Department of Water Resources
Testimony for SWRCB Hearing on Cease and Desist Order

Report on San Joaquin Drainage Programs [1]

Introduction

This report, prepared by the Department of Water Resources (DWR), summarizes the many programs and extensive funding that it has engaged in to order to reduce the volume and concentration of saline discharges to the San Joaquin River. This information demonstrates the actions that DWR, the United States Bureau of Reclamation (USBR) and others have taken to help achieve water quality standards in the Delta, and DWR believes that this information is relevant to the issue under consideration in this hearing. The State Water Resources Control Board (SWRCB) should consider this information when determining if DWR and Reclamation have taken actions within their control to meet the Delta standards.

In D-1641, the SWRCB allocates responsibility for the Vernalis flow and salinity requirements to USBR because it is one of the largest diverters of water from the San Joaquin River (SJR) and because the Central Valley Project (CVP) exports Delta water to farmers on the west side of the San Joaquin Valley. The reduction in San Joaquin River flows from tributaries streams in combination with discharges of saline surface and subsurface drainage water results in increases of salt loads in the river at Vernalis. Although DWR is not responsible for meeting Vernalis standards established by the State Water Resources Control Board (SWRCB), it has been given responsibility for meeting salinity standards at the Brandt Bridge and Delta stations. Improvements in San Joaquin River water quality will help achieve water quality at these locations.

Many agencies with interests in the Delta recognize the value of improving SJR water quality. The CALFED Bay-Delta Program includes actions to address drainage problems in the San Joaquin Valley to improve downstream water quality (CALFED ROD, August 28, 2000, p.66-67). In December 1991, the USBR , U.S. Fish and Wildlife Service (FWS), U.S. Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS), the California Department of Fish and Game (DFG), California Department of Food and Agriculture (DFA), the SWRCB and DWR signed a Memorandum of Understanding (MOU) to implement a management plan for agricultural subsurface drainage on the westside San Joaquin Valley (SWRCB 1995 WQCP, p. 30). Many actions have been funded subsequent to the MOU. These actions are described in the attached DWR report.

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[1] Prepared by Jose Faria, Supervising Engineer, DWR San Joaquin District.

Central Valley Regional Water Quality Control Board (CVRWQCB) data demonstrate that the USBR has complied with established salinity objectives, with some exceptions (Figure 1). The majority of noncompliance occurred during the drought years from 1987 through 1992. Figure 1 and 2 shows that hydrological conditions have a direct effect on the water quality of the river; however, water quality objectives apply regardless of hydrological conditions. Since 1995, conditions have improved partly due to improved hydrologic conditions and because of additional measures taken by DWR and USBR..

It is important to note historical hydrologic conditions for the SJR near Vernalis. Figure 1 data from the Central Valley Regional Water Quality Control Board (CVRWQCB) graphs the 30-day running average electrical conductivity respectively for the SJR near Vernalis while Figure 2 illustrates the annual average flow and the10-year average annual flow for the same location. Figure 1 also demonstrates that, in general, the USBR has been in compliance with salinity objectives since 1995, with the exception of the drought years 1987 to 1992. Figures 1 and 2 clearly indicate that hydrological conditions directly affect the water quality and flow regime of the river; however, water quality objectives apply regardless of hydrological conditions. Since 1995, conditions have improved partly due to improved hydrologic conditions and also because of additional measures taken by DWR, USBR, and many collaborating agencies. These measures include: 1) Providing fresh water to dilute saline discharges and to increase flows upstream of Vernalis from New Melones reservoir (Table 1) and through the Vernalis Adaptive Management Program (VAMP) agreement (Table 2) and 2) Controlling discharge of saline water into the SJR upstream of Vernalis.

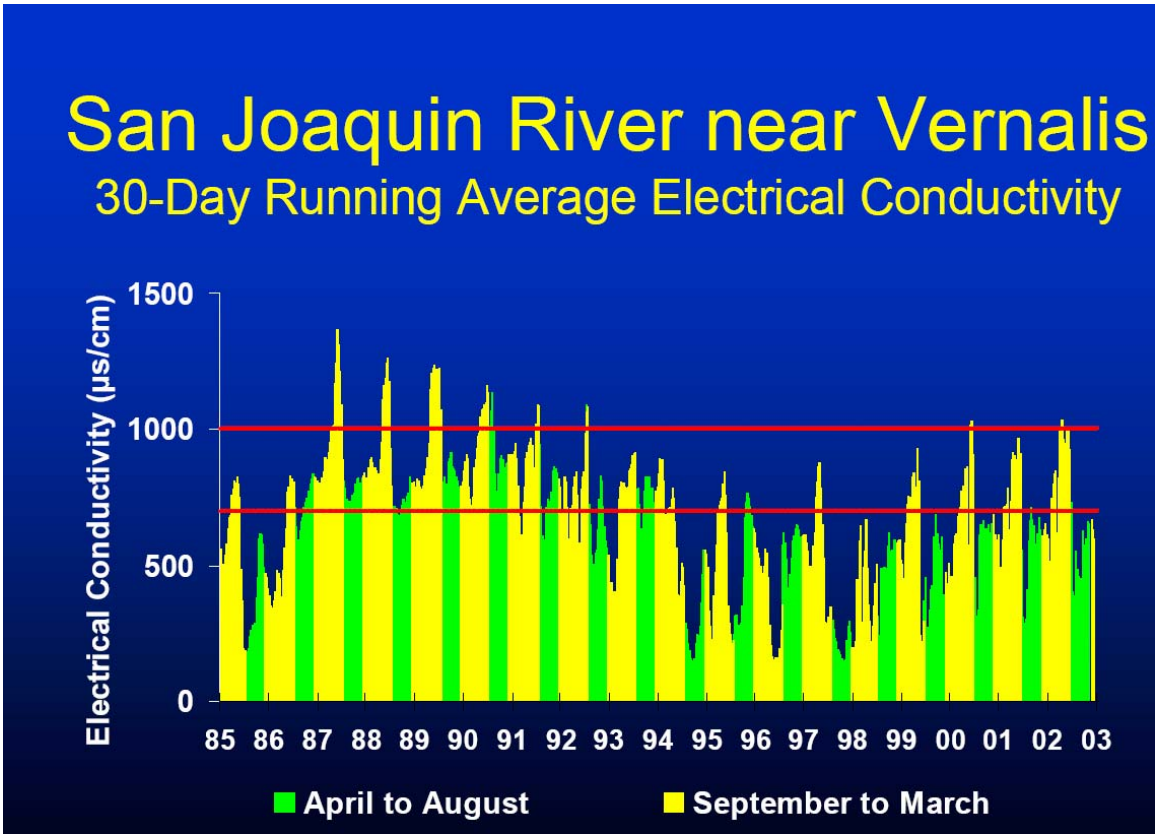

Figure 1. San Joaquin River at Vernalis, Electrical Conductivity
Source: Central Valley Regional Water Quality Control Board

