CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

PROPOSED AMENDMENTS TO THE WATER QUALITY CONTROL PLAN FOR THE SACRAMENTO RIVER AND SAN JOAQUIN RIVER BASINS

TO ESTABLISH SALINITY WATER QUALITY OBJECTIVES IN THE LOWER SAN JOAQUIN RIVER (MOUTH OF MERCED TO VERNALIS)

DRAFT STAFF REPORT

FEBRUARY 2017, AMENDED MAY 2017

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CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

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This publication is a report by staff of the California Regional Water Quality Control Board, Central Valley Region. This report contains the evaluation of alternatives and technical support for the adoption of a Basin Plan Amendment to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins. Mention of specific products does not represent endorsement of those products by the Central Valley Water Board.

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Acknowledgments

Thank you to the participants of the Lower San Joaquin River Committee and the Central Valley Salinity Alternatives for Long Term Sustainability (CV-SALTS) initiative for their commitment and work on this project.

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EXECUTIVE SUMMARY

The purpose of this Staff Report is to provide the rationale and supporting documentation for proposed amendments to the Water Quality Control Plan (Basin Plan) for the Sacramento River Basin and San Joaquin River Basin (Central Valley Water Board, 2016a) that would establish salinity water quality objectives (WQOs) in Reach 83 of the Lower San Joaquin River (LSJR), which is defined as the LSJR from the mouth of the Merced River to the Airport Way Bridge near Vernalis. This report proposes amendments to the Basin Plan that would:

1. Define salinity WQOs that are protective of beneficial uses in the LSJR. The proposed Basin Plan amendments would establish a WQO that would require that electrical conductivity (EC) at 25 degrees Celsius[1] not exceed 1,550 micro Siemens per centimeter (µS/cm) as a 30-day running average, except during Extended Dry Periods,[2] when the WQO would require that EC not exceed 2,470 µS/cm as a 30-day running average and 2,200 µS/cm as an annual average using at a minimum the previous four consecutive quarterly samples.
2. Incorporate an implementation program into the Basin Plan to achieve proposed salinity WQOs.
3. Set an EC performance goal of 1,350 µS/cm during certain months and water-year types, based on modeling results of expected water quality.
4. Require the implementation of a monitoring and surveillance program to evaluate the effectiveness of the implementation program.

These proposed amendments would set water quality objectives for EC that would be protective of the beneficial uses in the LSJR including Agricultural Supply (AGR) and Municipal and Domestic Supply (MUN). In addition, setting an EC performance goal will promote achievement of the best possible water quality under variable conditions. The

[1] An EC measurement made or corrected to 25 °C is equivalent to specific conductance

[2] An Extended Dry Period is defined using the State Water Board's San Joaquin Valley "60-20-20" Water Year Hydrologic Classification to assign a numeric indicator to a water year type as follows:

- Wet – 5
- Above Normal – 4
- Below Normal – 3
- Dry – 2
- Critically Dry – 1

The indicator values will be used as follows to determine when an Extended Dry Period is in effect:

- An Extended Dry Period shall begin when the sum of the current year's 60-20-20 indicator value and the previous two year's 60-20-20 indicator values total six (6) or less.
- An Extended Dry Period shall be deemed to exist for one water year (12 months) following a period with an indicator value total of six (6) or less.

The method for determining the San Joaquin Valley Water Year Hydrologic Classifications is defined in the State Water Board Revised Water Right Decision 1641, March 2000, Figure 2, page 189. This method uses the best available estimate of the 60-20-20 San Joaquin Valley water year hydrologic classification at the 75% exceedance level using the best available data published in the California Department of Water Resources' ongoing Bulletin 120 series.

proposed amendments do not change or replace the EC WQOs for the San Joaquin River at the Airport Way Bridge near Vernalis which was set by the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan) for water entering the southern Delta (State Water Resources Control Board, 2006).

In Revised *Water Right Decision 1641*, the California State Water Resources Control Board (State Water Board) directed the Central Valley Regional Water Quality Control Board (Central Valley Water Board) to develop and adopt salinity objectives and a program of implementation for the main stem of the San Joaquin River upstream of Vernalis (State Water Resources Control Board, 2000). In 2004, the Central Valley Water Board adopted the Control Program for Salt and Boron Discharges into the Lower San Joaquin River (Control Program) that included a Total Maximum Daily Load (TMDL) to address EC in the LSJR and meet the WQOs in the Bay-Delta Plan at the Airport Way Bridge near Vernalis. The Control Program and TMDL were subsequently approved by the United States Environmental Protection Agency (US EPA) in 2006. The TMDL is implemented through waivers of waste discharge requirements (WDRs) or WDRs that apportion load allocations to different geographic subareas in the valley. As an alternative to the load allocations, the TMDL allows discharger participation in a Central Valley Water Board approved real-time management program as a means to attain salinity WQOs, while maximizing the export of salts out the watershed to help protect the region's agricultural production and long term sustainability. The Control Program also required a second phase to establish and implement new salinity and boron objectives for the San Joaquin River upstream of Vernalis.

The Central Valley Water Board held an initial California Environmental Quality Act (CEQA) scoping meeting for a basin planning effort to develop the upstream WQOs on 11 May 2005. After preliminary studies, the Central Valley Water Board held a second CEQA scoping meeting on 30 March 2009, to limit the geographic scope of the project to the section of the river upstream of the Airport Way Bridge near Vernalis to the Merced River. Central Valley Water Board staff subsequently released a draft report, *Salt Tolerance of Crops in the Lower San Joaquin River (Merced to Stanislaus River Reaches)* (LSJR Salt Tolerance Report) in March 2010 that presented the application of crop salt sensitivity parameters needed to establish EC water quality criteria in the LSJR (Central Valley Water Board, 2010a). At that same time, the Central Valley Water Board requested that the Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS) initiative continue the effort on the upstream San Joaquin River beneficial use and salt and boron objectives evaluation and to continue to work on the policy and science to develop a basin plan amendment that would address those issues. CV-SALTS is a collaborative stakeholder driven and managed program to develop sustainable salinity and nitrate management planning for the Central Valley.

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The proposed WQOs herein are the result of a stakeholder-driven effort led by the LSJR Committee, which is a subcommittee of the CV-SALTS. It includes members of irrigation, water, and resource conservation districts, city, county, state and federal agencies, producers, growers, irrigators, water quality and watershed coalitions, managed wetlands, drainage authorities, clean water and wastewater associations, consultants of various organizations and other interested parties.

Between May 2010 and the end of 2015, the LSJR Committee developed recommendations for EC WQOs that are protective of beneficial uses in the LSJR, EC Performance Goals that may be achievable, and recommendations for a program to implement the WQOs and Performance Goals for consideration by the Central Valley Water Board. The Committee began by conducting reviews of beneficial uses and water quality data for the LSJR, including white papers on Aquatic Life (Buchwalter, David, Ph.D., North Carolina State University, 2014) and Stock Watering sensitivity to salinity (Kennedy/Jenks Consultants, 2013), and concluded that additional work was needed to determine reasonable protection of Agricultural Supply (AGR) and potential Municipal and Domestic Supply (MUN) beneficial uses. The Committee also decided there was not enough information available to support a change from the current boron WQOs for the LSJR, and instead focused their efforts on the EC WQOs and EC Performance Goals. Next, the Committee developed guidelines for determining reasonable protection of AGR to assist with development of EC WQOs and vetted them with the CV-SALTS Executive Committee. The guidelines recommend key components to consider when determining reasonable protection of AGR and include a leaching fraction to represent irrigation practices when site-specific data are not available, crop yield values acceptable to stakeholders under certain conditions, and metrics for identifying the most salt sensitive commercial crop that requires protection. In addition, an Extended Dry Period definition was developed to assist with establishing reasonable salinity objectives in the LSJR during time periods when water supplies are constrained.

The LSJR Committee then developed EC water quality criteria for consideration as WQOs protective of AGR for this Basin Plan Amendment by entering existing and recently acquired scientific data, and applying the recommended guidelines into the Hoffman Model, a steady-state soil-water salinity model. This model had been peer reviewed during the State Water Board's salinity review of the Bay-Delta (State Water Resources Control Board, 2012) and used in the 2010 draft and the finalized LSJR Salt Tolerance Report (Central Valley Water Board, 2016b). The proposed EC WQO of 1,550 µS/cm is derived from the Hoffman model for the LSJR by utilizing a leaching fraction of 15 percent and protecting for a 95 percent almond crop yield, during a 5th percentile annual rainfall year (all but 5% of the driest years from 1951-2013) In conformance with the WQOs and sampling regimes established in the San Joaquin River at Vernalis for the protection of agricultural uses of water entering the Bay-Delta,

the LSJR Committee recommended maintaining the same water quality compliance period of a 30-day running average of mean daily EC (State Water Resources Control Board, 2000). The proposed WQO likewise falls within the recommended range (900 to 1600 µS/cm) of Title 22 of the California Code of Regulation's Secondary Maximum Contaminant Level (SMCL) for specific conductance, which is considered reasonably protective of the MUN use in the Basin Plan.

The preferred project alternative also incorporates separate EC WQOs for Extended Dry Periods. These Extended Dry Period EC WQOs were developed using the Hoffman model to protect a lower almond crop yield expectation of at least 75 percent. During these periods, an EC WQO of 2,470 µS/cm as a maximum 30-day running average is proposed as reasonably protective of irrigation supply water. A concurrent EC WQO of 2,200 µS/cm as an annual average (using at a minimum the previous four consecutive quarterly samples) is also proposed for an Extended Dry Period to reasonably protect the potential MUN beneficial use because such a value is equivalent to the short term Title 22 SMCL for specific conductance.

The Watershed Analysis Risk Management Framework (WARMF) watershed modeling tool, using historical conditions to simulate salt loading in the LSJR, was applied to evaluate the ability of different implementation strategies to meet the proposed salinity WQOs. The compliance point for the evaluation was the LSJR at Crows Landing, a point upstream of freshwater dilution flows from the Tuolumne and Stanislaus Rivers. The preferred implementation plan selected by the LSJR Committee includes the execution of current and currently planned activities to manage irrigation return flows to the LSJR. Modeling of this implementation strategy indicated that the proposed salinity objectives would be met at Crows Landing.

The LSJR Watershed drains approximately 2.9 million acres, which includes approximately 1.4 million acres of acricultural land use. A key activity within the selected implementation plan is the Grassland Bypass Project achieving zero discharge of subsurface agricultural return flows by the end of 2019. The discharge is from 97,000-acres of the Grassland Bypass Project area to tributaries of the LSJR. The planned activities in the watershed are predicted to result in the LSJR reaching compliance with the proposed EC and existing boron WQOs for this stretch of the river by the end of 2019. The proposed objectives and implementation program are also predicted to improve (decrease) salinity levels over historic conditions and reduce the reliance on New Melones fresh water releases while continuing to meet the salt objectives downstream at the Airport Way Bridge near Vernalis.

The WARMF watershed modeling analyses also suggested that the selected implementation program will result in the attainment of an EC value of 1,350 µS/cm in

the LSJR during certain seasons or water-year types. These findings were not conclusive and, as a result, the LSJR Committee stakeholders recommended that an EC value of 1,350 µS/cm be established as an implementation performance goal during specific months of the irrigation season of certain water-year types to promote the best possible water quality. The Staff Report includes a proposed monitoring plan to verify compliance with the LSJR EC and boron WQOs and attainment of the EC performance goal. The LSJR Committee proposed that the Central Valley Water Board use future monitoring data to reevaluate the EC WQOs ten years after adoption of the Basin Plan Amendment and determine whether or not an adjustment to lower the WQOs is appropriate.

This Staff Report also evaluates the proposed Basin Plan Amendment's consistency with existing federal and state laws, regulations and policies, contains an environmental analysis that complies with the applicable requirements of the California Environmental Quality Act (CEQA), and includes antidegradation and economic analyses that evaluate potential impacts of this project. The Board's Basin Planning Program is considered a certified regulatory program, which means that the Board is exempt from the requirement to prepare an environmental impact report for basin planning activities under the California Environmental Quality Act. (Pub. Res. Code, § 21080.5; Cal. Code Regs., tit. 14, § 15251(g).) The Board's environmental review of the proposed Basin Plan Amendments is instead contained in this Staff Report, which is considered to be part of the "substitute environmental documentation" or "SED".

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PROPOSED BASIN PLAN AMENDMENT LANGUAGE

The proposed changes to the Basin Plan are as follows. Text additions to the existing Basin Plan language are underlined. Text deletions to the existing Basin Plan are in ~~strikethrough~~.

