers.

Sediment sampling will be conducted in October 2001 and in the spring of 2002 at eight locations throughout the Pool. Subsequently, sediment sampling will be conducted in the fall of each year. Each sample will be analyzed for the following parameters: selenium, arsenic, boron, molybdenum, clay percentage, cation exchange capacity, EC, total organic carbon, and pH. Concentrations will be expressed on a sediment dry weight basis.

Table 4-1. Relevant Water Quality Screening Benchmarks for Selected Constituents or Parameters

Parameter	Value	Reference	Notes
Irrigation Water Quality Guidelines			
Arsenic	50 µg/L	DWR, 1994	Article 19 Water Quality Objective - maximum
Boron	0.6 mg/L	DWR, 1994	Article 19 Water Quality Objective - monthly average
Selenium	50 µg/L	DWR, 1994	Article 19 Water Quality Objective - maximum
Total Dissolved Solids	440 mg/L	DWR, 1994	Article 19 Water Quality Objective - monthly average
Drinking Water Protection Criteria			
Arsenic	50 µg/L	Marshack, 2000	Primary MCL
Boron	0.630 mg/L	Marshack, 2000	U.S. EPA IRIS reference dose
Selenium	50 µg/L	Marshack, 2000	Primary MCL
Total Dissolved Solids	500 mg/L	Marshack, 2000	Secondary MCL
Refuge Water Supply Objectives			
Arsenic	10 µg/L	CVPIA	Preliminary Draft Water Quality Objectives (11/14/1995) (Title 34, P.L. 102-575, Section 3406(d)
Boron	2.6 mg/L	CVPIA	Preliminary Draft Water Quality Objectives (11/14/1995) (Title 34, P.L. 102-575, Section 3406(d)
Molybdenum	19 µg/L	CVPIA	Preliminary Draft Water Quality Objectives (11/14/1995) (Title 34, P.L. 102-575, Section 3406(d)
Selenium	2 µg/L	CVPIA	Preliminary Draft Water Quality Objectives (11/14/1995) (Title 34, P.L. 102-575, Section 3406(d)
Aquatic Life Protection Criteria (Sacramento River and San Joaquin River Basin Plan)			
Arsenic	10 µg/L	CVRWQCB, 1998	Dissolved concentration
Boron	0.8 mg/L	CVRWQCB, 1998	Total concentration; Monthly mean, non-critical year
Selenium	2 µg/L	CVRWQCB, 1998	Total concentration; Monthly mean; same as USFWS guideline

Table 4-2. Deviations of Average Daily EC Measurements (μmhos/cm) at Canal Intakes from Concurrent Measurements at Check 21 on the DMC during 2000.

	CCID Main Canal	CCID Outside Canal	Columbia Canal	Firebaugh Canal	SLCC Arroyo Canal
Outside of MPG Pumping Period					
Average	-61.7	25.0	48.3	-38.2	25.0
Minimum	-421	-43	-242	-383	-65
Maximum	130	91	206	140	111
During MPG Pumping Period					
Average	14.6	27.3	-38.8	9.1	19.9
Minimum	-23	-47	-352	-130	-182
Maximum	38	127	65	122	109

Note:

A negative value indicates that the water entering the canal has a lower EC than the water in the DMC.

Table 4-3. Predicted Increase in Selenium Concentration in Fresno Slough Branch of Mendota Pool due to MPG Transfer Pumping in 2001