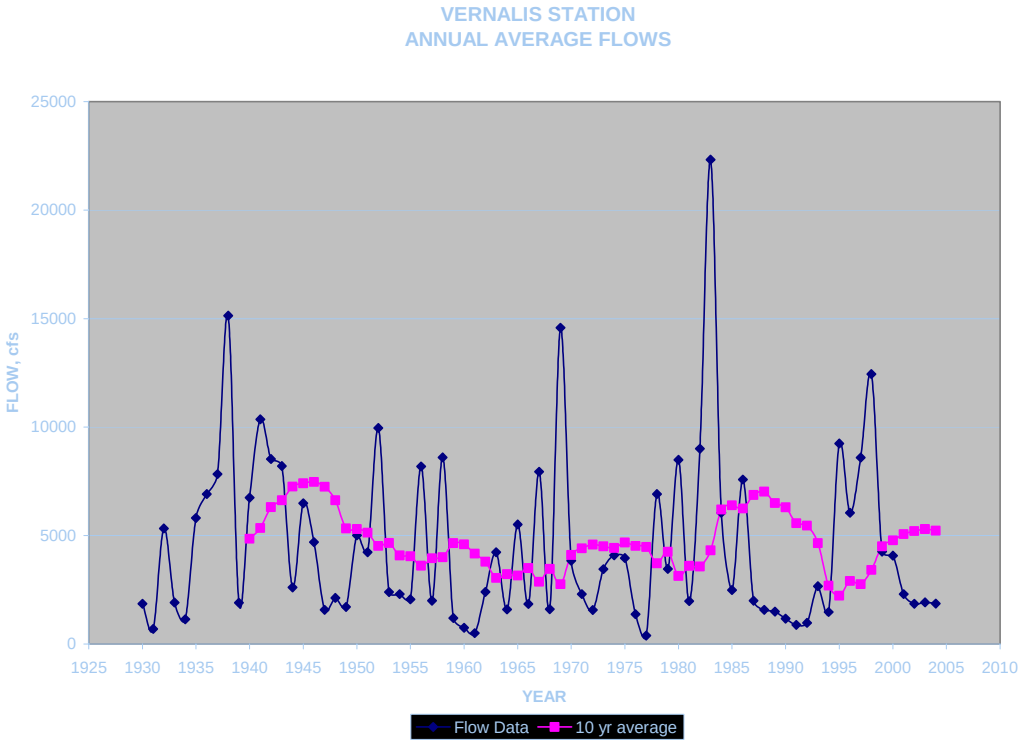

Figure 2 San Joaquin River Average Annual Flows at Vernalis

Table 1
New Melones Reservoir – 1991-2003
Average Monthly Flow Releases to Meet Salinity and Flow Objectives at Vernalis

WQ Release	AF/Month
January	1,894
February	30,675
March	97,758
April	109,971
May	39,904
June	128,782
July	143,753
August	71,077
September	33,304
October	2,255
November	0
December	0
TOTAL	659,373 AF
Average monthly release	50,721 AF

Table 2
Vernalis Adaptive Management Plan 2000-2004

Year	VAMP Pulse Period	Target Vernalis/Export Flows	Observed Vernalis/Export Flows	VAMP Supplemental Water
		(cfs)	(cfs)	(acre-feet)
2000	4/15-5/15	5,700/2,250	5,869/2,155	77,680
2001	4/20-5/20	4,450/1,500	4,224/1,420	78,650
2002	4/15-5/15	3,200/1,500	3,301/1,430	33,430
2003	4/15-5/15	3,200/1,500	3,235/1,446	58,065
2004	4/15-5/15	3,200/1,500	3,155/1,331	65,591

Source: San Joaquin River Agreement-VAMP technical report

Measures to provide fresh water for dilution of saline flows above Vernalis

New Melones Reservoir releases plus the VAMP flow contributions have averaged 722,000 acre-feet per year. The San Joaquin River Agreement commits DWR to help fund water purchases to meet flow requirements on the SJR for VAMP. The USBR and DWR agreed to spend up to $3 million and $1 million, respectively, per year to purchase VAMP water. Figure 3 describes in part the beneficial effect of New Melones and VAMP flow releases at Vernalis when compared with other upstream SJR stations.

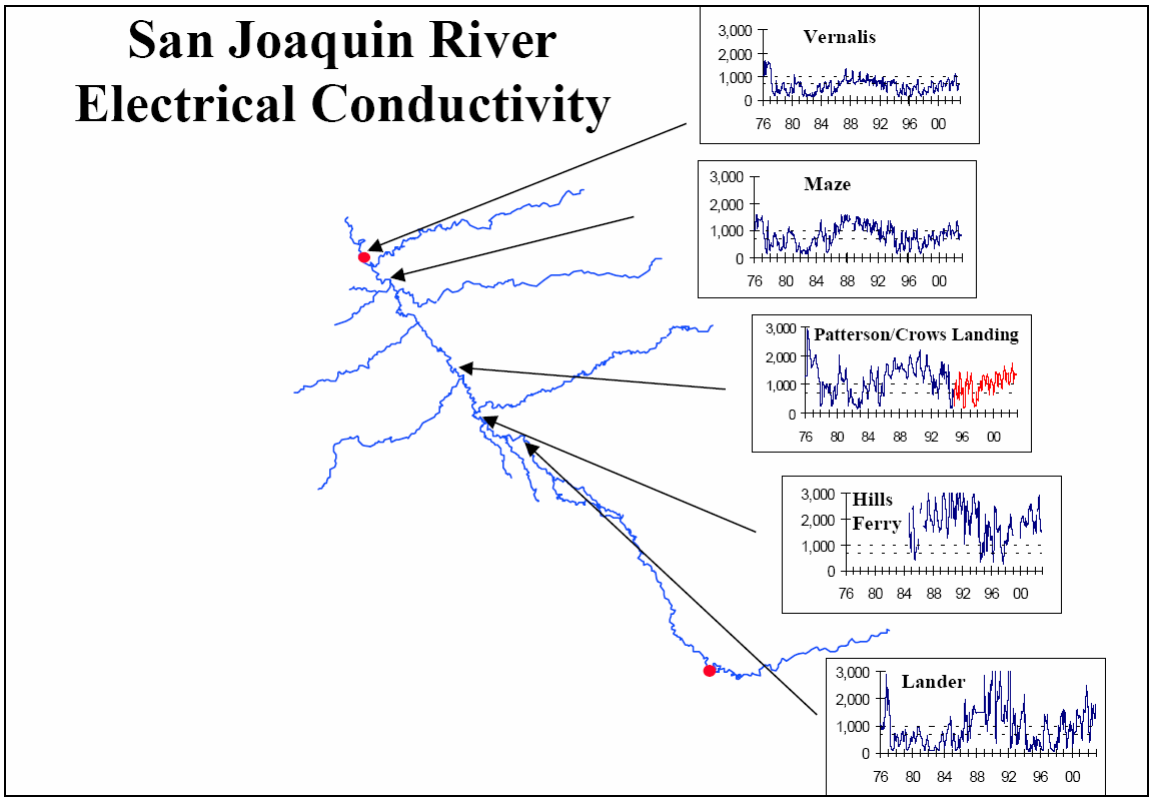

Figure 3. San Joaquin River Electrical Conductivity at Vernalis and Other Stations Source: Central Valley Regional Water Quality Control Board

Measures to control salinity in the San Joaquin River upstream of Vernalis

In D1641, the SWRCB recognizes that regional management of drainage water is the preferred method to meet the SJR objectives (page 84). Department of Water Resources, USBR, the CVRWQCB as well as many local, public and private agencies have made tremendous efforts to achieve salinity objectives in this area. A significant amount of public and private money has been, and continues to be invested in salinity reduction efforts for the SJR. In order to

better understand the salinity reduction measures taken, it is important to describe the sources of the salt load that averages one million tons per year in the SJR at Vernalis. In an average year, CVP water supplies carry more than 800,000 tons of salt into the northern portion of the San Joaquin Valley. Most of this salt load originates from the Delta and approximately 350,000 tons of this salt load are ultimately recycled back to the Delta through agricultural surface and subsurface returns and wetland discharges (Water Facts: Salt Balance in the San Joaquin Valley, Jan 2001). Tables 3 and 4 contain CVRWQCB information describing the sources of salt and the corresponding loads, while Figure 4 defines the Lower San Joaquin River (LSJR) areas that contribute salts.