CHAPTER 1 INTRODUCTION

Modify the Basin Plan under the heading, "3. East Valley Floor" (page I-3.00), as follows:

3. East Valley Floor

This subarea includes approximately 413 square miles of land on the east side of the LSJR that drains directly to the LSJR between the Airport Way Bridge near Vernalis and the Salt Slough confluence. The subarea is largely comprised of the land between the major east-side drainages of the Tuolumne, Stanislaus, and Merced Rivers. This subarea lies within central Stanislaus County and north-central Merced County. Numerous drainage canals~~, including the Harding Drain~~ and natural drainages~~, drain~~ occur in this this subarea. The subarea is comprised of the following minor subareas:

CHAPTER III WATER QUALITY OBJECTIVES

Modify the Basin Plan under the heading, "Salinity" (page III-6.02), as follows:

Electrical Conductivity and Total Dissolved Solids-- Special Cases in the Sacramento and San Joaquin River Basins Other Than the Delta

The objectives for electrical conductivity and total dissolved solids in Table III-3 apply to the water bodies specified. To the extent of any conflict with the general Chemical Constituents water quality objectives, the more stringent shall apply, with the exception of the electrical conductivity water quality objectives for Reach 83 of the San Joaquin River, which the Board has determined to be protective of all beneficial uses within Reach 83.

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Modify the Basin Plan under the heading, "Salinity" (Table III-3 on page III-7.00), as follows:

Table III-3

ELECTRICAL CONDUCTIVITY AND TOTAL DISSOLVED SOLIDS

PARAMETER	WATER QUALITY OBJECTIVES	APPLICABLE WATER BODIES
Electrical Conductivity (at 25°C)	Shall not exceed 230 micromhos/cm (50 percentile) or 235 micromhos/cm (90 percentile) at Knights Landing above Colusa Basin Drain; or 240 micromhos/cm (50 percentile) or 340 micromhos/cm (90 percentile) at I Street Bridge, based upon previous 10 years of record.	Sacramento River (13, 30)
	Shall not exceed 150 micromhos/cm (90 percentile) in well-mixed waters of the Feather River.	North Fork of the Feather River (33); Middle Fork of the Feather River from Little Last Chance Creek to Lake Oroville (36); Feather River from the Fish Barrier Dam at Oroville to Sacramento River (40)
	Shall not exceed 150 micromhos/cm from Friant Dam to Gravelly Ford (90 percentile).	San Joaquin River, Friant Dam to Mendota Pool (69)
	Shall not exceed 1550 micromhos/cm (as a 30-day running average), except during Extended Dry Periods[3], when concentrations shall not exceed 2470 micromhos/cm (as a 30-day running average) and 2200 micromhos/cm (as an annual average using at a minimum the previous four quarterly samples)	San Joaquin River between the Mouth of Merced River and the Airport Way Bridge near Vernalis (83)
Total Dissolved Solids	Shall not exceed 125 mg/l (90 percentile)	North Fork of the American River from the source to Folsom Lake (44); Middle Fork of the American River from the source to Folsom Lake (45); South Fork of the American River from the source to Folsom Lake (48, 49); American River from Folsom Dam to Sacramento River (51)
	Shall not exceed 100 mg/l (90 percentile)	Folsom Lake (50)
	Shall not exceed 1,300,000 tons	Goose Lake (2)

[3] See Chapter IV-32.00 for definition of an Extended Dry Period

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Modify the Basin Plan under the heading, "Control Program for Salt and Boron Discharges into the Lower San Joaquin River (LSJR)" (pages IV-32.00 through IV-32.07), as follows:

Control ~~p~~Program for Salt and Boron Discharges into the Lower San Joaquin River (LSJR)

The goal of the salt and boron control program is to achieve compliance with salt and boron water quality objectives without restricting the ability of dischargers to export salt out of the San Joaquin River basin.

For the purpose of this control program, nonpoint source land uses include all irrigated lands and nonpoint source discharges are discharges from irrigated lands.

Irrigated lands are lands where water is applied for producing crops and, for the purpose of this control program, includes, but is not limited to, land planted to row, field and tree crops as well as commercial nurseries, nursery stock production, managed wetlands, and rice production.

This control program is phased to allow for implementation of existing water quality objectives, while providing the framework and timeline for implementing future water quality objectives.

The salt and boron control program establishes ~~salt load limits~~ 1) a method for determining the maximum allowable salt loading to the LSJR from discharges to achieve compliance with salinity water quality objectives (WQOs) at the Airport Way Bridge near Vernalis ~~with salt and boron water quality objectives for the LSJR~~ and 2) WQOs and an implementation program for salinity between the mouth of the Merced River and the Airport Way Bridge. ~~The Regional Water Board establishes a method for determining the maximum allowable salt loading to the LSJR. Load allocations are established for nonpoint sources and waste load allocations are established for point sources.~~

Salt Loading and the Vernalis Salinity Control Program

Load allocations to specific dischargers or groups of dischargers are proportionate to the area of nonpoint source land use contributing to the discharge. Control actions that result in salt load reductions will be effective in the control of boron.

Load allocations are established for nonpoint sources and waste load allocations are established for point sources.

~~The salt and boron control program establishes timelines for: 1) developing and adopting salt and boron water quality objectives for the San Joaquin River upstream of the Airport Way Bridges near Vernalis; 2) a control program to achieve these objectives; and 3) developing and adopting a groundwater control program.~~

Per the amendments to the Basin Plan for control of salt and boron discharges into the ~~lower San Joaquin River (~~LSJR~~)~~ basin, approved by the Regional Water Board in Resolution No. 88-195, Resolution No. 2004-0108, and Resolution No.

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R5-2017-XXX and incorporated herein, the Regional Water Board will take the following actions, as necessary and appropriate, to implement this control program:

1. The Regional Water Board shall use waivers of waste discharge requirements or waste discharge requirements to apportion load allocations to each of the following seven geographic subareas that comprise the LSJR:

   a. San Joaquin River Upstream of Salt Slough
   b. Grassland
   c. Northwest Side
   d. East Valley Floor
   e. Merced River
   f. Tuolumne River
   g. Stanislaus River

   These subareas are described in Chapter 1 and in more detail in Appendix 41.

2. Dischargers of irrigation return flows from irrigated lands are in compliance with this control program if they meet any of the following conditions:

   a. Cease discharge to surface water
   b. Discharge does not exceed 315µS/cm electrical conductivity (based on a 30-day running average)
   c. Operate under waste discharge requirements that include effluent limits for salt
   d. Operate under a waiver of waste discharge requirements for salt and boron discharges to the LSJR

3. The Regional Water Board will adopt ~~a~~ waivers of waste discharge requirements or waste discharge requirements for salinity management, or incorporate into ~~an~~ existing agricultural waivers or waste discharge requirements, the conditions required to participate in a Regional Water Board approved real-time management program. Load allocations for nonpoint source dischargers participating in a Regional Water Board approved real-time management program are described in Table IV-4.4. Additional waiver conditions or waste discharge requirements will include use of Regional Water Board approved methods to measure and report flow and electrical conductivity. Participation in a Regional Water Board approved real-time management program and attainment of salinity water quality objectives at the Airport Way Bridge near Vernalis will constitute compliance with this control program.

4. The Regional Water Board will adopt waste discharge requirements with fixed monthly base load allocations specified as effluent limits for nonpoint source discharges that do not meet conditions specified in ~~a~~ waivers of waste discharge requirements or waste discharge requirements for salinity management. Entities operating under ~~WDRs~~ waste discharge requirements, or that will be required to operate under ~~WDRs~~ waste discharge requirements in order to comply with other programs, may participate in a Regional Water Board approved real-time management program in lieu of additional ~~WDRs~~ waste discharge requirements for salinity if they meet the conditions specified in the waiver of ~~WDRs~~ waste discharge requirements for salinity management, as described in item 3.

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5. Fixed monthly base load allocations and the method used to calculate real-time load allocations are specified in Table IV-4.4.

6. Waste Load Allocations are established for point sources of salt in the basin. NPDES permitted discharges shall not exceed the salinity water quality objectives established for the LSJR at the Airport Way Bridge near Vernalis unless the discharger is a member of a Regional Water Board-approved real time management program or a pollutant trading program consistent with the Control Program for Salt and Boron Discharges into the LSJR The Regional Water Board will revise NPDES permits to incorporate ~~TMDL allocations~~ the requirements of the Control Program when the permits are renewed or reopened at the discretion of the Regional Water Board.

7. Supply water credits are established for irrigators that receive supply water from the Delta Mendota Canal (DMC) or the LSJR between the confluence of the Merced River and the Airport Way Bridge near Vernalis as described in Table IV-4.4.

8. Supply water Load Allocations are established for salts in irrigation water imported to the LSJR Watershed from the Sacramento/San Joaquin River Delta as described in Table IV-4.4.

   Per Resolution No. R5-2014-0150, ~~T~~the Regional Water Board ~~will attempt to enter into~~ adopted a revised Management Agency Agreement (MAA) with the U.S. Bureau of Reclamation, replacing a 2008 MAA to address salt imports from the DMC to the LSJR watershed. The MAA ~~shall~~ includes provisions requiring the U.S. Bureau of Reclamation to:

   a. Meet DMC load allocations; or
   b. Provide mitigation and/or dilution flows to create additional assimilative capacity for salt in the LSJR equivalent to DMC salt loads in excess of their allocation.

   The Regional Water Board shall request a report of waste discharge from the U.S. Bureau of Reclamation to ~~address~~ meet DMC ~~discharges~~ load allocations if a MAA ~~is not established by 28 July 2008~~ meeting the provisions identified above does not remain in place.

9. The Regional Water Board will review and, if necessary, update the load allocations and/or waste load allocations by 28 July 2012 and every 6 years thereafter. Any changes to waste load allocations and/or load allocations can be made through subsequent amendment to this control program. Changes to load allocations will be implemented through revisions of the applicable waste discharge requirements or waivers of waste discharge requirements. Changes to waste load allocations will be implemented through revisions of the applicable NPDES permits.

10. The Regional Water Board encourages real-time water quality management and pollutant trading of waste load allocations, load allocations, and supply water allocations as a means for attaining salt and boron water quality objectives while maximizing the export of salts out of the LSJR watershed. This control program shall in no way preclude basin-

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wide stakeholder efforts to attain salinity water quality objectives in the LSJR so long as such efforts are consistent with the control program.

11. The established waste load allocations, load allocations, and supply water allocations represent a maximum allowable level. The Regional Water Board may take other actions or require additional reductions in salt and boron loading to protect beneficial uses.

12. Salt loads in water discharged into the LSJR or its tributaries for the express purpose of providing dilution flow are not subject to load limits described in this control program if the discharge:

    a. complies with salinity water quality objectives for the LSJR at the Airport Way Bridge near Vernalis;
    b. is not a discharge from irrigated lands; and
    c. is not provided as a water supply to be consumptively used upstream of the San Joaquin River at the Airport Way Bridge near Vernalis.

13. Entities providing dilution flows, as described in item 12, will obtain an allocation equal to the salt load assimilative capacity provided by this flow. This dilution flow allocation can be used to: 1) offset salt loads discharged by this entity in excess of any allocation or; 2) trade, as described in item 10. The additional dilution flow allocation provided by dilution flows will be calculated as described in Table IV-4.4.

~~14. It is anticipated that salinity and boron water quality objectives for the San Joaquin River from Mendota Dam to the Airport Way Bridge near Vernalis will be developed and considered for adoption in the second phase of this TMDL, according to time schedule in Table IV-4.1.~~

~~**Table IV-4.1: Schedule for developing water quality objectives for salt and boron in the LSJR from Mendota Dam to the Airport Way Bridge near Vernalis**~~

~~Milestone~~	~~Date~~
~~Staff report on criteria needed to protect beneficial uses~~	~~October 2004~~
~~Staff report and Regional Water Board workshop on water quality objectives that can reasonably be achieved~~	~~June 2005~~
~~Draft second phase TMDL with water quality objectives and program of implementation for LSJR from Mendota Dam to Airport Way Bridge near Vernalis~~	~~September 2005~~
~~Board Hearing for consideration of adoption~~	~~June 2006~~

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Compliance with Water Quality Objectives Upstream of the Airport Way Bridge near Vernalis

~~15. Salinity and boron water quality objectives for the San Joaquin River from Mendota Dam to the Airport Way Bridge near Vernalis will be implemented using the implementation framework described in this 'Control Program for Salt and Boron Discharges into the Lower San Joaquin River' or other implementation mechanisms, as appropriate.~~

1. Per the amendments to the Basin Plan for control of salt and boron discharges into the LSJR basin between the Airport Way Bridge near Vernalis and the mouth of the Merced River, approved by the Regional Water Board in Resolution No. 88-195 and Resolution No. R5-2017-XXXX, and incorporated herein, the following actions will be implemented:

   a. The Regional Water Board will determine nonpoint source discharge compliance with electrical conductivity and boron WQOs using data collected at Crows Landing and Maze Road. Daily average electrical conductivity data will be utilized to calculate the 30-day running averages for electrical conductivitycompliance; weekly boron concentration data will be utilized to calculate the monthly average and maximum boron concentrations for compliance.
   b. The Regional Water Board has established a non-regulatory performance goal for the LSJR that represents a potentially-achievable 30-day running average that is lower than the WQO. As the Salt and Boron Control Program is implemented, the Regional Water Board will continue to evaluate whether this performance goal is achievable during the irrigation seasons of Wet, Above Normal, Below Normal, and Dry Water Years, as specified in Table IV-4.1.