Month	Inflow from: North[1] (ac-ft)	Inflow from: MPG Wells[2] (ac-ft)	Ambient Selenium: Concentration[3] (□g/L)	Ambient Selenium: Load (kg)	Selenium Load from MPG Wells (kg): Shallow Wells	Selenium Load from MPG Wells (kg): Deep Wells	Selenium Load from MPG Wells (kg): Total	Se Concentration Increment (□g/L)	Total Se Concentration[4] (□g/L)
January	11,453	0	2.3	32.5	0.0	0.0	0.0	0.0	2.3
February	12,975	0	2.2	35.2	0.0	0.0	0.0	0.0	2.2
March	13,416	0	2.3	38.1	0.0	0.0	0.0	0.0	2.3
April	9,568	0	2.3	27.1	0.0	0.0	0.0	0.0	2.3
May	14,294	3,597	1.3	22.0	5.6	2.3	7.9	0.1	1.4
June	26,972	3,212	1.1	36.6	5.7	1.1	6.8	0.1	1.2
July	20,557	3,040	0.9	22.8	6.2	0.0	6.2	0.1	1.0
August	16,282	3,040	0.2	4.0	6.2	0.0	6.2	0.2	0.4
September	14,431	3,111	0.9	16.0	5.7	0.8	6.5	0.1	1.0
October	7,721	3,390	0.8	7.6	5.6	1.6	7.2	0.3	1.1
November	8,842	2,296	1.2	13.1	3.8	1.1	4.9	0.1	1.3
December	0	0	-	-	-	-	-	-	-
Total	**156,511**	**21,687**		**255.1**	**39.0**	**6.8**	**45.8**		
Mean			**1.4**						**1.5**

[1] Net flow across transect A-A', i.e. to the south, based on the water budget for the northern portion of the Pool.
[2] Inflow from MPG wells along the Fresno Slough.
[3] Measured at Check 21 on the DMC during the corresponding months in 2000 (Bureau of Reclamation, unpubl. data).
[4] Calculated as the quotient of the combined monthly selenium load and total water inflow.

Table 4-4. Predicted Increase in Total Dissolved Solids (TDS) in Fresno Slough Branch of Mendota Pool due to MPG Transfer Pumping in 2001

Month	Inflow from: North[1] (ac-ft)	Inflow from: MPG Wells[2] (ac-ft)	Ambient TDS: Concentration[3] (mg/L)	Ambient TDS: Load (tons)	TDS Load from MPG Wells (tons)[4]: Shallow Wells	TDS Load from MPG Wells (tons)[4]: Deep Wells	TDS Load from MPG Wells (tons)[4]: Total	TDS Increment (mg/L)	Total TDS[5] (mg/L)
January	11,453	0	396.0	5,594	0	0	0	0	396
February	12,975	0	372.0	5,954	0	0	0	0	372
March	13,416	0	322.0	5,329	0	0	0	0	322
April	9,568	0	286.0	3,375	0	0	0	0	286
May	14,294	3,597	300.0	5,289	3,515	1,180	4,695	152	452
June	26,972	3,212	259.0	8,617	3,591	571	4,161	84	343
July	20,557	3,040	216.0	5,477	3,905	0	3,905	106	322
August	16,282	3,040	218.0	4,378	3,905	0	3,905	130	348
September	14,431	3,111	246.0	4,379	3,591	335	3,926	138	384
October	7,721	3,390	320.0	3,048	3,515	693	4,208	209	529
November	8,842	2,296	344.0	3,752	2,381	469	2,851	137	481
December	0	0	-	-	-	-	-	-	-
Total	**156,511**	**21,687**		**55,192**	**24,404**	**3,248**	**27,651**		
Mean			**298**						**385**

[1] Net flow across transect A-A', i.e. to the south, based on the water budget for the northern portion of the Pool.
[2] Inflow from MPG wells along the Fresno Slough.
[3] Mean TDS (converted from EC measurements) at DMC-Check 21 in 2000 (Bureau of Reclamation, unpubl. data).
[4] Based on July 2000 measurements of EC at the MPG introduction points (converted to TDS).
[5] Calculated as the quotient of the combined monthly TDS load and total water inflow.