Table 3
San Joaquin River at Vernalis

Approximate Sources of Salt	**Load**
Sierra Nevada Tributaries	18%
Groundwater	28%
Agricultural Surface Returns	26%
Agricultural Subsurface Returns	17%
Managed Wetlands	9%
Municipal and Industrial	2%

Table 4
San Joaquin River at Vernalis

Approximate Sources of Salt	**Area of Contribution**
I SJR Upstream Salt Slough	9%
II Merced	
III Tuolumne	
IV Stanislaus	
Total SJR Tributaries Streams:	19%
V East Valley Floor	5%
VI Northwest Side	30%
VII Grasslands	37%

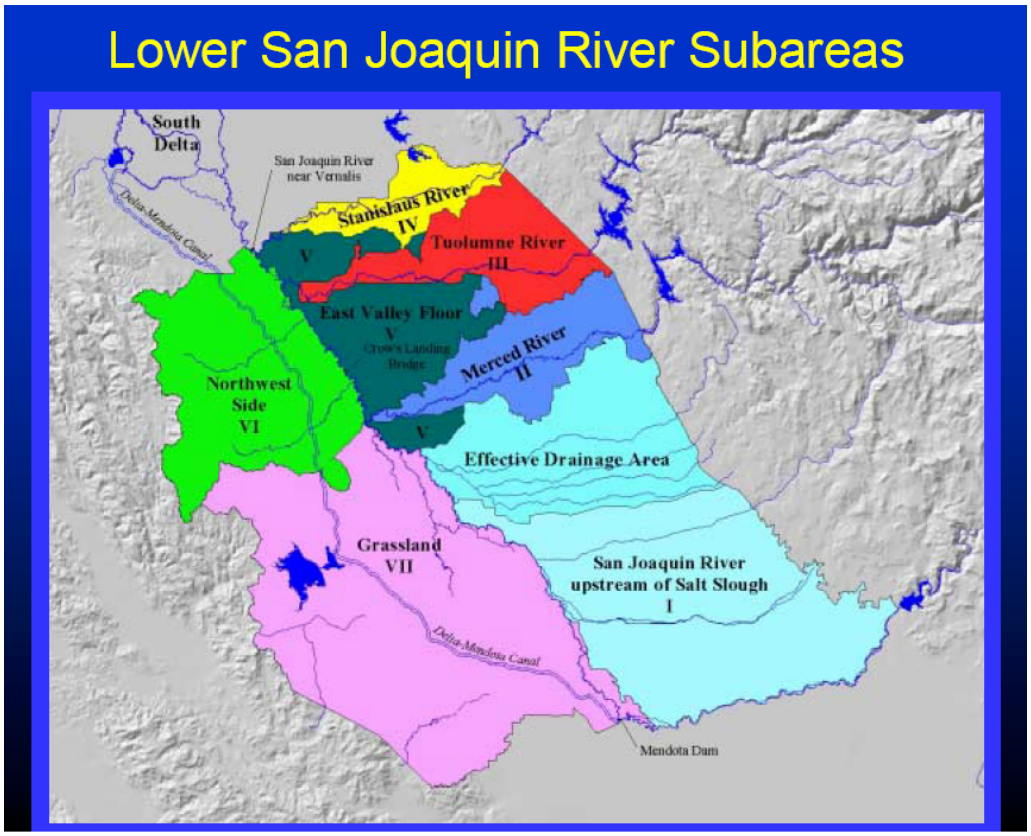

Figure 4. Salt Source Contribution Areas of the Lower San Joaquin River

Measures to control salinity upstream of Vernalis include: (1) On-farm management activities to reduce subsurface drainage, (2) Real-time management to maximize the assimilative capacity of the SJR, and (3) Ongoing efforts to improve wetlands discharges.

On-Farm Drainage Management Activities

Drainage management activities have been effective in reducing the salt load in the San Joaquin River. These source control measures include: Irrigation Water Conservation such as use of improved irrigation systems; Tiered Water Pricing, based on increased water cost for increased water use; Agricultural tailwater and tilewater control and recycling; and Agricultural subsurface drainage water use through the San Joaquin River Improvement Project. A good example of the effectiveness of these measures has been demonstrated by the efforts of the Grasslands Area farmers as a part of the Grasslands Bypass Project (GBP). Figures 5 and 6 shows the reductions achieved in volume of discharge and salt loads. Since the implementation of the GBP, discharge flows have decreased from 58,000 AF to about 30,000 AF and salt loads have been reduced from 210,000 tons to 117,000 tons. Funding sources and expenditures for implementation of the components of the GBP are shown in Table 5.Many components of the Grasslands Bypass Project, including the San Joaquin River Improvement Project, are also a part of the Westside Regional Drainage Plan.