Table IV-4.1: Electrical Conductivity Performance Goal Periods (except during Extended Dry Periods)

WY Type	Irrigation Season		Non-irrigation Season
	Mar-Jun	Jul-Sept	Oct-Feb
Wet	1350 µS/cm		
Above Normal	1350 µS/cm		
Below Normal	1350 µS/cm		
Dry	1350 µS/cm		
Critical			

   c. Attainment of the electrical conductivity Performance Goal will be evaluated using data collected at Crows Landing and Maze Road.
   d. Ten years after Regional Water Board's adoption of the Basin Plan Amendment, and based on the evaluations described in the subparagraphs above, the Regional Water Board will consider reopening the Basin Plan to potentially revise the LSJR electrical conductivityWQOs.
   e. During an Extended Dry Period, the electrical conductivity WQO will be 2470 µS/cm (30-day running average) to protect the AGR beneficial use. In addition, during an Extended Dry Period, the electrical conductivity WQO for protection of the potential MUN beneficial use shall be 2200 µS/cm as the average of the previous four (4) consecutive quarterly samples at a minimum.

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An Extended Dry Period is based in part on the water year type numeric indicator identified in the State Water Board's San Joaquin Valley "60-20-20" Water Year Hydrologic Classification[4] as follows:

- Wet – 5
- Above Normal – 4
- Below Normal – 3
- Dry – 2
- Critically Dry – 1

The indicator values will be used as follows to determine when an Extended Dry Period is in effect:

- An Extended Dry Period shall begin when the sum of the current year's 60-20-20 indicator value and the previous two year's 60-20-20 indicator values total six (6) or less.
- An Extended Dry Period shall be deemed to exist for one water year (12 months) following a period with an indicator value total of six (6) or less.

2. In addition to meeting the requirements of the Vernalis Salinity Control Program, considerations for NPDES permitted discharges to the LSJR are as follows:

   a. When evaluating whether an NPDES point source discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion of the EC WQOs for the Lower San Joaquin River, the Regional Water Board should consider available dilution of the effluent in the receiving water, and may consider dilution as determined down to the first downstream diversion that provides AGR irrigation supply or MUN beneficial use.
   b. If an NPDES point source discharge is deemed to have reasonable potential to cause or contribute to an instream excursion above the EC WQOs, water quality-based effluent limits shall be required. For publicly-owned treatment works (POTWs), the water quality-based effluent limitations may be established in terms of EC concentration or total dissolved solids (TDS) loading to account for site-specific consideration of dry weather versus wet weather conditions. However, concentration and loading limits shall not be applied at the same time. When establishing water quality-based effluent limitations for POTWs in terms of TDS loading, an EC to TDS ratio of 0.64 shall be used to convert EC concentrations to TDS concentrations, unless a discharger-specific ratio can be demonstrated. The design average dry weather flow of the POTW shall be used to calculate the TDS loading limits.
   c. For NPDES point source discharges, if water quality-based effluent limits are required:
      i. effluent limitations for protection of AGR beneficial uses shall be expressed as monthly averages instead of thirty-day running averages;
      ii. effluent limitations for protection of MUN beneficial uses should be expressed as an annual average.

[4] The method for determining the San Joaquin Valley Water Year Hydrologic Classifications is defined in the State Water Board Revised Water Right Decision 1641, March 2000, Figure 2, page 189. This method uses the best available estimate of the 60-20-20 San Joaquin Valley water year hydrologic classification at the 75% exceedance level using the best available data published in the California Department of Water Resources' ongoing Bulletin 120 series.

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d. The Regional Water Board will incorporate the requirements of the EC water quality objectives for the Lower San Joaquin River when the NPDES permits are renewed or reopened at the discretion of the Regional Water Board.

~~16. A groundwater control program for sources of salt discharges into the LSJR will be developed by June 2020 if water quality objectives in the LSJR are not being attained.~~

Implementation Priority and Schedules

Salt Loading and the Vernalis Water Quality Objectives

~~17.~~The Regional Water Board will focus control actions on the most significant sources of salt and boron discharges to the LSJR. Priority for implementation of load allocations to control salt and boron discharges will be given to subareas with the greatest unit area salt loading (tons per acre per year) to the LSJR (Table IV-4.2). The priorities established in Table IV-4.2 will be reviewed by 28 July 2012 and every 6 years thereafter.

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Table IV-4.2: Priorities for implementing load allocations[1]

Subarea	Priority
San Joaquin River Upstream of Salt Slough	Low
Grassland	High
Northwest Side	High
East Valley Floor	Low
Merced River	Low
Tuolumne River	Medium
Stanislaus River	Low
Delta Mendota Canal[2]	High

[1] Priorities based on the unit area salt load from each subarea and mass loading from the DMC
[2] Delta Mendota Canal is not a subarea

~~*Time Schedules for Implementation*~~

~~18~~1. The Regional Water Board will incorporate base load allocations into waste discharge requirements and real-time load allocations into conditions of waiver of waste discharge requirements by 28 July 2008. Dischargers regulated under a waiver of waste discharge requirements for dischargers participating in a real-time management program for the control of salt and boron in the LSJR shall comply with the waiver conditions within 1 year of the date of adoption of the waiver.

~~19~~2. Existing NPDES point source dischargers are low priority and subject to the compliance schedules for low priority discharges in Table IV-4.3. New point source discharges that begin discharging after the date of the adoption of this control program must meet the requirements of the Control Program for Salt and Boron Discharges into the ~~Lower San Joaquin River~~ LSJR upon the commencement of the discharge.

Table IV-4.3: Schedule for Compliance with the load allocations for salt and boron discharges into the LSJR

Priority	Year to implement[1]	
	Wet through Dry Year Types	Critical Year Types
High	8	12
Medium	12	16
Low	16	20

[1]number of years from the effective date [28 July 2006] of this control program

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~~16~~3. A groundwater control program for sources of salt discharges into the LSJR will be developed by June 2020 if water quality objectives in the LSJR are not being attained.

Water Quality Objectives Upstream of the Airport Way Bridge near Vernalis

1. The electrical conductivity water quality objectives for the San Joaquin River between its confluence with the Merced River and the Airport Way Bridge near Vernalis will be implemented by 1 January 2020.

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Table IV-4.4 Summary of Allocations and Credits

BASE SALT LOAD ALLOCATIONS

Base Load Allocations (thousand tons of salt)

Year-type[1]	Month / Period												
	Jan	Feb	Mar	Apr 1 to Apr. 14	Pulse Period [2]	May 16 to May 31	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	41	84	116	23	72	31	0	0	5	45	98	44	36
Abv. Norm	44	84	64	26	71	14	0	0	0	44	58	35	32
Blw. Norm	22	23	31	11	45	8	0	0	0	38	41	34	30
Dry	28	39	25	5	25	1	0	0	0	25	31	27	28
Critical	18	15	11	0	0	0	0	0	0	19	30	26	23

REAL-TIME SALT LOAD ALLOCATIONS

Nonpoint source dischargers operating under waiver of waste discharge requirements or waste discharge requirements must participate in a Regional Water Board approved real-time management program and meet real-time load allocations. Loading capacity and real-time load allocations are calculated for a monthly time step. The following method is used to calculate real-time load allocations. Flows are expressed in thousand acre-feet per month and loads are expressed in ~~thousand~~ tons per month.

Loading Capacity (LC) in ~~thousand~~ tons per month is calculated by multiplying flow in thousand acre-ft per month by the salinity water quality objective in µS/cm, a unit conversion factor of 0. 8293, and a coefficient of 0.85 to provide a 15 percent margin of safety to account for any uncertainty.

$$LC = Q * WQO * 0.8293 * 0.85$$

Where:
LC = total loading capacity in ~~thousand~~ tons per month
Q = flow in the San Joaquin River at the Airport way Bridge near Vernalis in thousand acre-feet per month
WQO = salinity water quality objective for the LSJR at Airport Way Bridge near Vernalis in µS/cm

The sum of the real-time Load Allocations (LA) for nonpoint source dischargers are equal to a portion of the LSJR's total Loading Capacity (LC) as described by the following equation:

$$LA = LC - L_{BG} - L_{CUA} - L_{GW} - \Sigma WLA$$

Where:
LA = sum of the real-time Load Allocations for nonpoint source dischargers
L_{BG} = loading from background sources
L_{CUA} = consumptive use allowance
L_{GW} = loading from groundwater
ΣWLA = sum of the waste load allocations for all point sources

Background loading in ~~thousand~~ tons is calculated using the following equation:

$$L_{BG} = Q * 85\ \mu S/cm * 0.8293$$

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Table IV-4.4 Summary of Allocations and Credits (continued)

Consumptive use allowance loading is calculated with the following equation:

$L_{CUA} = Q * 230\ \mu S/cm * 0.8293$

Monthly groundwater Loading (L_{GW}) (in thousand tons)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
15	15	30	32	36	53	46	27	16	13	14	15

Waste load allocations for individual point sources are calculated using the following equation:

$WLA=Q_{PS}*WQO*0.8293$

where:
WLA = waste load allocation in ~~thousand~~ tons per month
Q_{PS} = effluent flow to surface waters from the NPDES permitted point source discharger (in thousand acre-feet per month)
WQO = salinity water quality objective for the LSJR at Airport Way Bridge near Vernalis in µS/cm

APPORTIONING OF SALT LOAD ALLOCATION

An individual discharger or group of dischargers can calculate their load allocation by multiplying the nonpoint source acreage drained by the load allocation per acre.

$$\text{LA per acre} = \frac{\text{LA}}{\text{nonpoint source acreage}} \text{Total}$$

As of 1 August 2003, the total nonpoint source acreage of the LSJR Basin is 1.21-million acres. Nonpoint source land uses include all irrigated agricultural lands (including managed wetlands). Agricultural land includes all areas designated as agricultural or semi-agricultural land uses in the most recent land use surveys published by the California Department of Water Resources. California Department of Water Resources land use surveys are prepared and published on a county-by-county basis. Multiple counties or portions of counties may overlay a given subarea. The land use surveys must be used in combination with a Geographic Information System to quantify the agricultural land use in each subarea. Nonpoint source land areas will be updated every 6 years though an amendment to the Basin Plan if updated California Department of Water Resources land use surveys have been published. The following land use surveys (or portions thereof) are used to quantify agricultural land use in the LSJR watershed.

County	Year of most recent land use survey[1]
Merced	1995
Madera	1995
San Joaquin	1996
Fresno	1994
Stanislaus	1996

[1]-as of 1 August 2003

Acreage of managed wetlands is based on the boundaries of the federal, private and state owned wetlands that comprise the Grassland Ecological Area in Merced County. Agricultural lands (as designated in DWR land uses surveys) within the Grassland Ecological Area are counted as a<u>n</u> agricultural land use and not as managed wetlands. All other lands within the Grassland Ecological Area are considered to be managed wetlands.