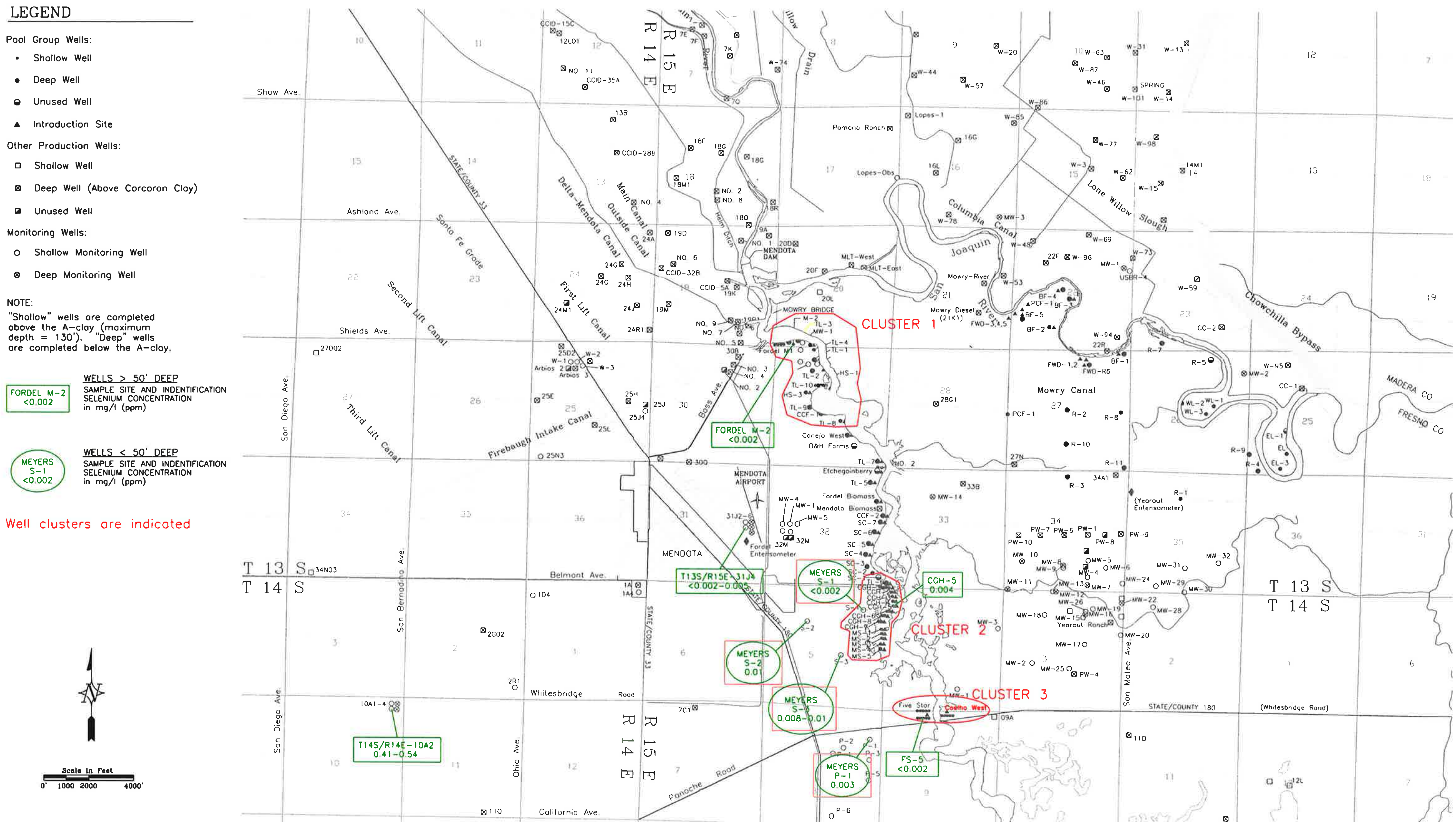

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Figure 4-1
Selenium Concentrations in Water From Shallow Wells (1999)