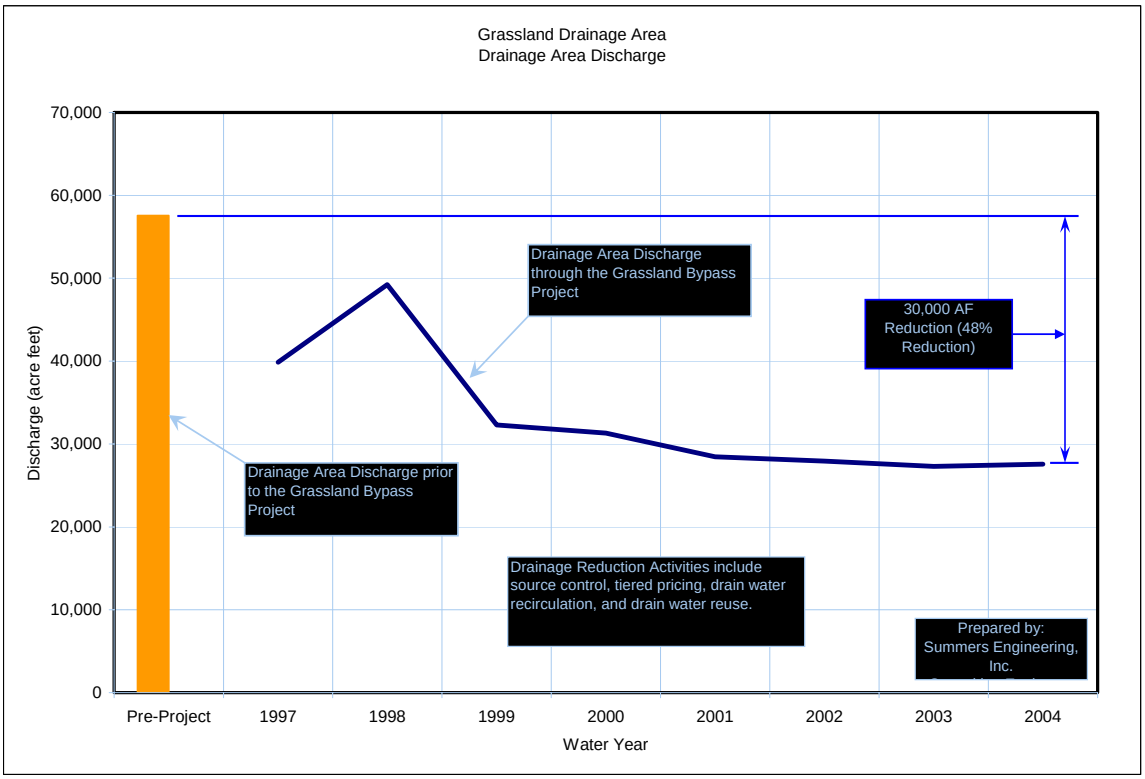

Figure 5. Grasslands Drainage Area, Drainage Discharges

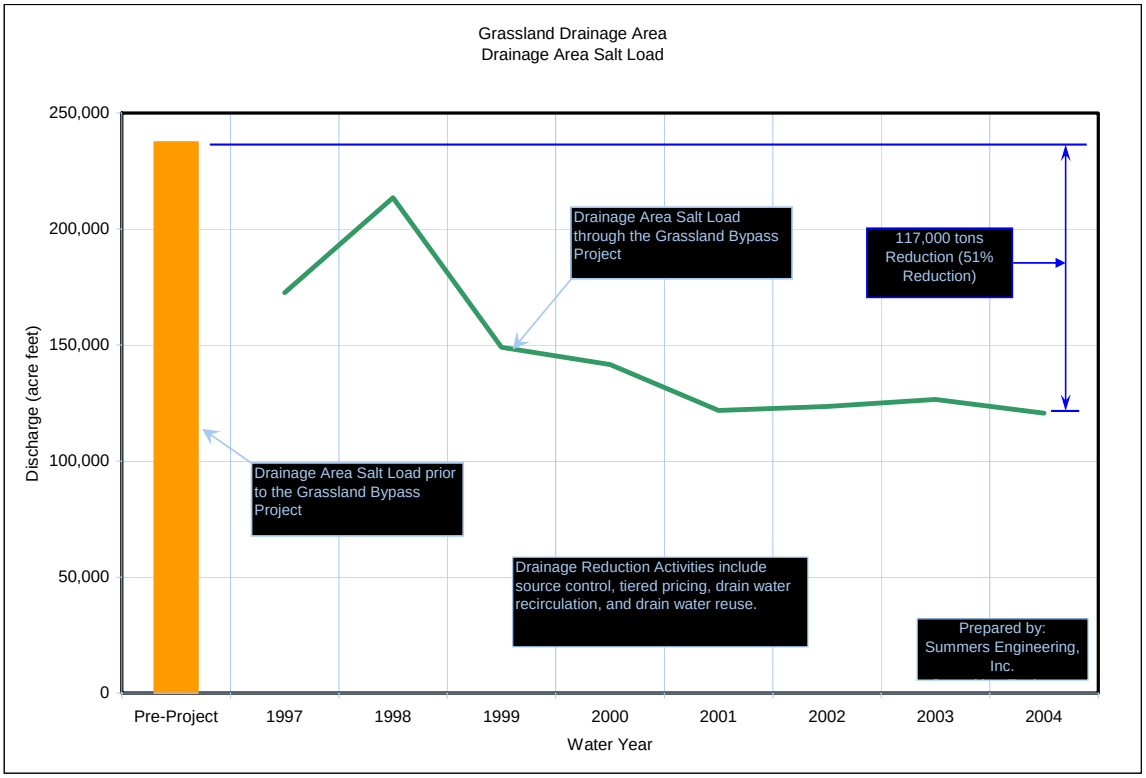

Figure 6. Grasslands Drainage Area, Drainage Salt Load

Table 5
Grassland Drainage Area
Previous Funding for the In-Valley Drainage Solution

Project	Funding Source	Grant Funding	Loan Funding	District Funding	Total
Grassland Bypass Construction	SWRCB State Revolving Fund		$ 600,000		$ 600,000
Charleston D.D. Recirculation System	SWRCB State Revolving Fund		$ 320,000		$ 320,000
Charleston D.D. Recirculation System : CH-3	Charleston D.D.			$ 71,200	$ 71,200
Firebaugh Canal W.D. Recirculation Systems	Firebaugh Canal W.D.			$ 271,100	$ 271,100
Pacheco W.D. Drainwater Recirculation System	SWRCB State Revolving Fund		$ 1,375,000		$ 1,375,000
Panoche W.D. Drainwater Recirculation System	SWRCB State Revolving Fund		$ 4,228,000		$ 4,228,000
Pacheco W.D. Acquisition of Improved Irrigation Eq.	SWRCB State Revolving Fund		$ 737,500		$ 737,500
Panoche D.D. Acquisition of Improved Irrigation Eq.	SWRCB State Revolving Fund		$ 4,997,294		$ 4,997,294
Panoche D.D. Road Watering Project	Panoche D.D.			$ 12,000	$ 12,000
San Joaquin River Improvement Project (SJRIP)					
Land Purchase & Initial Development	Prop 13 (Directed Action)	$ 17,500,000			$ 17,500,000
2004-05 Development Project	USBR	$ 904,100		$ 95,900	$ 1,000,000
Halophyte Development Project	USBR	$ 290,000		$ 15,000	$ 305,000
Grassland Integrated Drainage Management Proj.	Prop 13	$ 987,200		$ 246,800	$ 1,234,000
PE-5 Pump Station	Panoche D.D.			$ 13,200	$ 13,200
Algal-Bacterial Selenium Reduction Proj. (ABSR)	USBR/DWR/CalFed	$ 3,352,000		$ 225,000	$ 3,577,000
USBR: RO Pilot Plant		$ 440,000		$170,000	$ 610,000
	Subtotal	**$ 23,473,300**	**$ 12,257,794**	**$ 1,120,200**	**$ 36,851,294**
March 2005 Update:					
Panoche D.D. SJRIP Reuse Development Project	SWRCB - Prop 50	$ 389,500		94,800	$ 484,300
SJRIP Reuse Expansion Project	USBR	$ 890,000			$ 890,000
Panoche W.D. Ag Drainage Loan Project - Irri. Impr.	SWRCB		$ 1,800,000		$ 1,800,000
	Subtotal	**$ 24,752,800**	**$ 14,057,794**	**$ 1,215,000**	**$ 40,025,594**

Source Summers Enginnering

Even though the San Joaquin Valley Drainage Implementation Program (SJVDIP) has been idled since 2003, DWR continues to implement many of its recommendations. In addition to source control, DWR through its Agricultural Drainage and other programs implements recommendations of the SJVDIP by maintaining research and demonstration projects to develop drainage reuse technologies, drainage treatment and disposal technologies, and salt separation and utilization. Table 6 summarizes grants directly and indirectly related to salinity control and drainage water toxic elements reduction in the San Joaquin Valley. More than 72 million dollars in grants have been distributed by DWR through Project Funds and bond money from Propositions 13, 50, and 204 (drainage sub-account).

Additional efforts proposed to control saline water discharges into the San Joaquin River include the West Side Regional Plan, USBR's San Luis Drainage Feature Reevaluation to provide drainage service to the San Luis Unit of the Central Valley Project and the Integrated On-Farm Drainage Management Program that DWR and collaborating agencies maintain. In addition, the San Joaquin River Management Group, of which DWR is a member, recently completed its report recommendations controlling salinity in the San Joaquin River. Recommendations include:

1. Fully implementing the West Side Regional Drainage Plan.
2. Further evaluating and pursuing managed wetland drainage management action to mitigate impacts of February through April drainage releases.
3. Developing a real-time water quality management coordination group involving LSJR tributaries, LSJR drainers and DWR to coordinate reservoir release and SWP/CVP Project operations (head of Old River barrier and New Melones operations) to realize opportunities to improve water quality and increase the utility of stored water releases.