CONSUMPTIVE USE ALLOWANCE

In addition to the base load allocations or real-time load allocations shown above, a consumptive use allowance (L_{CUA}) is provided to each discharger:

L_{CUA} in tons per month = discharge volume <u>in thousand</u> acre-feet per month * 230 µS/cm * 0.8293

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Table IV-4.4 Summary of Allocations and Credits (continued)

SUPPLY WATER CREDITS

A supply water credit is provided to irrigators in the Grassland and Northwest Side Subareas that receive water from the DMC. This DMC supply water credit is equal to 50 percent of the added salt load, in excess of background, delivered to Grassland and Northwest Side subareas. The following fixed DMC supply water credits apply to dischargers operating under base load allocations:

DMC supply water credits (thousand tons)

Year-type[1]	Month / Period												
	Jan	Feb	Mar	Apr 1 to Apr. 14	Pulse Period [2]	May 16 to May 31	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NORTHWEST SIDE SUBAREA													
Wet	0.0	0.2	0.0	0.7	1.4	0.7	2.0	2.6	2.6	1.0	0.9	0.6	0.0
Abv. Norm	0.0	0.0	0.0	0.8	1.9	1.0	2.3	2.3	2.6	1.2	0.8	0.3	0.0
Blw. Norm	0.0	0.0	0.0	1.0	2.6	1.5	3.4	4.2	3.3	2.5	1.9	0.8	0.0
Dry	0.0	0.0	0.0	0.1	0.3	0.2	0.3	0.5	0.5	0.2	0.2	0.0	0.0
Critical	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRASSLAND SUBAREA													
Wet	2.1	5.9	13.9	7.8	17.3	8.8	22.6	20.8	23.2	17.2	16.0	10.4	3.7
Abv. Norm	1.2	4.8	9.4	10.4	24.7	13.6	27.6	20.3	24.5	23.9	16.6	7.5	2.6
Blw. Norm	1.4	5.7	13.8	12.5	29.5	15.9	32.6	29.2	29.8	32.9	25.3	12.8	4.5
Dry	2.2	6.7	15.9	11.1	23.4	11.2	22.9	23.1	24.0	28.0	23.7	13.0	5.3
Critical	3.3	8.9	17.2	10.2	24.1	13.3	33.3	32.5	31.8	27.5	28.7	13.6	5.9

The following method is used to calculate real-time DMC supply water credits in ~~thousand~~ tons per month and applies to dischargers operating under real-time load allocations.

Real-time CVP Supply Water Credit = Q_{CVP}* (C_{CVP} - C_{BG}) * 0.8293*0.5

Where:
Q_{CVP} = volume of water delivered from CVP in thousand acre-feet per month[3]
C_{CVP} = electrical conductivity of water delivered from CVP in µS/cm[3]
C_{BG} = background electrical conductivity of 85 µS/cm

For irrigators in the Northwest Side Subarea an additional supply water credit is provided to account for salts contained in supply water diverted directly from the LSJR (LSJR diversion water credit). The LSJR diversion credit is equal to 50 percent of the added salt load (in excess of background) in supply water diverted from the San Joaquin River between the confluence of the Merced River and the Airport Way Bridge near Vernalis. The following fixed LSJR supply water credits apply to dischargers operating under base load allocations:

LSJR supply water credits (thousand tons)

Year-type[1]	Month / Period												
	Jan	Feb	Mar	Apr 1 to Apr. 14	Pulse Period [2]	May 16 to May 31	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0.0	0.6	9.2	6.2	9.4	11.0	17.2	23.5	20.5	9.5	1.3	0	0
Abv. Norm	0.0	0.8	5.0	7.4	12.3	11.2	21.8	24.9	20.3	10.7	1.5	0	0
Blw. Norm	0.0	0.6	5.5	7.0	14.4	13.4	27.3	33.1	24.9	13.9	2.4	0	0
Dry	0.0	0.7	5.3	6.4	11.1	10.7	27.5	34.0	20.3	11.4	2.4	0	0
Critical	0.0	0.8	4.5	5.1	14.8	10.6	25.2	28.5	22.3	8.7	2.5	0	0

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Table IV-4.4 Summary of Allocations and Credits (continued)

The following method is used to calculate Real-time LSJR supply water credits in ~~thousand~~ tons per month and applies to dischargers operating under real-time load allocations.

Real-time LSJR Supply Water Credit = $Q_{LSJR\ DIV}$* ($C_{LSJR\ DIV}$ -C_{BG}) * 0.8293 * 0.5

Where:

$Q_{LSJR\ DIV}$ = volume of water diverted from LSJR between the Merced River Confluence and the Airport Way Bridge near Vernalis in thousand acre-feet per month[4]

$C_{LSJR\ DIV}$ = electrical conductivity of water diverted from the LSJR in µS/cm[4]

C_{BG} = background electrical conductivity of 85 µS/cm

SUPPLY WATER ALLOCATIONS

The U.S. Bureau of Reclamation DMC load allocation (LA_{DMC}) is equal to the volume of water delivered from the DMC (Q_{DMC}) to the Grassland and Northwest side Subareas at a background Sierra Nevada quality of 85 µS/cm.

$LA_{DMC} = Q_{DMC}$ * 85 µS/cm * 0.8293

DILUTION FLOW ALLOCATIONS

Entities providing dilution flows obtain an allocation equal to the salt load assimilative capacity provided by this flow, calculated as follows:

$A_{dil} = Q_{dil}*(C_{dil}-WQO)*0.8293$

Where:

A_{dil} = dilution flow allocation in ~~thousand~~ tons of salt per month

Q_{dil} = dilution flow volume in thousand acre-feet per month

C_{dil} = dilution flow electrical conductivity in µS/cm

WQO = salinity water quality objective for the LSJR at Airport Way Bridge near Vernalis in µS/cm

[1] The water year classification will be established using the best available estimate of the 60-20-20 San Joaquin Valley water year hydrologic classification (as defined in Footnote 17 for Table 3 in the State Water ~~Resources Control~~ Board's *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary*, ~~May 1995~~December 2006) at the 75% exceedance level using data from the Department of Water Resources Bulletin 120 series. The previous water year's classification will apply until an estimate is made of the current water year.

[2] Pulse period runs from 4/15-5/15. Period and distribution of base load allocation and supply water credits between April 1 and May 31 may change based on scheduling of pulse flow as specified in State Water Board Revised Water Rights Decision 1641. Total base load allocation for April 1 through May 31 does not change but will be redistributed based on any changes in the timing of the pulse period

[3] Methods used to measure and report the volume and electrical conductivity of water delivered from the CVP to irrigated lands must be approved by the Regional Water Board as part of ~~the~~ waste discharge requirements or waivers of waste discharge requirements conditions required to participate in a Regional Water Board approved real-time management program

[4] Methods used to measure and report the volume and electrical conductivity of water diverted from the SJR between the confluence of the Merced and the Airport Way Bridge near Vernalis must be approved by the Regional Water Board as part of the waiver conditions required to participate in a Regional Water Board approved real-time management program

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CHAPTER V SURVEILLANCE AND MONITORING

Modify the Basin Plan by adding a new heading and text to the bottom of page V-5.00, as follows:

Salt and Boron Discharges into the Lower San Joaquin River

The amendments to the Basin Plan that established boron and electrical conductivity WQOs for discharges into the lower San Joaquin River (LSJR) between the mouth of the Merced River and the Airport Way Bridge near Vernalis were approved by the Regional Water Board in Resolution No. 88-195 and Resolution No. 2017-XXXX, incorporated herein. The Regional Water Board will review data collected at Crows Landing and Maze Road to determine compliance with the LSJR electrical conductivity WQOs and attainment of the Performance Goal. Daily average electrical conductivity measurement calculations will be utilized to calculate the 30-day running average for WQO compliance and Performance Goal attainment. The Regional Water Board will review boron concentration data collected weekly at Crows Landing to determine if the monthly average or maximum boron WQOs are being exceeded. Should the boron objectives be exceeded at Crows Landing, boron analyses should be expanded to weekly sampling at Maze Road and the Airport Way Bridge near Vernalis. To evaluate changing loads into the system that may result from changing management activities and/or changes in hydrology, continuous flow monitoring is recommended in the river at Crows Landing, Maze Road and the Airport Way Bridge near Vernalis.

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LIST OF ACRONYMS AND ABBREVIATIONS

§	Section
µS/cm	Micro Siemens per centimeter
µg/L	Micrograms per liter
AB	Assembly Bill
AGR	Agricultural Supply
Basin Plan	Water Quality Control Plan for the Sacramento River and San Joaquin River Basins
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta Estuary
Central Valley Water Board	California Regional Water Quality Control Board – Central Valley Region
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
Control Program	Control Program for Salt and Boron Discharges into the Lower San Joaquin River
CV-SALTS	Central Valley Salinity Alternatives for Long-term Sustainability
CWA	Federal Water Pollution Control Act (Clean Water Act)
Delta	Sacramento-San Joaquin Delta
EC	Electrical Conductivity at 25 degrees Celsius (an EC measurement made at or corrected to 25° C is equivalent to specific conductance)
LA	Load Allocation
LC	Loading Capacity
LSJR	Lower San Joaquin River
MAA	Management Agency Agreement
MUN	Municipal and Domestic Supply
NPDES	National Pollution Discharge Elimination System
NPS	nonpoint source
Porter-Cologne	Porter-Cologne Water Quality Control Act
RPA	Reasonable Potential Analysis
Salt Tolerance Report	*Salt Tolerance of Crops in the Lower San Joaquin River (Merced to Stanislaus River Reaches*
SJR	San Joaquin River
State Water Board	California State Water Resources Control Board

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1 INTRODUCTION

Salinity management has been a long-term issue in the San Joaquin Valley. Upstream irrigation development and instream irrigation return flows in the Lower San Joaquin River (LSJR), coupled with the Valley hydrologic and geologic characteristics, are the principle reasons for the salinity problem in the Valley. In September 2004, the Central Valley Regional Water Quality Control Board (Central Valley Water Board) adopted an amendment to the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Basin Plan), titled *Control Program for Salt and Boron Discharges into the Lower San Joaquin River* (Control Program). The Control Program was developed in response to directives from the State Water Resources Control Board (State Water Board) in Water Right Decision 1641 (D-1641) (State Water Resources Control Board, 2000). The Control Program established salt load limits in non-point source discharges and waste load allocations in point source discharges to the LSJR in an effort to achieve compliance with electrical conductivity (EC) Water Quality Objectives (WQOs) at the Airport Way Bridge near Vernalis, set by the State Water Board in the Water Quyality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (State Water Board, May 1995). This staff report provides the technical and policy foundation for a proposed amendment to the Control Program intended to meet a State Water Board directive to establish salinity WQOs in the LSJR upstream of Vernalis.

1.1 Background

1.1.1 Salinity Issues in the LSJR

The salt and boron water quality impairment in the LSJR is due, in large part to large-scale water development coupled with extensive agricultural land use and associated agricultural discharges in the watershed. LSJR flows have been severely diminished by the construction and operation of dams and diversions and the resulting consumptive use of water. Most of the natural flows from the Upper San Joaquin River (SJR) and its headwaters are diverted at the Friant Dam via the Friant-Kern Canal to irrigate crops outside the SJR Basin. Diverted natural river flows have been replaced with poorer quality (higher salinity) imported water from the Sacramento-San Joaquin Delta (Delta) that is primarily used to irrigate crops on the west side of the LSJR basin. Surface and subsurface agricultural discharges are the largest sources of salt and boron loading to the LSJR; and river water quality is heavily influenced by irrigation return flows during the irrigation season. Water quality generally improves downstream as higher quality flows from the Merced, Tuolumne, and Stanislaus Rivers dilute salt and boron concentrations in the main stem of the LSJR.

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Since the 1940s, mean annual salt and boron concentrations in the LSJR at the Delta Boundary at Vernalis had increased significantly (Lower San Joaquin River Committee, 2013d). However, it was not until May 1991 that WQOs for salinity (EC, total dissolved solids and chloride) in the San Joaquin River near Vernalis were adopted by the State Water Board as part of the San Francisco Bay-Delta (Bay-Delta) Water Quality Control Plan review. These objectives were not however implemented. In 1995 and again in 2006, the State Water Board adopted the Bay-Delta Water Quality Control Plan, both of which included salinity objectives (EC) measured near Vernalis as well at three interior southern Delta sites (State Water Resources Control Board, 1995) (State Water Resources Control Board, 2006).

Adoption of D-1641 in 1999 by the State Water Board, in part, implemented the salinity standards contained in the Bay Delta Plan. The Bay Delta Plan and D-1641 directed the Central Valley Water Quality Board to:

a. Initiate its salt load reduction program to reduce annual salt loads to the San Joaquin River by at least 10 percent and to adjust the timing of discharges from low flow to high flow periods, and
b. Promptly develop and adopt salinity objectives and a program of implementation for the main stem of the San Joaquin River upstream of Vernalis.

In 1998, the San Joaquin River was listed on the federal Clean Water Act (CWA) section 303(d) list as impaired by electrical conductivity and boron (State Board Resolution 1998-055). CWA section 303(d)(1)(C) requires a State to establish a Total Maximum Daily Load (TMDL) for any pollutant causing an impairment of a beneficial use and/or non-attainment of an adopted WQO. Adoption of a TMDL for salt and boron under State Law meant that the Central Valley Water Board needed to develop a program of implementation to reduce salt and boron loading to levels needed to achieve the WQOs identified for the Bay-Delta at Vernalis and incorporate these requirements in a revision to its Basin Plan.