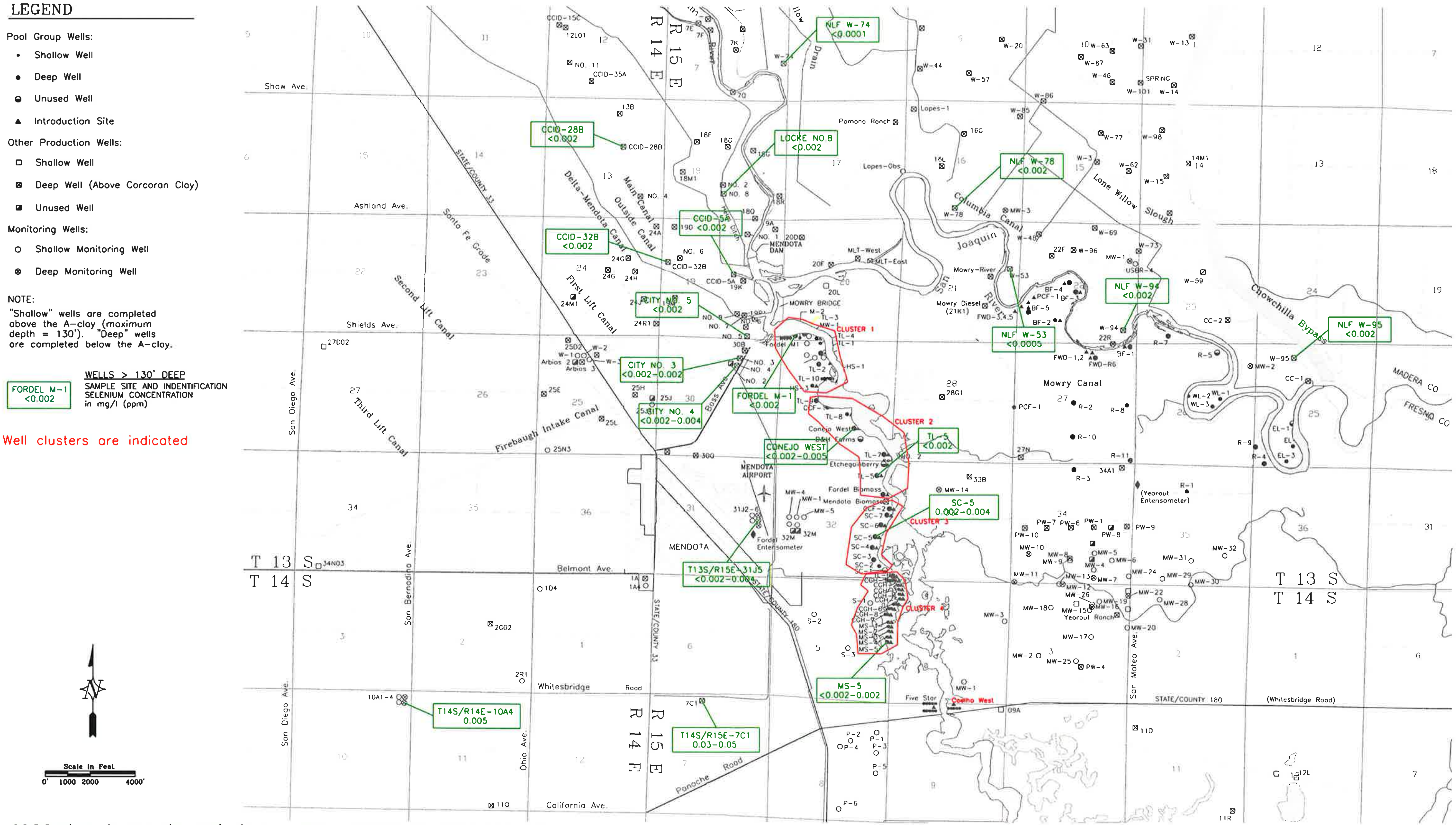

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Figure 4-2
Selenium Concentrations in Water From Deep Wells (1999)

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