TABLE 6
DWR Grants

2001	Westside RCD	Prop. 13	Total Utilization of Drainage & Minimization of Evaporation	$111,280
2001	USDA/Ag. Research Serv.	Prop. 13	Salt-Tolerant Crops Evaluation	$69,600
2001	San Joaquin Valley Drainage Auth	Prop. 13	SW Stanislaus Co. Regional Drainage Water Mgt.	$616,200
2001	Stanislaus RCD, West	Prop. 13	Irrigation Mgmt. & Dormant Spray Reduction	$160,523
2001	WaterTech	Prop. 13	Irrigation Scheduling	$200,000
2001	Columbia Canal Co.	Prop. 13	On-farm Irrigation System Improvements	$152,823
2001	Panoche Water District	Prop 13	Grassland Integrated Drainage Management Proj.	$987,200
2002	Panoche Water District	Prop. 13	Herndon Avenue Lateral Feasibility Study. Modernization Feasibility	$54,545
2002	Banta Carbona Irrigation District	Prop. 13	Banta-Carbona Irrigation District Modernization Feasibility Study	$99,204
2002	Westlands Water District	Prop. 13	Water Measurement Enhancement Project	$82,500
2004	Patterson Irrigation District	Prop. 50	Agricutural Water Reuse Best Management Practices to	$1,053,000
2004	California State University - Fresn	Prop. 50	Improve District-Level Irrigation Efficiency	$1,027,779
2004	Modesto Irrigation District	Prop. 50	Ditch pipeline to Improve Water Quality	$500,000
2004	Oakdale Irrigation District	Prop. 50	Irrigation District Tailwater Recovery Program	$731,500
2004	USDA	Prop. 50	Improved Water Use Efficiency for Vegetables grown in the SJV	$248,000
2004	San Joaquin County RCD	Prop. 50	Expanded Mobile Irrigation Lab and Irrigation Workshops	$60,000
2005	San Joaquin RIver Exchange Con	Prop. 50	Upper San Joaquin River Conceptual Restoration Plan - Integrated Regional Water Management Plan	$499,952
2000	Vernalis Adaptive Managenemt Plan		Purchase water for pulse flows to meet SWRCB standards	$5,000,000
2000	Friant Water Users Authority and	Prop. 13 C	San Joaquin River Restoration Program	$15,700,000
2000	Panoche Drainage District	Prop. 13 C	San Joaquin River Water Quality Improvement Project	$17,500,000
2000	Environmental Water Account	Prop. 13 C	Water Transfers	$6,250,000
2000	San Luis & Delta Mendota WA *	Prop. 13 C	Water Transfer	$6,250,000
2000	Westlands Water District	Prop. 13 C	Irrigation Systems Improvement Project: On farm irrigation improve	$5,000,000
2000	San Luis Water District	Prop. 13 C	Relift Canal Lining Project	$1,000,000
2000	Del Puerto Water District	Prop. 13 C	Irrigation Systems Improvement Project: On farm irrigation improve	$500,000
2000	UC Riverside	Prop. 204 (	IFDM Present Status and Further Research	$51,303
2000	DWR	Prop. 204 (	Red Rock Ranch IFDM Monitoring	$317,000
2000	UC Davis	Prop. 204 (	Producing Forage Crops Using Drainage	$45,990
2000	Westside Resources Conservatio	Prop. 204 (	Various IFDM Start-Up Proposals	$267,797
2000	SJV Drainage Authority	Prop. 204 (	Planning and Design for Grasslands Drainage Reuse	$150,000
2000	DWR	Prop. 204 (	Conceptual Planning and Design for Grasslands Drainage Reuse	$60,000
2000	DWR-USFWS	Prop. 204 (	Development of IFDM Wildlife Management Criteria	$75,000
2000	DWR	Prop. 204 (	Monitoring Wildlife Impacts at IFDM Demonstration Projects	$105,000
2000	Buena Vista Water Storage Distric	Prop. 204 (	Buena Vista Desalination Pilot Demonstration	$100,000
2000	DWR-WRCD	Prop. 204 (	Water and Salt Recovery Through Solar Distillation	$120,000
2000	UC-Davis	Prop. 204 (	Investigate systems of salt separation, utilization, and purification	$60,000
2000	UC-Davis	Prop. 204 (	Salt Utilization in Glass Making	$33,000
2000	DWR	Prop. 204 (	Survey of Location and Acreage of Westside SJV Irrigation Methods	$75,000
2000	DWR	Prop. 204 (	Contracts and Program Management/Fund Administration	$160,000
2000	DWR	Prop. 204 (	Contribution to SJV Drainage Implementation Program (2001 and 20	$44,000
2001	UC Davis	Prop. 204 (	Using Forages and Livestock to Manage Drainage Water in the San	$169,950
2001	USDA	Prop. 204 (	Crop Production with In-situ Use of Shallow Saline Groundwater	$402,600
2001	WRCD	Prop. 204 (	Expanded Demonstration Projects for Integrated On-Farm Drainag	$335,000
2001	UC Berkeley	Prop. 204 (	Grassland Drainage Area Algal-Bacterial Selenium Removal Facility	$125,000
2002	CSU-Fresno	Prop. 204 (	Evaluate cumulative water use (ET) for salt tolerant forages in RRR	$90,030
2002	Westlands Water District	Prop. 204 (	Removal of Selenium from Drainage water in lined reduction channe	$100,000
2002	Tulare Lake Drainage DIstrict	Prop. 204 (	Develop biological design criteria for a wetland located within the T	$120,000
2002	Patterson Water District	Prop. 204 (	Compare and contrast salinity mass balance on Patterson WD and V	$121,000
2002	DWR-UTEP	Prop. 204 (	Feasibility of Salinity Gradient Solar Pond Technology in San Joaquir	$180,000
2002	USDA	Prop. 204 (	Biofuels - Biofuel and Se-enriched forage from Canola	$65,500
2002	UC Davis	Prop. 204 (	Utilizing the saline biomass for energy and producing value-added pr	$175,346
2002	UC Davis	Prop. 204 (	Develop a mass balance on water and Se on TLDD and Lost Hills E	$202,500
2002	DWR	Prop. 204 (	Real Time Water Quality Measurements in the San Joaquin River	$87,226
2002	UC Riverside	Prop. 204 (	A comparative economic analysis of implementing an evaporation p	$36,196
2003	UC Daviis - CSU Fresno	Prop. 204 (	Evaluate yield and animal acceptability of forages grown under irriga	$247,272
2003	UC Davis	Prop. 204 (	Evaluate the efficacy of reducing Se load by intensive harvest of brin	$176,588
2003	UCLA	Prop. 204 (	Evaluate drainage water quality for membrane desalination process	$167,456
		Prop. 204 (	Construct and test ion exchange processes in a pilot on farm ion exc	$93,500
2005	UCLA	Prop. 204 (	Concentration of Mineral Salts from Membrane Desalting of Agricult	$159,116
2005	UC Merced	Prop. 204 (	Wetland drainage management technology development in support	$199,807
2005	UC Davis	Prop. 204 (	Predicting water use, crop growth,and quality of Bermuda grass unde	$175,533
2000	UC Davis	DWR- Proj	Mycrophyte-Mediated Se Bigeochemistry and its role in Bioremediati	$134,200
2000	UC Davis	DWR- Proj	TLDD - Flow trough Wetland Systems for the removal of Se in Irrigat	$60,000
2000	UC Davis	DWR- Proj	In Situ Se. Volatilization and From Measurements at SJV Evaporatio	$14,200
2000	UC Davis	DWR- Proj	Assesing the Efficacy of Macroinvertebrate Harvest and Algal Se Vol	$159,000
2000	UC Davis	DWR- Proj	Recovery of Sodium Sulfate from Drainage Water	$50,000
2000	UC Davis	DWR- Proj	Utilization of Agricultural Drainage Salt in Textile Processing	$50,000
2000	UC Davis	DWR- Proj	Recovery, purification, and utilization of salts from agricultural subsu	$155,616
2001	Broadview Water District	DWR- Proj	Active Land Managemet Program to Reduce Drainage Water	$130,000
2003	USDA	DWR- Proj	Direct ET Determination of Grass and Truckload crops by lysimeter f	$110,000
2003	Buena Vista Water Storage Distric	DWR- Proj	Buena Vista Ag Drainage Desalination Pilot Demonstration	$270,000
2000	UCLA	DWR- Proj	Optimizing processes for desalination of Agricultural Drainage Water	$300,000
			TOTAL	$70,380,832

TABLE 6 (Continuation)