1.1.2 Salt and Boron Control Program

The Central Valley Water Board's 2004 amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) satisfied the first directive of the State Board's D-1641 as well as the CWA's requirement to adopt a TMDL to meet salt and boron water quality standards in the LSJR. The Control Program established salt load limits in non-point source discharges and waste load allocations in point source discharges to the LSJR in an effort to achieve compliance with existing EC WQOs at Vernalis. The Control Program was approved by the US EPA

in 2006 and is implemented through waivers of waste discharge requirements (WDRs) or WDRs that apportion load allocations to different geographic subareas in the valley. As an alternative to the load allocations, the Control Program allows discharger participation in a Central Valley Water Board approved real-time management program as a means to attain salinity WQOs, while maximizing the export of salts out the watershed to help protect the region's agricultural production and long term sustainability. A Real Time Management Program (RTMP) was approved by the Central Valley Water Board in December 2014.

To address the State Water Board's second directive in D-1641, the Control Program also required that the Central Valley Water Board establish salinity WQOs in the San Joaquin River, upstream of Vernalis. The objective of this current basin plan amendment is to meet this requirement of the Control Program. This amendment does not propose to make any changes to the current WQOs established at Vernalis to protect beneficial uses in the southern portion of the Bay-Delta.

1.2 Efforts to Develop Salinity Water Quality Objectives in LSJR

1.2.1 Central Valley Water Board Efforts (2006 – 2010)

The Central Valley Water Board held an initial CEQA scoping meeting for a basin planning effort to develop the upstream WQOs on 11 May 2005. After preliminary studies, the Central Valley Water Board held a second CEQA scoping meeting on 30 March 2009, to limit the geographic scope of the project to the section of the river from its confluence with the Sanislaus River to its confluence with the Merced River. During this same time frame, Central Valley Water Board staff focused their efforts on evaluating the salt-sensitivity of irrigated crops in the LSJR area. Staff subsequently released a draft report, Salt Tolerance of Crops in the Lower San Joaquin River (Merced to Stanislaus River Reaches) (LSJR draft Salt Tolerance Report) in March 2010 that presented the application of crop salt sensitivity parameters in a steady state soil salinity model to establish EC water quality criteria for the LSJR (Central Valley Water Board, 2010a) to protect irrigated agriculture.

1.2.2 Lower San Joaquin Committee Efforts (2010 – Current)

After receiving initial public comments on the LSJR draft Salt Tolerance Report, the Central Valley Water Board requested that the Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS) continue the effort on developing the salinity objectives including the policy and science to develop a basin plan amendment. CV-SALTS is a collaborative stakeholder driven and managed program to develop sustainable salinity and nitrate management planning for the Central Valley.

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To conduct the review of beneficial uses and WQOs on the LSJR, CV-SALTS established the Lower San Joaquin River Committee (LSJR Committee) as a stakeholder effort to conduct a review and recommend changes to the Basin Plan that will enable the Central Valley Water Board to use its regulatory tools to assure the protection of beneficial uses and manage salt in the basin. The LSJR Committee includes members of irrigation, water, and resource conservation districts, city, county, state and federal agencies, producers, growers, irrigators, water quality and watershed coalitions, managed wetlands, drainage authorities, clean water and wastewater associations, consultants of various organizations and other interested parties. The LSJR Committee developed a work plan to guide the completion of a Basin Plan Amendment for establishing salinity WQOs and an implementation program to meet those objectives for the LSJR, between the Merced River inflow and the Airport Way Bridge near Vernalis Reach 83).

1.3 LSJR Committee Work Plan

In the development of the Work Plan (Lower San Joaquin River Committee, 2012), the LSJR Committee discussed the following goals for the program of establishing WQOs for the LSJR:

a. Reasonable protection of beneficial uses;
b. Maintain the capability to increase the level of beneficial use of the LSJR;
c. Set up a comprehensive plan to achieve salt balance in the river basin which is inclusive of all current and developing water beneficial uses and economic interests;
d. Establish WQOs and implementation mechanisms that not only protect beneficial uses in the LSJR basin but also downstream;
e. Develop objectives and implementation based on sound science;
f. Identify feasible plans for funding the implementation alternatives, projects and follow-up needed to demonstrate success;
g. Develop broad public understanding and ownership of the salt management plan within the LSJR Basin and beyond in the Central Valley;
h. Provide regulatory certainty to encourage capital investment and long-range planning that provides adaptability and flexibility; and
i. Use common language, understanding and decision tools.

The tasks identified to meet these goals included the following:

1) Prepare San Joaquin River Basin description and water use reports

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2) Evaluate LSJR beneficial uses
3) Review established salinity objectives and potential water quality criteria
4) Review and select a salinity water quality model that can be used to establish potential WQOs for the LSJR
5) Review and select a water quality model to establish baseline salinity levels in the river
6) Review and select potential management implementation actions to model and assess feasibility and achievability
7) Develop and analyze project alternatives
8) Prepare economic analysis of implementation actions to meet potential alternatives
9) Prepare a program of implementation, including monitoring and surveillance
10) Prepare environmental and CEQA documentation
11) Prepare final recommendations to the Central Valley Water Board

The work described in this Staff Report and the proposed WQOs herein are the result of this stakeholder-driven effort led by the LSJR Committee in coordination with staff from the Central Valley Water Board.

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2 PROJECT AREA DESCRIPTION

2.1 Watershed Setting

The Central Valley Water Board is responsible for the water quality of the Central Valley of California. The Central Valley is comprised of two valleys, the Sacramento Valley and the San Joaquin Valley. The San Joaquin Valley is, in turn, divided into two basins, the San Joaquin River Basin and the Tulare Lake Basin. The Tulare Lake Basin is an enclosed basin with no natural drainage. The San Joaquin River drains the San Joaquin River Basin while the Sacramento River drains the Sacramento Valley. Both the Sacramento River and San Joaquin River drain into the Sacramento River and San Joaquin River Delta (Delta) that flows into San Francisco Bay.

The San Joaquin River watershed is bordered by the Sierra Nevada Mountains on the east, the Coast Range on the west, the Delta to the north, and the Tulare Lake Basin to the south. From its source in the Sierra Nevada Mountains, the San Joaquin River flows southwesterly until it reaches Friant Dam. Below Friant Dam, the SJR flows westerly to the center of the San Joaquin Valley near Mendota, where it turns northwesterly to eventually join the Sacramento River in the Delta. The main stem of the entire SJR is about 300 miles long and drains approximately 13,500 square miles.

The major tributaries to the San Joaquin River upstream of the Airport Way Bridge near Vernalis (the boundary of Delta) are on the east side of the San Joaquin Valley, with drainage basins in the Sierra Nevada. The Sierra Nevada is the primary source of both the valley's water supply and the alluvial material that forms the eastern side of the valley floor and along the San Joaquin River as it moves through the valley trough. The major east side tributaries are the Stanislaus, Tuolumne, and Merced Rivers. The Cosumnes, Mokelumne, and Calaveras Rivers flow into the San Joaquin River downstream of the Airport Way Bridge near Vernalis.

In 1945, the headwaters of the San Joaquin River, captured in the Millerton Reservoir after completion of Friant Dam, were diverted to the Tulare Lake Basin through the Friant-Kern Canal. These diversions have resulted in long stretches of the river between Friant Dam and the mouth of the Merced River receiving no fresh water most of the time. Downstream of the Merced River, flows in the San Joaquin River increase and salinity levels decrease somewhat as it picks up higher quality water from the Merced and its other major tributaries, particularly the Tuolumne and Stanislaus Rivers to the east. All of the main eastside river flows are managed by regulated reservoirs.

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The Coast Range provides the alluvial material for a major portion of the western side of the river and several smaller, ephemeral streams flow into the SJR from this side of the valley. These streams include Hospital, Ingram, Del Puerto, Orestimba, Panoche, and Los Banos Creeks. All have drainage basins in the Coast Range, flow intermittently, and contribute sparsely to water supplies. Mud Slough (north) and Salt Slough also drain the Grassland Watershed on the west side of San Joaquin Valley. During the irrigation season, surface and subsurface agricultural return flows contribute greatly to these west side creeks and sloughs.

2.2 Geology and Hydrology

The geology of the Sierra Nevada Range on the east side of the San Joaquin River Basin and the Coast Ranges on the west side has had a marked influence on the valley floor sediments and salinity. Drainage from the western slope of the Sierra Nevada has created large alluvial fans of low-salinity, well sorted sands and gravels on the eastern side of the Basin. This has resulted in coarse-textured alluvial material on the east side of the San Joaquin River that is low in natural salinity and boron. As one moves westward on the alluvial fans towards the valley trough, this coarse-textured material becomes finer. In contrast, the Coast Ranges are made up of Jurassic and Cretaceous sandstones and shales of marine origin. These are known to be high in salt and boron.

The predominant storm track for the Central Valley is west to east from the Pacific Ocean. This makes the eastern side of the Coast Range (the portion making up the western side of the San Joaquin River Basin) a rain shadow of lower rainfall. In contrast, the western slopes of the high-altitude Sierra Nevada receive considerably more precipitation than the eastern side of the Sierra Nevada. The lower rainfall on the western side of the San Joaquin River Basin has resulted in poorly sorted sediments that, as a general rule, are of lower permeability and higher salinity when compared to those on the eastside.

Typical of a Mediterranean climate, precipitation in the watershed varies annually and seasonally, as well as by watershed elevation. Precipitation in the Basin ranges from as little as 5 inches per year on the valley floor to over 80 inches per year at the higher elevations of the Sierra Nevada (U.S. Geological Survey, 1998). Most of the precipitation falls in the late fall, winter and early spring periods with a prolonged dry period in the remainder of the year. Precipitation is predominately snow above 4 -5,000 feet elevation with rain in the middle and lower elevations of the Sierra Nevada and Coast Range. As a result, natural hydrology reflects a mixed runoff regime, dominated by winter-spring rainfall runoff and spring-summer snowmelt runoff (McBain and Trush, 2002). Snowmelt runoff generates a majority of the flow volume from the watershed

with little runoff contributed from the western side of the Basin in the rain shadow of the Coast Ranges.

Historically, wetlands covered a large portion of the San Joaquin River Basin, fed by floods that overflowed the banks of the tributaries and main stem of the San Joaquin River. These floods inundated the valley floor and were caused by rainfall events in the valley and the lower elevations of the Sierra Nevada during the winter and spring months, and by snow melt from higher elevations during the spring and summer months. Over 90 percent of these wetlands were drained and farmed during the latter part of the 19th century and the early 20th. In conjunction with this land use change, the river and most of its tributaries were dammed and the flows stored in reservoirs. This has changed the hydraulics of the valley floor from one predominated by flooding and overbanking of the stream and river channels to one predominated by irrigation applied over much of the valley floor.

Winter or spring rain-on-snow events likely contributed the largest instantaneous flow events and played a major role in channel forming processes while the snow melt period was probably the longest prolonged flow periods and contributed to overbank inundation and high water tables. This created a vast floodplain and wetland habitat that supported large populations of fish and wildlife (McBain and Trush, 2002).