Year Begun	Local Agency	Project Title	Total Cost	Objective
1988	Westlands Water District	Demonstration of Emerging Irrigation	$552,408	Demonstrate the potential of emerging irrigation technologies to reduce the volume of drainage water in the western San Joaquin Valley.
1988	Westlands Water District & Broadview Water District	Demonstration of Improved Furrow Irrigation	$568,000	Demonstrate advanced technologies, innovative concepts to improve on-farm irrigation efficiencies, and irrigation uniformities while maintaining or increasing the yield.
1991	Central California Irrigation District	Grasslands Drainage Basin Water Conservation Coordinator	$64,286	Provide technical expertise, educate water users, improve irrigation management, and decrease subsurface drainage.
1987	Panoche Water & Drainage District	Irrigation Efficiency & Regional Subsurface Drainage Flow on the Westside of the San Joaquin Valley	$171,000	Evaluate whether the discharge of selenium and other toxic trace elements in the drainage water could be reduced by improving on-farm irrigation practices and drainage management.
1990	Panoche Water & Drainage District	Relationship between Contaminant Loads & Drain Flows for Drainage Systems on the Westside of the San Joaquin Valley	$175,000	Evaluate the hydrologic interaction between the load (or mass) of salt, boron, selenium, and molybdenum and the volume of water removed by agricultural drains, taking into consideration different soils and crops.
1988	USGS	Groundwater Quantity & Quality into the San Joaquin River	$140,000	Identify the quality of groundwater flows to the San Joaquin River.
1988	Broadview Water District	Tiered-Block Water Pricing	$175,000	Test the effectiveness of tiered-block water pricing in reducing irrigation water use without reducing crop yield.
1988	Westlands Water District	Agroforestry Systems for Sequential Reuse of Drainage Water	$324,863	Use agroforestry systems to lower a high water table, reuse saline drainage water, and remove salts and trace elements from irrigation land.
1992	Broadview Water District	Shallow Groundwater Management	$175,000	Develop subsurface drainage design and irrigation and drainage management criteria to maximize the use of shallow groundwater during the growing season, while minimizing agricultural drainage pollutant load and impacts on crop yield.
1995	USDA	Growth and Water Relations of Plant Species Suitable for Saline Drainage Water Reuse Systems	$218,800	Determine the crop/water production functions for eucalyptus trees under different salinity and boron treatments, the ion-loading characteristics of a selected eucalyptus genotype and the ion interactions that contribute to foliar injury.
1995	Regents of UC	Selenium Management in Integrated On-Farm Drainage Management Systems through Volatilization	$107,741	Determine the extent which selenium (Se) is removed to the atmosphere through biological volatilization from different components of Integrated On-Farm Drainage Management systems.
N/A	Regents of UC	Boron Accumulation and Toxicity in Integrated On-Farm Drainage Management	$40,000	Determine the long term impacts of soil boron accumulation with Integrated On-Farm Drainage Management systems in the San Joaquin Valley.
N/A	CSU, Fresno	Survey of Linear Move Irrigation Systems in California	$6,000	Conduct a survey of growers using linear move irrigation systems, identify the costs and benefits associated with the systems, and determine if any systems were used to mitigate agricultural drainage problems.
1998	Pond-Shafter-Wasco RCD	Irrigation Workshops and Training Manuals	$31,770	Workshops targeted specific irrigation districts and regions and were designed to assist farm irrigation managers and workers who perform irrigation operations.
1999	CSU, Fresno	Integrated On-Farm Drainage Management Workshops	$80,000	A series of workshops on Integrated On-Farm Drainage Management.
1996	Regents of UC	Advances in Irrigation Symposium	$8,000	Three symposiums on "Advances in Irrigation".

Real-time Water Quality Monitoring Program

The DWR operates and maintains 25 river monitoring stations and shares responsibility with USGS for another three stations along the lower San Joaquin River System. The Real-timeWater Quality Monitoring Program (RTWQMP) provides information on existing water quality conditions and forecasts flow and water quality conditions to SJR managers and stakeholders. The information provided is important for improving management and coordination of reservoir releases, agricultural and wetlands drainage flows, and eastside tributary releases to achieve water quality objectives at the SJR compliance points. DWR currently expends over one million dollars per year to maintain and operate these stations. In the early stages, RTWQMP was funded by USBR and then by CALFED. Currently, DWR has assumed responsibility for funding most of the RTWQMP for the San Joaquin River.

Table 9 provides lists the lower San Joaquin River surface water monitoring stations and includes DWR stations as well as other cooperating agency stations in the RTWQMP.

One important activity of this program is forecasting flow and salinity conditions on the SJR so that decision makers can take advantage of assimilative capacity of the river when available. For this purpose, DWR collects data from the network of stations and inputs it into the San Joaquin River Input-Output Day (SJRIODAY) model. The model forecasts salinity and flow conditions on the River near Vernalis, and other upstream stations on a biweekly basis. DWR publishes the information on its website on a weekly basis. Figure 7 shows an example of the information displayed:

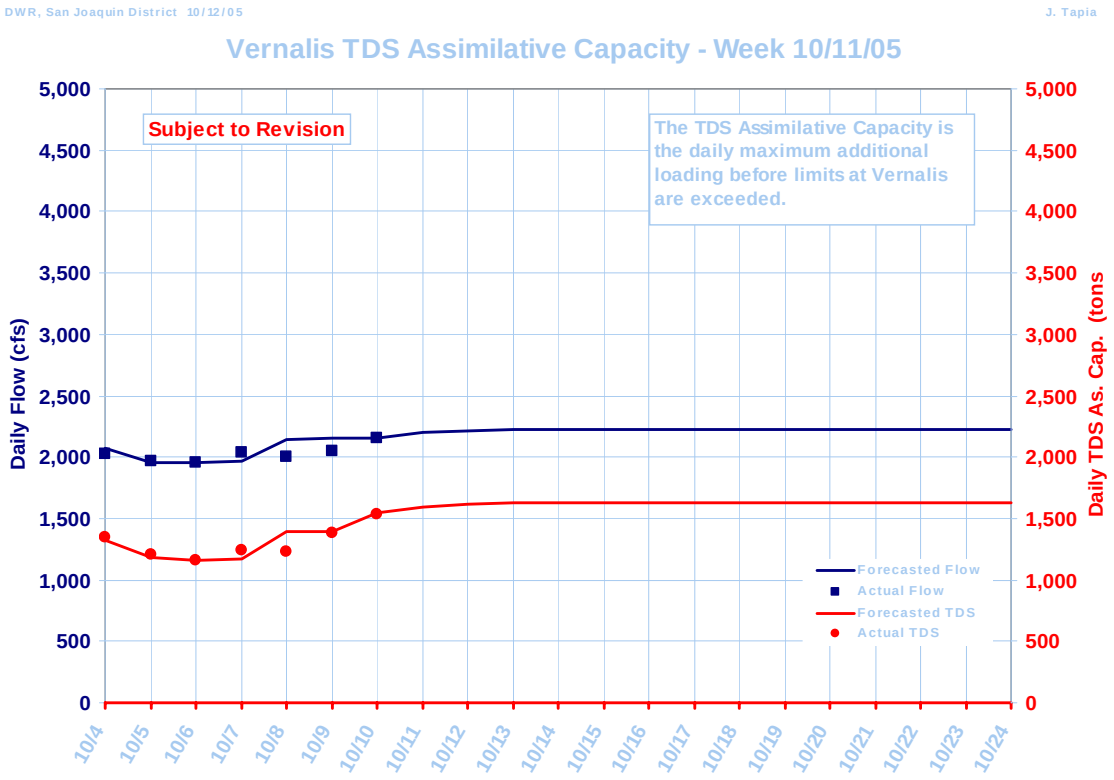

Figure 7. San Joaquin River Input-Output Day Modeling Forecasts

Efforts to Improve Wetlands Discharges

Wetlands discharges contribute about 9% of the total salt load in the San Joaquin River near Vernalis. This contribution is likely to increase as additional water is supplied to the area wildlife refuges (Figure 8). Timing of wetland releases with assimilative capacity of the SJR will result in significant water quality improvements. However, little has been done in this regard due to concerns over disrupting existing, proven wetland management practices.