2.3 LSJR Project Area

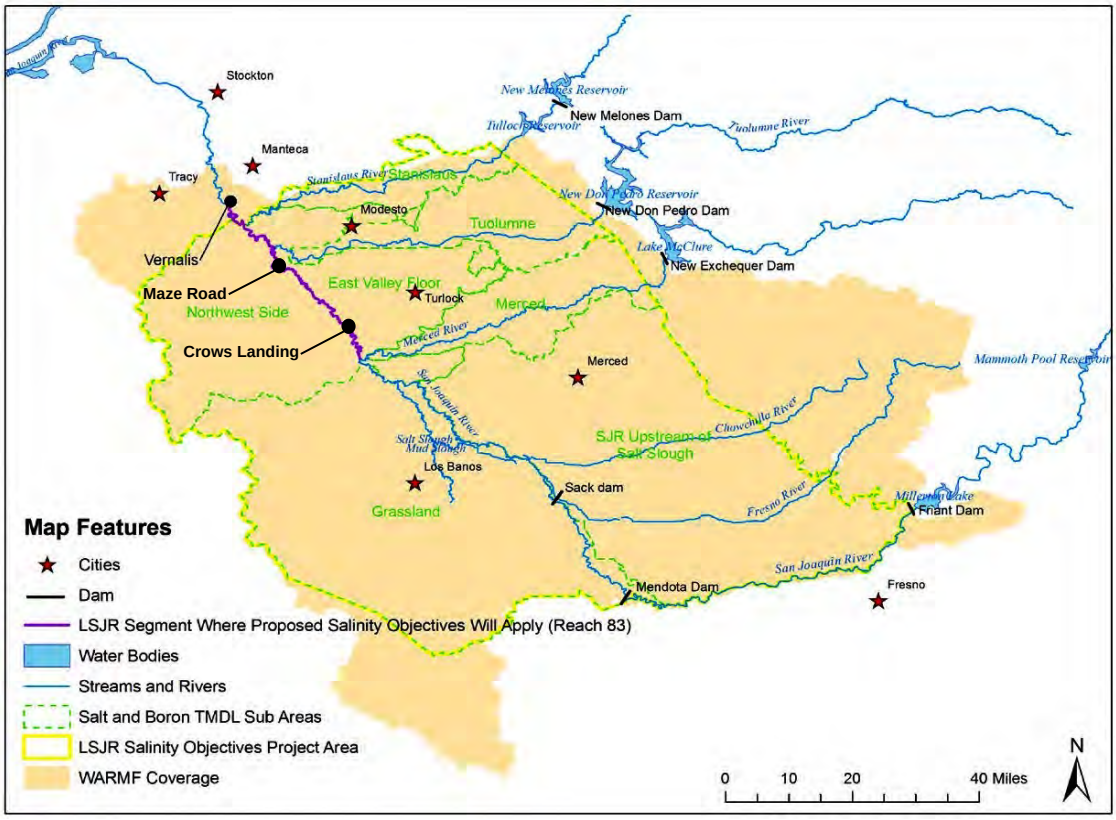
This project addresses water quality in the LSJR watershed, a subset of the San Joaquin River Basin. The LSJR watershed is defined as the area draining to the San Joaquin River from Mendota Dam to the Airport Way Bridge near Vernalis (132.5 miles). The geographic scope of the project area is the LSJR from its confluence with the Merced River to the Airport Way, near Vernalis (46.3 miles). Figure 2-1 shows the LSJR project area. The Basin Plan defines this stretch of the San Joaquin River as Reach 83. The eastern boundary of the LSJR watershed excludes the areas upstream of dams on the major eastside reservoirs including Lake McClure, New Don Pedro, New Melones, and other similar reservoirs in the LSJR system. The southeastern boundary of the project area is formed by the upper San Joaquin River (from Friant Dam to Mendota Dam). Water conditions in the LSJR at its confluence with the Merced River are influenced by the upstream inflows, including Salt Slough and Mud Slough entering from the westside.

The LSJR project area is about 68.5 thousand acres, with over 75% of the area made up of irrigated agriculture and managed wetlands, according to surveys conducted by the Department of Water Resources (DWR) (California Department of Water

Resources, 2009). Those likely to use water for irrigation include individual water right holders and water agencies such as West Stanislaus Irrigation District (ID), Patterson ID, and El Solyo Water District (WD). More information on the type of irrigated crops grown in the LSJR project area is provided in Chapter 5, Water Quality Objectives. The non-irrigated lands in the LSJR Project area include urban areas, water courses, residential properties, open land, dairies and feedlots and farm homesteads.

The LSJR project area includes portions of San Joaquin, Stanislaus, and Merced counties. The reach of the LSJR from the Merced River to Tuolumne River is 34.7 miles in length. The reach includes two commonly used water monitoring sites: Crows Landing and Patterson. The major tributaries draining the eastside of the project area in this reach are the Merced and the Tuolumne Rivers, while Orestimba, Salado, and Del Puerto Creeks drain the west side. The LSJR from the Tuolumne River to the Stanislaus River is 8.4 miles in length and is drained on the west side by Ingram and Hospital creeks, and includes the Maze Road monitoring site. The stretch from the Stanislaus River to the Airport Way Bridge, near Vernalis is 2.7 miles in length.

Figure 2-1 Overview map of Lower San Joaquin River Project Area



2.4 Historic Salinity Water Quality and Resulting Limitations

The construction of Friant Dam, the diversion of headwaters to the Tulare Lake Basin, and the replacement of Sierra Nevada flows with Sacramento-San Joaquin Delta diversions, fundamentally changed natural hydrologic conditions within the LSJR Basin. Salinity concentrations for the LSJR between the Merced River and Vernalis became primarily dependent on freshwater flows from the east through the Merced, Tuolumne and Stanislaus Rivers, agricultural drainage from the west, and groundwater accretion. Salinity concentrations measured in the LSJR as electrical conductivity (uS/cm) from 1986 through 2013, are depicted in Figures 2-2 and 2-3 for Crows Landing (augmented with information from the nearby Patterson site) and Maze Road, respectively. These locations are shown on Figure 2-1. The Maze Road site is downstream of both the Merced and Tuolumne Rivers and has overall lower salinity concentrations than the Crows Landing site which is just downstream of the Merced River.

The concentrations at each site vary widely both by season within a water year (from October 1 through September 30) as well as between water year types. Wet water years as defined by the San Joaquin Valley Water Year Index, as defined in State Water Board Revised Water Right Decision 1641 (D-1641) (State Water Resources Control Board, 2000) occurred during 1986, 1993, 1995 through 1998, 2005, 2006, and 2011, and have distinctly lower electrical conductivity than those found during critically dry years such as 1987 through 1992, 2007, 2008 and 2013.

After 1985, more focus was directed at water quality within the LSJR due to recognition of elevated concentrations of selenium entering the river through Mud Slough (north) and Salt Slough from the Grassland Drainage Area (Figure 2-1). Monitoring increased within the river providing a more thorough record for salinity concentrations in addition to the information gathered on selenium. The Grassland Bypass Project (GBP) was initiated in September 1996 and began to progressively reduce the amount of subsurface agricultural drainage from the Grassland Drainage Area entering the LSJR upstream of Crows Landing. The GBP had a notable effect on overall salinity concentrations in the LSJR. Pre-GBP, salinity concentrations at Crows Landing regularly exceeded 2,200 umhos/cm measured as electrical conductivity (EC) and exceeded 2,500 EC during critically dry years such as Water Years 1987 and 1992. Post-GBP, salinity concentrations remain below 2,000 EC even during critically dry Water Years 2007, 2008 and 2013 (Figure 2-2).

The pattern of reduction pre- and post-GBP is also apparent at the Maze Road location, which is downstream of the Tuolomne River. Pre-GBP salinity regularly exceeded 1,600 EC and reached 1,800 EC during critically dry water years, while post-GBP salinity concentrations remained below 1,400 EC (Figure 2-3).

Figures 2-4 and 2-5 show the distinct seasonal patterns as well as overall differences between Water Year types for salinity at both Crows Landing and Maze Blvd., respectively, post-GBP. Relatively elevated salinity levels occur during the irrigation season at both locations between July and October, but peak concentrations tend to occur during the spring, between March and May for all but above normal and wet

rainfall years. These peak concentrations correspond to pre-irrigation activities and the draining of seasonal wetlands.

Figure 2-2 Crows-Patterson Historical Daily Average EC

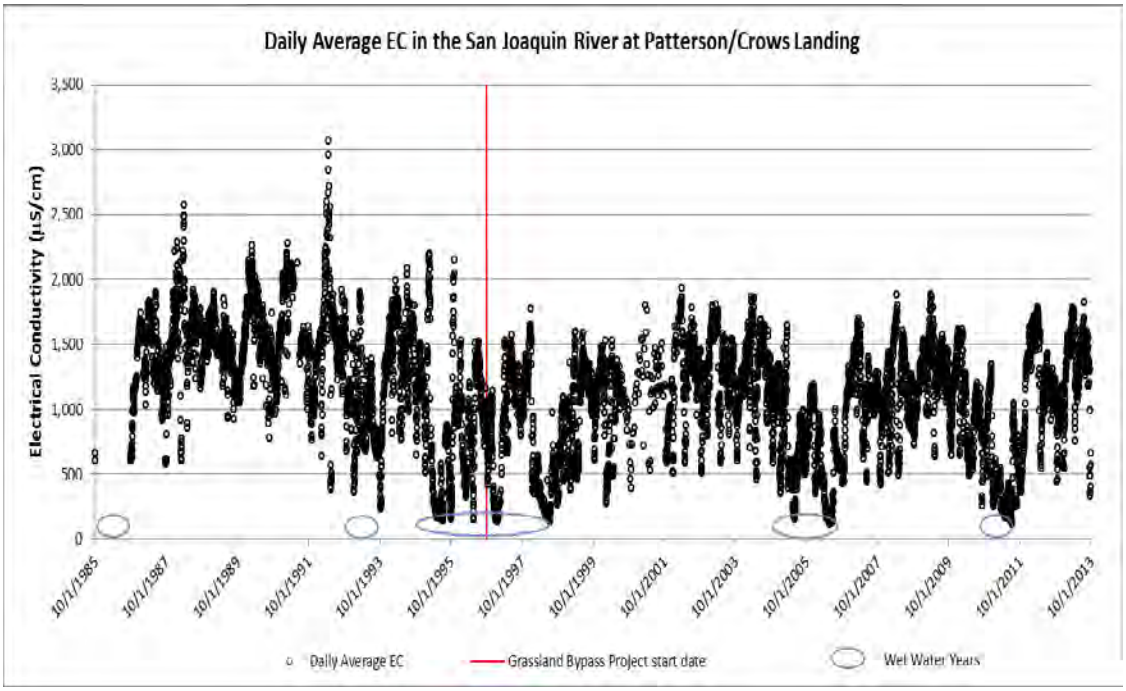


Figure 2-3 Maze Road Historical Daily Average EC

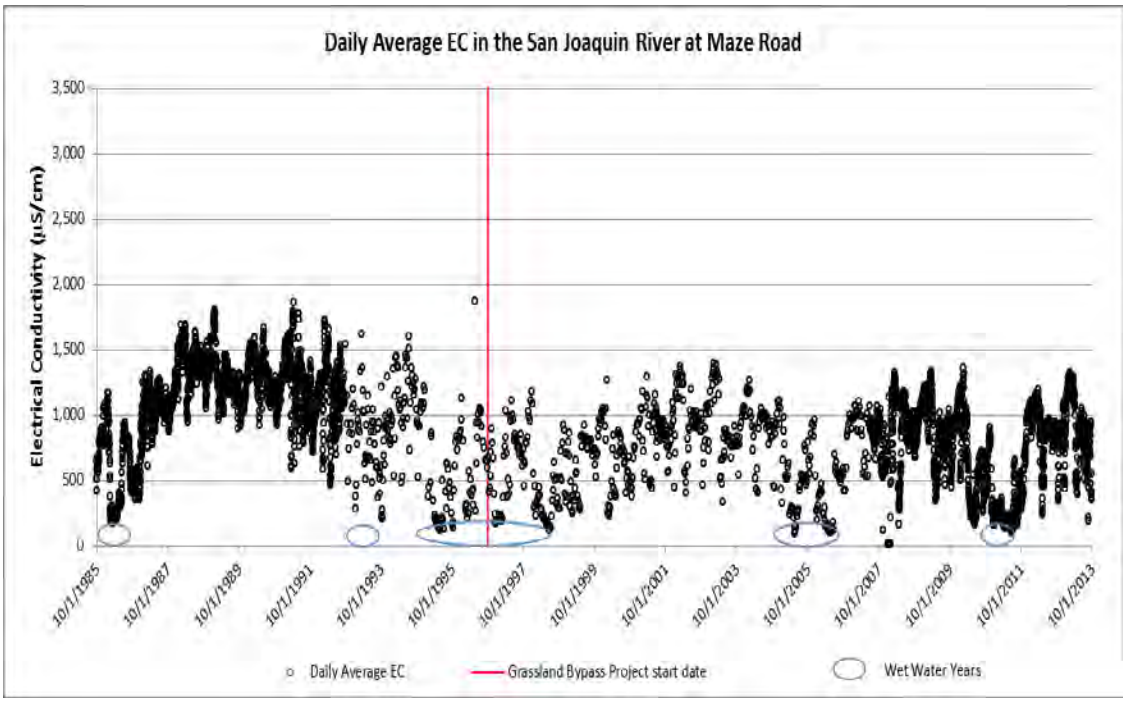


Figure 2-4 Crows-Patterson Historical Daily Average of 30-day Running Average EC by Water Year Type