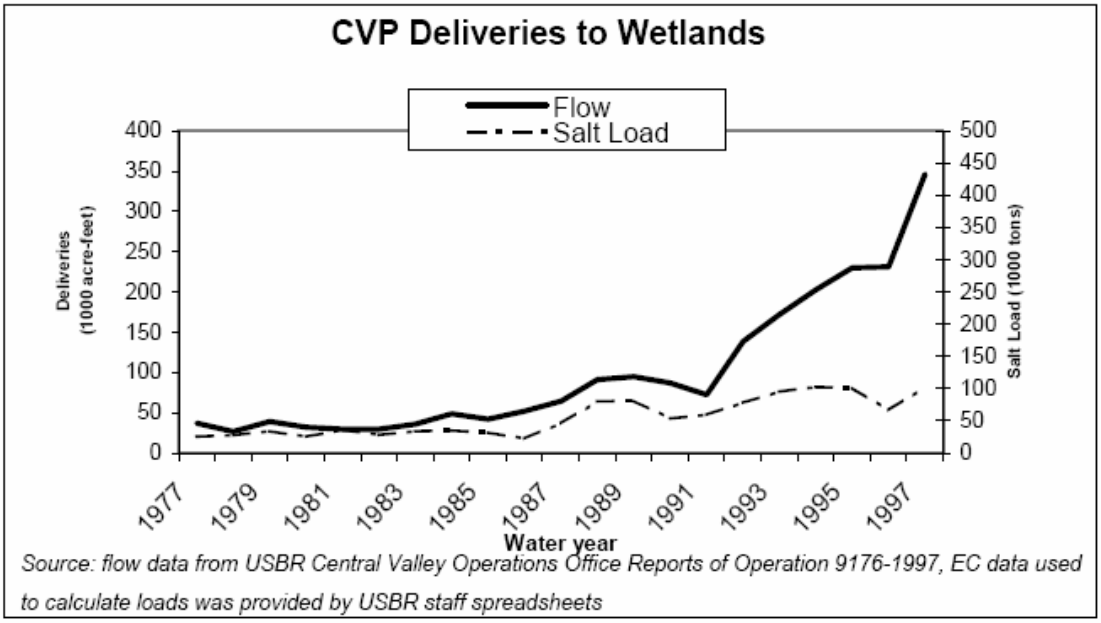

Figure 8. Central Valley Project Wetlands Water Deliveries
Source: Central Valley Regional Water Quality Control Board

Research is needed to determine if improved wetlands management practices can be achieved which will benefit both wildlife and SJR water quality. Current research to improve wetland discharges has focused on real-time water quality monitoring and adaptive management. Research goals are to coordinate timing of wetland discharges when assimilative capacity is available. Various grant funding has been provided, for wetland discharge studies (Table 7).

Table 7
CALFED Grant Funded Projects

Project	Year Funded	Amount	Recipient
Effect of Delayed Wetland Drawdown On Moist Soil Plants	2005	$200,000	California Department of Fish and Game
Adaptive Real-Time Monitoring & Management of Seasonal Wetlands in the San Luis National Wildlife Refuge to Quantify Contaminant Sources & Improve Water Quality in the San Joaquin River	2002	$320,000	Berkeley National Labs
Vernalis Real-Time Water Quality Monitoring Station	2002	$615,000	California Department of

			Water Resources
Adaptive Real-Time Water Quality Management of Seasonal Wetlands in the Grassland Water District.	2000	$671,900	Grassland Water District
San Joaquin River Real-Time Water Quality Management Program	1997	$931,857	California Department of Water Resources, San Joaquin District

In addition to funds provided by CALFED for the study on the *Effect of Delayed Wetland Drawdown on Moist Soil Plants*, staff from DWR and DFG are discussing the possibility of conducting a joint study to assess other aspects of delayed wetland drawdown. It is anticipated that DWR will conduct a study complementing DFG's current wetland drawdown research. DWR, DFG and U.C. Davis staff are working cooperatively on a study plan.

The studies on delayed wetland drawdown will be conducted in coordination with a study funded by DWR under Proposition 204 (drainage sub-account). The study will be conducted as a continuation of the Real-time Water Quality Monitoring Program.

The CVRWQCB also has a grants program supported by funds from Propositions 40, and 50. The CVRWQCB grants applicable to wetland water quality are shown in Table 8.

Table 8
Regional Board Funded Projects

Project	Year Funded	Proposition #	Amount	Recipient
Monitoring Constructed Wetlands to Improve Water Quality of Irrigation Return Flows	2005	40	$500,000	UC Davis
Adaptive, Coordinated Real-Time Management of Wetland Drainage	2005	50	$998,029	Grasslands Water District