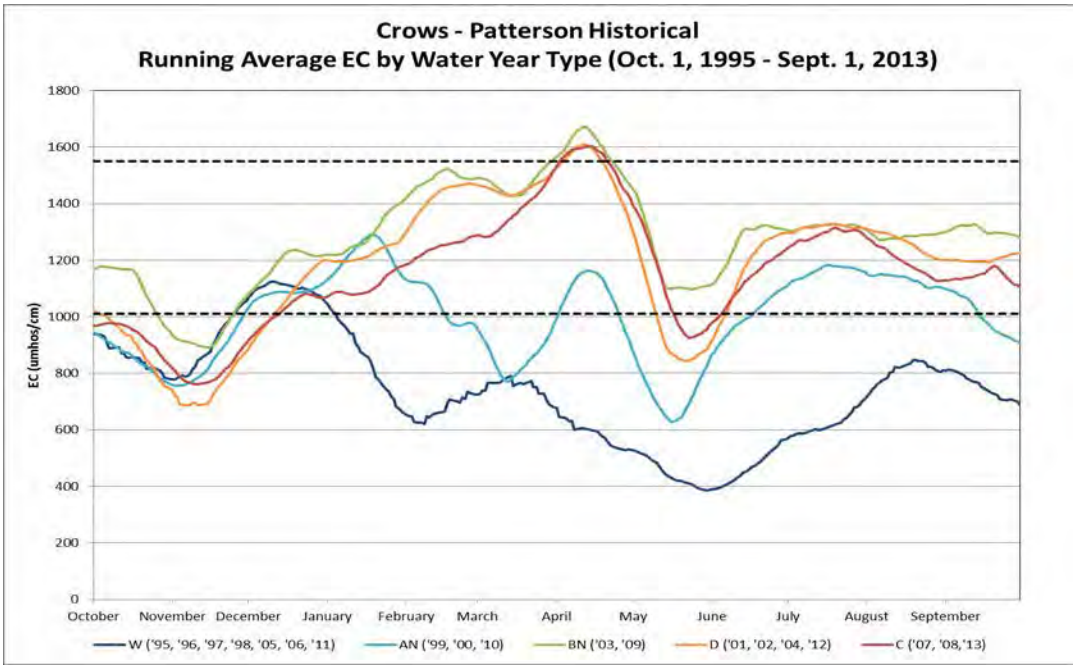
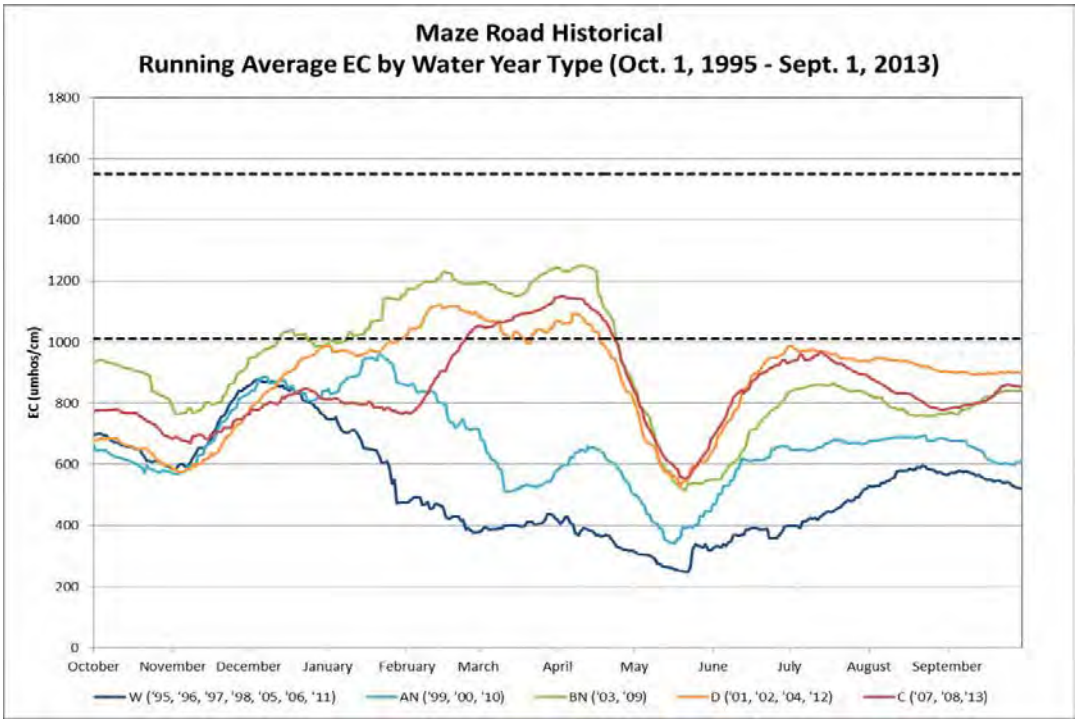


Figure 2-5 Maze Road Historical Daily Average of 30-day Running Average EC by Water Year Type



2.5 Biological Resources

The San Joaquin Valley provides habitat for fish and wildlife with as many as 24 state or federally listed threatened and endangered species (plant and animal). Historically, the LSJR and tributaries provided a diverse fishery resource, including large populations of salmon, steelhead, sturgeon, American shad, and striped bass. Steady declines in fish and wildlife habitat have occurred since development of major water projects, with approximately 85 percent of historic seasonal and permanent wetlands having been drained and/or reclaimed for agriculture and drastic reductions of the Chinook Salmon Fishery with the completion of dams and diversion structures. Although striped bass continued to spawn in the southern Delta, it was noted that they only migrated into the LSJR during the wettest years, and that the run of striped bass was small even under ideal conditions (Radtke and Turner, 1967); (Turner, 1966); (State Water Resources Control Board, 1991).

During the 1991 review of the Bay-Delta Plan, the State Water Board re-evaluated the salinity objectives that had been adopted to protect striped bass spawing (440 EC) near Prisoners Point in the LSJR downstream of Vernalis. The review determined that the objective and location were appropriate and acknowledged that not setting similar objectives in the reach of the river upstream of Prisoners Point ". . .effectively establishes a barrier to adult migration and spawning farther upstream on the San Joaquin River." Moving the lower salinity barrier upstream of Prisoners Point was not recommended, due in part to elevated salinity concentrations upstream, lack of consistent dilution (which was provided by the movement of Sacramento River water through the Delta Cross Channel in the Prisoners Point area), and assumptions that eggs and young that were produced farther upstream would be carried to the export pumps. The review also notes the lack of a strong experimentally-derived correlation between salinity and spawning success for similar environments and documents the concerns in its Appendix 5.4.5.

As part of the 1991 revision of the Bay-Delta Plan, the State Water Board adopted salinity water quality objectives for salinity at Vernalis as follows:

- Irrigation Season (Apr1-Aug31): 700 uS/cm (30-day running average)
- Non-Irrigation Season (Sep1-Mar31): 1,000 uS/cm (30-day running average)

The objectives were adopted to provide reasonable protection of beneficial uses in the Delta downstream of Vernalis and were based on protection of agricultural irrigation supply. These objectives apply between Vernalis and Prisoners Point and while they may be limiting striped bass spawning by contributing to the creation of a "salinity barrier", the bass do still migrate into the LSJR and upstream tributaries.

The barrier was also thought to limit sturgeon spawning in the upper river, but recent studies have identified white sturgeon spawning in wet and dry Water Years (2011 and 2012, respectively) just downstream of the inflow from the Tuolumne River (Jackson and Van Eenennaam, 2013). The finding may correspond to the fact that sturgeon were noted to be broadly tolerant of temperature, salinity and flow in a 2015 peer-reviewed

paper in San Francisco Estuary & Watershed Science titled *Sturgeon in the Sacramento-San Joaquin Watershed: New Insights to Support Conservation and Management* (Klimley, A. Peter, et al., 2015).

Green sturgeon have not been identified in the LSJR above Vernalis. Studies tracking migration patterns have identified the green sturgeon and, in particular, their spawning habitat as being contained within the Delta and Sacramento River Basin (Klimley, A. Peter, et al., 2015).

3 LAWS, REGULATIONS, AND POLICIES RELEVANT TO BASIN PLANNING

This staff report proposes amendments to the Basin Plan. There are a number of federal and state laws, regulations and policies that are specifically relevant to the Basin Planning process. This chapter summarizes these laws, regulations, and policies.

3.1 Legal Requirements for Establishing and Amending the Basin Plan

Water Code section 13240 authorizes the Regional Water Boards to formulate and adopt water quality control plans for all areas within their region. A Basin Plan is the basis for regulatory actions taken for water quality control. The Basin Plan is also used to satisfy parts of Section 303 of the Federal Clean Water Act (CWA), which requires states to adopt water quality standards. Basin Plans are adopted and amended by the Regional Water Boards through a structured process involving full public participation and state environmental review. Basin Plan amendments do not become effective until approved by the State Water Board and the Office of Administrative Law (OAL). U.S. Environmental Protection Agency (USEPA) approval is required for Basin Plan amendments that affect surface water quality standards. This Basin Plan amendment proposes changes to the existing water quality standards as well as the implementation of new standards.

A Basin Plan must consist of the following (Wat. Code § 13050.):

- beneficial uses to be protected,
- WQOs to protect those uses, and
- a program of implementation needed for achieving WQOs.

Regional Water Boards adopt and amend basin plans through a structured process involving peer review, public participation, and environmental review. Regional Water Boards must comply with CEQA (Pub. Res. Code., § 21000 et seq.) when amending their basin plans. The Secretary of Natural Resources has certified the basin planning process as exempt from the CEQA requirement to prepare an environmental impact report. (Pub. Res. Code, § 21080.5; Cal. Code Regs., tit. 14, § 15251, subd. (g).) Instead, State Water Board regulations on its exempt regulatory programs require the Regional Water Boards to prepare a written report and an accompanying CEQA Environmental Checklist and Determination with respect to Significant Environmental Impacts (CEQA Checklist) (Cal. Code Regs., tit. 23, § 3775 et seq.)

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The next sections detail the laws, regulations and policies that apply to Basin Planning and are relevant to the proposed amendments.

3.2 Legal Requirements for Establishing, Designating and Modifying Beneficial Uses

3.2.1 Federal Statutes and Regulations

The Federal Water Pollution Control Act (Clean Water Act, 33 U.S.C. § 1251 et seq.) is the primary federal law regulating the discharge of pollutants to navigable waterways. The Clean Water Act's primary purpose is to, "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (33 U.S.C., §1251) The Clean Water Act delegates to the states the primary duty of establishing water quality standards. (33 U.S.C., § 1313) Water quality standards are state laws that describe the desired condition of state waterbodies subject to the jurisdiction of the Clean Water Act, and consist of the designated uses of such waters and water quality criteria that are protective of such uses. State beneficial use designations must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes, including navigation. (40 C.F.R. § 131.10.)

Federal regulations require the protection of designated uses in all waters of the United States. Federal regulations establish special protections for the uses specified in Clean Water Act section 101(a)(2). Clean Water Act section 101(a)(2) states that it is a national goal that, wherever attainable, water quality should be sufficient "for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water." These uses are also referred to as "fishable/swimmable" uses.

Under 40 CFR section 131.10, subdivision (j), a state must conduct a "use attainability analysis" (defined in 40 CFR § 131.3, subd.(g).) whenever a state wishes to remove a designated fishable/swimmable use from a waterbody. 40 CFR section 131.10, subdivision (g) defines six circumstances where it would be appropriate for a state to remove a fishable/swimmable use.

3.2.2 State Statutes and Regulations

The existing and potential beneficial uses are defined by the Central Valley Water Board in Chapter II of the Basin Plan (Central Valley Water Board, 2016a). Chapter II, page II-1.00 of the Basin Plan states that,

> "Beneficial uses are critical to water quality management in California. State law defines beneficial uses of California's waters that may be protected against

quality degradation to include (and not be limited to) '...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves' (Water Code Section 13050(f))."

In addition, Water Code section 13241 requires that, "past, present, and probable future beneficial uses of water" be considered in establishing WQOs. The Basin Plan also emphasizes that, "[p]rotection and enhancement of existing and potential beneficial uses are primary goals of water quality planning."

Page II-1.00 of the Basin Plan describes several points that need to be considered in setting and protecting beneficial uses:

- *"All water quality problems can be stated in terms of whether there is water of sufficient quantity or quality to protect or enhance beneficial uses.*

- *Beneficial uses do not include all of the reasonable uses of water. For example, disposal of wastewaters is not included as a beneficial use. This is not to say that disposal of wastewaters is a prohibited use of waters of the State; it is merely a use which cannot be satisfied to the detriment of other beneficial uses. Similarly, the use of water for the dilution of salts is not a beneficial use although it may, in some cases, be a reasonable and desirable use of water."* [The finding and pronouncement that management of salt is an important consideration in the use of water is significant as it defines the policy of the Board to not exclude the management of salt within existing water supplies provided it is not done to the detriment of other beneficial uses.]

- *The protection and enhancement of beneficial uses require that certain quality and quantity objectives be met for surface and ground waters.*

- *Fish, plants, and other wildlife, as well as humans, use water beneficially.*

Beneficial use designation (and water quality objectives, see Chapter III of the Basin Plan) must be reviewed at least once during each three-year period for the purpose of modification as appropriate (40 CFR 131.20)."

3.2.3 State Water Board Sources of Drinking Water Policy (Resolution 88-63)

State Water Board Resolution 88-63, the Sources of Drinking Water Policy (*Sources of Drinking Water Policy*) establishes state policy that all waters are considered suitable or potentially suitable to support the MUN beneficial use, with certain exceptions.