Table 9

SAN JOAQUIN RIVER AND RESERVOIR STATION META DATA

								Real-time Monitoring							Bi-annually Analysis						
Station ID	CDEC ID	River Stations	Elev ft	Latitude	Longitude	County	Operator	Telemetered	Stage	Flow	EC	H2O Temp	DO	Chlorophyll	Minerals (lab)	Nutrients (lab)	Minor Elements (lab)	EC (field)	pH (field)	DO (field)	H2O Temp (field)
B00416		Eastside Bypass Below Mariposa Bypass				Merced	DWR		X	X											
B03115		Stanislaus R. At Koetitz Ranch	30	37º 42' 00" N	121º 10' 12" W	Stanislaus	DWR		X	X					X	X	X	X	X	X	X
B05516		Bear Creek Below Eastside Canal	20			Merced	DWR		X	X											
B07040		San Joaquin River At Maze Road Bridge	39	37.642N	121.228W	Stanislaus	DWR		X	X					X	X	X	X	X	X	X
	BDT	San Joaquin River at Brandt Bridge	0	37.8650 N	121.3231 W	San Joaquin	DWR	X	X		X	X									
B07802	CBP	Chowchilla Bypass	170	36.774N	120.285W	Madera	DWR	X	X	X											
B05155	CRS	Merced River At Cressey	165	37.4250N	120.6630W	Merced	DWR	X	X	X	X	X									
B04130	DCM	Dry Creek near Modesto	88	37.657N	120.923W	Stanislaus	DWR	X	X	X					X	X	X	X	X	X	X
	DNB	San Joaquin River at Donny Bridge	239	36.834N	119.966W	Madera	USBR	X	X	X	X	X									
B00435	ELN	Eastside Bypass Near El Nido	100	37.133N	120.567W	Merced	DWR	X	X	X											
B07375	FFB	San Joaquin R @ Fremont Ford Bridge	65	37.310N	120.930W	Merced	USGS	X	X	X	X				X	X	X	X	X	X	X
	GRF	San Joaquin River At Gravelly Ford	170	36.798N	120.16W	Fresno	DWR	X	X	X	X	X									
	LDC	Little Dry Creek (USBR)	350	36.942N	119.683W	Fresno	USBR	X	X	X											
B04175	LGN	Tuolumne River Below La Grange Dam	170	37.6660N	120.4410W	Stanislaus	USGS	X	X	X											
B05525	MCK	Bear Creek At McKee Road	187	37.309N	120.444W	Merced	USACE	X	X	X											
B07710	MEN	San Joaquin River Near Mendota	170	36.783N	120.367W	Fresno	USGS/DWR	X	X	X					X	X	X	X	X	X	X
B05184	MMF	Merced River Below Merced Falls	310	37.522N	120.331W	Merced	Merced Co.	X	X	X											
B04120	MOD	Tuolumne River At Modesto	90	37.6500N	121.0010W	Stanislaus	DWR	X	X	X	X	X									
B95820	MSD	San Joaquin River At Mossdale Bridge	31	37.786N	121.306W	San Joaquin	Co.	X	X		X	X	X	X							
	MSG	Mud Slough Near Gustine	70	37.263N	120.906W	Merced	USGS	X	X	X	X	X									
	MSGCR	Mud Slough At Gun Club Road		37.231N	120.899W	Merced	Grasslands		X	X	X	X									
B05170	MSN	Merced River Near Snelling	260	37.5020N	120.4510W	Merced	DWR	X	X	X											
B05125	MST	Merced River Near Stevinson	82	37.3710N	120.9310W	Fresno	DWR	X	X	X	X	X			X	X	X	X	X	X	X
B07300	NEW	San Joaquin River At Newman	90	37.3500N	120.9770W	Merced	USGS/DWR	X	X	X											
B03175	OBB	Stanislaus River At Orange Blossom Bridge	117	37.7830N	120.7500W	Stanislaus	DWR	X	X	X	X	X									
	OCL	Orestimba Creek Near Crows Landing	65	37.414N	121.015W	Stanislaus	USGS	X	X	X	X	X									
	OH1	Old River at Head	15	37.8080N	121.3290W	San Joaquin	DWR	X	X	X		X									
B87100	ORE	Orestimba Creek Nr Newman		37.316N	121.124W	Stanislaus	USGS	X	X	X											
B03125	RIP	Stanislaus River At Ripon		37.7300N	121.1090W	San Joaquin	USGS	X	X	X											
	RPN	Ripon	35	37.7300N	121.1090W	San Joaquin	USBR	X			X	X	X								
	RR1	Rough and Ready Island	15	37.9630N	121.3650W	San Joaquin	DWR	X	X	X	X	X		X							
B07250	SCL	San Joaquin River At Crows Landing Bridge	60	37.428N	120.003W	Stanislaus	USGS	X	X	X	X	X									
B07798	SJB	San Joaquin River Below Bifurcation	170	36.773N	120.286W	Madera	DWR	X	X	X											
B07885	SJF	San Joaquin River Below Friant	294	36.984N	119.723W	Fresno	USGS	X	X	X	X	X									
	SJL	San Joaquin R Below Old River Nr Lathrop	10	37.810N	121.323W	San Joaquin	DWR	X	X												
B07200	SJP	San Joaquin River At Patterson Bridge	97	37.4940N	121.0810W	Stanislaus	DWR	X	X	X	X	X			X	X	X	X	X	X	X
B07400	SJS	San Joaquin River Near Stevinson	82	37.2950N	120.8510W	Merced	DWR	X	X	X	X	X			X	X	X	X	X	X	X
B03185	SKF	Stanislaus R Bl Goodwin Nr Knights Ferry	253	37.854N	120.637W	Calaveras	USGS	X	X	X											
B03160	SOK	Stanislaus River At Oakdale	120	37.777N	120.852W	Stanislaus	USGS	X				X									
B00470	SSH	Salt Slough Near Stevinson	75	37.248N	120.851W	Merced	USGS	X	X	X	X	X			X	X	X	X	X	X	X
B07020	VER	Vernalis (USBR)	35	37.6670N	121.2670W	San Joaquin	USBR	X			X	X									
	VNS	San Joaquin River At Vernalis	35	37.6670N	121.2670W	San Joaquin	USGS/DWR	X	X	X											
NIGEL'S STATIONS																					
	DEL	Del Puerto Creek		37º 32' 29.3" N	121º 07' 2.0" W	Stanislaus	SJVDA	X	X	X	X	X									
		Grayson Drain																			
	HOS	Hospital Creek		37º 36' 37.7" N	121º 13' 50.8"	Stanislaus	SJVDA	X	X	X	X	X									
	ING	Ingram Creek		37º 36' 0.8" N	121º 13' 30.2"	Stanislaus	SJVDA	X	X	X	X	X									
	MSM	Marshall-Spanish -Moran Drains		37º 26' 10.7" N	121º 02' 10.2"	Stanislaus	SJVDA	X	X	X	X	X									
	NJD	New Jerusalem Drain		37º 43' 36.1"	121º 17' 58.4"	San Joaquin	SJVDA	X	X	X	X	X									
	RAM	Ramona Lake		37º 24' 49.9" N	121º 00' 53.6"	Stanislaus	SJVDA	X	X	X	X	X									
	WES	Westley Wasteway		37º 33' 27.3" N	121º 09' 36.3"	Stanislaus	SJVDA	X	X	X	X	X									
ADDITIONAL STATIONS																					
B00770.00		Delta-Mendota Canal to Mendota Pool	160	36º 47' 12" N	120º 23' 04" W	Fresno					X	X	X		X	X	X	X	X	X	X
B00400.00		Mud Slough at Hwy 140	60	37º 17' 28" N	120º 56' 40" W	Merced					X	X	X		X	X	X	X	X	X	X
B08735.00		Orestimba Creek at Hwy 33	106	37º 22' 42" N	121º 03' 18" W	Stanislaus					X	X	X		X	X	X	X	X	X	X
B07080.00		San Joaquin River at Grayson (of Laird Sl.)	30	37º 33' 48" N	121º 09' 06" W	Stanislaus									X	X	X	X	X	X	X
B04105.00		Tuolumne River at Tuolumne City	40	37º 36' 12" N	121º 07' 00" W	Stanislaus									X	X	X	X	X	X	X

Degradation of water quality on the San Joaquin River between Vernalis and Brandt Bridge

While salinity objectives at Vernalis are met most of time below Vernalis (Figure1), SJR water quality is subject to degradation from wastewater discharges from the cities of Manteca, Lathrop, Tracy, and Mountain House, and by tailwater and subsurface drainage discharges from local agriculture. A DWR analysis indicates that there is approximately an 8% increase in salinity on the SJR between Vernalis and Brandt Bridge. This represents an addition of approximately 80,000 tons of salt between these two stations 26 miles apart.

It is important to note that while the 0.7 mmhos/cm objective in the SJR was developed to protect beneficial agricultural uses in the south Delta, farmers in the

Grasslands Drainage Area representing Panoche, Pacheco, Charleston, and Firebaugh Canal water districts, have implemented successful measures to reuse tailwater and reduce subsurface drainage discharges by blending tilewater with their irrigation water supply to EC levels equal or exceeding 1 mmhos/cm. These water districts have received many grants and loans to implement these measures. Table 10 describes the crops these districts raised in 2002. A portion of these crops were grown with blended drainage and irrigation water. With careful irrigation management practices, these farmers continue to contribute more than $140 million to the California economy.

Table 10
Crops Grown in Selected Water Districts that Recycle Irrigation Water

Water District	Firebaugh Canal	Panoche	San Luis	Charleston	Pacheco
Irrigated Crop Survey 2002	**Acreage**	**Acreage**	**Acreage**	**Acreage**	**Acreage**
Alfalfa	3,890	1,547	1,662	401	1
Almonds/Pistachio	24	622	10,660	26	
Corn	63	3	652	40	
Cotton	10081	15402	10645	2421	732
Cucurbits	2334	5967	3879	547	1487
Dry Beans		128	141		
Grain	846	918	575	242	179
Onions & Garlic	334	1,196	914		108
Other Deciduous Trees	74		1,468		
Other Field Crops	257	128			
Other Truck Crops	2	2335	491	183	217
Pasture	32	167	28	8	
Rice					
Safflower	78	449			100
Sugar Beets	889	509	459		
Tomatoes	2087	6773	4466	433	1325
Vineyard		686	306		
Citrus			261		
Total	**20,991**	**36,830**	**36,607**	**4,301**	**4,149**

Conclusion

Evidence presented in this report demonstrates that DWR has taken proactive measures to help meet water quality objectives at the lower San Joaquin River compliance points. These contributions include the purchase of VAMP flows, pursuing recommendations of the interagency San Joaquin Valley Drainage Implementation Program through DWR's Agricultural Drainage Program and by providing and administering over $72 million in grants monies from Project Funds and Propositions 13, 50, and 204 (drainage sub-account). The Department of Water Resources also operates and maintains a network of real-time water

quality monitoring stations along the lower San Joaquin River and provides weekly forecasts of the assimilative capacity of the San Joaquin River at key locations as well as participating in, and funding, research that could help to improve wetlands saline discharge into the river.