The Basin Plan implements the *Sources of Drinking Water Policy* by assigning the MUN beneficial use to all water bodies that do not have their individual uses specifically listed in Table II-1. The *Sources of Drinking Water Policy* allows the Regional Water Boards to make exceptions to the MUN designation for surface and ground waters: 1) with total dissolved solids exceeding 3,000 mg/L (5,000 µS/cm EC); 2) with contamination that cannot reasonably be treated for domestic use; 3) where there is insufficient water supply for a single well to provide an average, sustained yield of 200 gallons per day; 4) in systems designed for wastewater collection or conveying or holding agricultural drainage; or 5) regulated as a geothermal energy producing source. Exceptions to the *Sources of Drinking Water Policy* may be made by amendment of water quality control plans. The *Sources of Drinking Water Policy* addresses only the designation of waters as sources of drinking water; it does not establish objectives for constituents that are protective of the designated MUN use.

3.3 Laws that Apply to the Establishment of Water Quality Objectives

3.3.1 Federal Statutes and Regulations

Federal regulations define water quality criteria to be, "… elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use." (40 C.F.R. § 131.3, subd. (b).) States must adopt water quality criteria to protect a waterbody's designated uses. Such criteria must be based on sound scientific rationale. (40 C.F.R. § 131.11.)

3.3.2 State Statutes, Regulations and Guidance

Water Code section 13050, subdivision (h), defines water quality objectives as "…the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area."

Pursuant to Water Code section 13241, when establishing water quality objectives, the Regional Water Board is required to consider:

(a) Past, present, and probable future beneficial uses of water;
(b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;
(c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;
(d) Economic considerations;

(e) The need for developing housing within the region;
(f) The need to develop and use recycled water

3.4 Laws that Apply to the Establishment of an Implementation Program in the Basin Plan

3.4.1 Federal Regulations and Guidance

Through Section 402, the Clean Water Act establishes a permitting system (the National Pollutant Discharge Eliminations System, or NPDES) that regulates the direct discharge of pollutants to surface waters of the United States. The USEPA has established regulations at 40 Code of Federal Regulations part 122 for the NPDES program. Individual states, including the State of California, may administer the federal NPDES Program, provided state laws meet the criteria established in 40 Code of Federal Regulations part 123.

40 Code of Federal Regulations section 122.44(d)(1)(ii) sets forth the criteria for establishing a procedure for determining whether a discharge has a reasonable potential to cause or contribute to a violation of water quality standards. It states, "When determining whether a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative or numeric criteria within a State water quality standard, the permitting authority shall use procedures which account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant or pollutant parameter in the effluent, the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity), and where appropriate, the dilution of the effluent in the receiving water." While the federal regulations do not contain explicit procedures to derive effluent limitations, USEPA has provided guidance (U.S. Environmental Protection Agency, 1991) that includes explicit procedures.

3.4.2 State Statues, Regulations, and Guidance

3.4.2.1 Water Code sections 13050 and 13242

Pursuant to Water Code section 13050, subdivision (j)(3), a basin plan amendment must include an implementation program to achieve water quality objectives. Water Code section 13242 requires that a program of implementation for achieving water quality objectives must include the following:

1) A description of the actions necessary to achieve the water quality objectives;
2) A time schedule; and
3) A description of monitoring and surveillance that must be undertaken to determine compliance with objectives.

3.4.2.2 Water Code section 106.3

In compliance with Water Code section 106.3, it is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.

3.5 Economic Review

California Law requires a consideration of economics when: (i) establishing water quality objectives (Wat. Code, § 13241. Subd. (d).); (ii) before implementing an agricultural water quality control program (Wat. Code, § 13141.); and (iii) when adopting an amendment that will require the installation of pollution control equipment or is a performance standard or treatment requirement (Pub. Resources Code, § 21159.).

3.5.1 Water Code section 13241

See the fourth factor (d) in section 3.3.2

3.5.2 Water Code section 13141

Water Code section 13141 states that, "prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of financing, shall be indicated in any regional water quality control plan." Section 1.2.1 describes the costs for implementing agricultural water quality control program in the no-action alternative. Section 1.2.1.3 describes the identification of potential sources of financing and the need to develop a comprehensive and regional financial strategy.

3.5.3 Public Resources Code section 21159

Public Resources Code section 21159 requires that an agency must perform "an environmental analysis of the reasonably foreseeable methods of compliance" for "…a rule or regulation that requires the installation of pollution control equipment or a performance standard or treatment requirement…The environmental analysis shall take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites."

3.6 Environmental Review – CEQA

The Central Valley Water Board, as a Lead Agency under the California Environmental Quality Act (CEQA), is responsible for evaluating all the potential environmental impacts that may occur due to changes made to the Basin Plan. (Pub. Res. Code, § 21000 et seq.) The Secretary of Resources has determined that the Central Valley Water Board's basin planning process qualifies as a certified regulatory program pursuant to Public

Resources Code section 21080.5 and California Code of Regulations, title 14, section 15251(g). This determination means that the Central Valley Water Board is exempt from the requirement to prepare an environmental impact report. Instead, this Staff Report and the Environmental Checklist provided in Appendix F satisfy the requirements of State Water Board's Regulations for Implementation of CEQA, Exempt Regulatory Programs, which are found at California Code of Regulations, title 23, section 3775 et seq.

3.7 Antidegradation Policy

The USEPA has established a federal antidegradation policy applicable to water quality programs in 40 CFR section 131.12 (*Federal Antidegradation Policy*). The State Water Resources Control Board has established an antidegradation policy for the State of California by adopting State Water Board Resolution 68-16, the Statement of Policy with Respect to Maintaining High Quality of Waters in California (*State Antidegradation Policy*). The Central Valley Water Board must ensure that its basin planning actions are consistent with the *Federal Antidegradation Policy* and the *State Antidegradation Policy*.

3.7.1 Federal Antidegradation Policy

The Federal Antidegradation Policy (40 CFR §131.12) states:

> "(a) The State shall develop and adopt a statewide antidegradation policy and identify the methods for implementing such policy pursuant to this subpart. The antidegradation policy and implementation methods shall, at a minimum, be consistent with the following:
>
> (1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.
>
> (2) Where the quality of the waters exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all

cost-effective and reasonable best management practices for nonpoint source control.

(3) Where high quality waters constitute an Outstanding National Resource Waters, such as waters with exceptional ecological, recreational or environmental assets, that water quality shall be maintained and protected.

(4) In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with section 316 of the Act."

3.7.2 State Antidegradation Policy

The*State Antidegradation Policy* states, in relevant part:

(1) Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

(2) Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

4 BENEFICIAL USES

One of the initial steps the LSJR Committee took while developing recommendations for salinity WQOs in the LSJR was undertaking a comprehensive evaluation of the beneficial uses in Reach 83. The goal of this evaluation was to determine whether the Basin Plan's current list of beneficial use designations in this stretch of the river was appropriate or needed additions, deletions and/or modifications (Lower San Joaquin River Committee, 2013a). Through this work, the committee, with assistance from its subcontractor, was able to identify all existing and potential beneficial uses for consideration in the development of WQOs in the LSJR, and further narrow the list to the ones that are most sensitive to salt (Larry Walker Associates (LWA), 2013).

This chapter describes the committee's review of the beneficial uses in the LSJR and summarizes its findings and recommendations.

4.1 Beneficial Uses in the Lower San Joaquin River

Chapter II of the Basin Plan defines different categories of beneficial uses that could be applied to surface waters in the Central Valley, including the San Joaquin River. A review of the Basin Plan was conducted to determine whether any of the presently designated beneficial uses for Reach 83 of the San Joaquin River needed to be de-designated, modified, or whether new designations needed to be applied. This was a required step prior to recommending appropriate salinity WQOs.

4.1.1 Current Basin Plan Designations for the Lower San Joaquin River

Existing (E) potential (P), and existing limited (L) beneficial uses which currently apply to surface waters of the Sacramento River and San Joaquin River Basins are presented in Table II-1 of the Basin Plan. The San Joaquin River on the valley floor, as defined in Table II-1 in the Basin Plan, includes four separate reaches extending from Friant Dam to Vernalis. The LSJR includes three of these four reaches and extends from the Mendota Dam to Vernalis. The project area for establishment of WQOs for salinity and boron includes only Reach 83, which is between the Mouth of the Merced River inflow and the Airport Way Bridge near Vernalis.

The beneficial uses that are designated by the Central Valley Water Board for the San Joaquin River are listed in Table II-1 of the Basin Plan. Beneficial uses designated for Reach 83 of the LSJR in the Basin Plan include:

- Potential Municipal and Domestic supply (MUN);
- Existing Agriculture Irrigation and Stock Watering (AGR);

- Existing Industrial Process Supply (PROC);
- Existing Contact Recreation (REC-1);
- Existing Non-contact Recreation (REC-2);
- Existing Warm Freshwater Habitat (WARM);
- Existing Warm and Cold Water Species Migration (MIGR);
- Existing Warm Water Spawning (SPWN - WARM); and
- Existing Wildlife Habitat (WILD).

4.1.2 Review of Beneficial Uses

To determine if conditions have changed since the original designations in 1975, the following review of beneficial uses of Reach 83 includes an evaluation of the existing beneficial uses listed in section 4.1.1 above and also considers the following unlisted beneficial uses:

- Industrial Service Supply (IND)
- Industrial Power Supply (POW)
- Commercial and Sport Fishing (COMM)
- Navigation (NAV)
- Cold Freshwater Habitat (COLD);
- Cold Water Spawning (SPWN - COLD)
- Preservation of Biological Habitats of Special Significance (BIOL)

4.1.2.1 Municipal and Domestic Supply (MUN)

Municipal and domestic use is designated as a potential beneficial use for Reach 83. The potential designation has been in existence since the original Basin Plan was adopted in 1975. Surveys of actual use were conducted in 1950, 1975 and again in 1985 and showed that no such uses or diversions were being made of the River for either municipal or domestic use. The State Water Board, in the report from the Technical Committee for WQ Order 85-1, did a complete review of beneficial uses on the San Joaquin River from the Salt Slough inflow (upstream of the Merced River Mouth) to Vernalis. The report noted that no municipal or domestic supply uses were being made, nor did any appear to exist or be likely to exist in the future. Therefore the State Water Board stated that the Central Valley Water Board should consider removing the MUN use designation from the San Joaquin River from the Salt Slough inflow (upstream of the Merced River Mouth) to Vernalis by amending the Basin Plan. Due to financial constraints and the need to deal with the higher priority selenium issue, the removal of the MUN beneficial use designation was never made by the Central Valley Water Board.

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In 1988, the State Water Board, pursuant to *Sources of Drinking Water Policy*, reconsidered the designation of MUN for all waters of the state. The *Sources of Drinking Water Policy* (see section10.3.3) required that all waters of the state be designated as either existing or potential MUN beneficial use unless they met one of the exemption criteria. None of the exemption criteria apply to Reach 83.

This review of beneficial uses, supported by the previous State Water Board report from the Technical Committee for WQ Order 85-1, indicates that it is unlikely that the MUN beneficial use would move from the present designation of "potential beneficial use" to an existing use in the forseeable future. The potential beneficial use has been listed for almost 40 years, and no entity has developed a municipal or domestic use on Reach 83, nor are any such plans being contemplated. The development of a municipal or domestic use would be unlikely under present conditions, as this reach of the river is fully appropriated, and it is unlikely that any new use would be permitted in the future without the transfer of water rights from another entity. There are no existing, pending, or anticipated water right permits for municipal or domestic use on Reach 83, and there are no pending or anticipated applications for such a use or transfer.

The LSJR from Friant Dam to Vernalis is highly regulated and releases of stored water to Reach 83 from the Merced River inflow to the Stanislaus River inflow are primarily operational releases for irrigation use and aquatic life protection. In addition, flow in this reach is made up of groundwater accretions from poor quality groundwater and agricultural return flows of varying quality. As a result, river water flow and quality in Reach 83 are highly variable, and thus of little or no potential to be a long-term municipal or domestic supply.

There is the expectation of new or increased flow requirements in Reach 83 due to the State Water Board reevaluation of the flow requirements to protect aquatic life and salmon migration into and through the Bay-Delta. This flow, however, is being designated for aquatic life protection and, thus, would not be available for diversion for other uses, including municipal and domestic supply.

There is also an expectation that increased flows will occur in Reach 83 as a result of the San Joaquin River Restoration Program, which is a program to re-water the San Joaquin River from below Friant Dam to the Merced River inflow. These flows, however, would not be available for re-diversion for other uses as they are designated in the settlement agreement for aquatic life protection above the Merced River inflow and may be available for re-diversion downstream of the Merced River inflow for recapture of water for the Friant portion of the federal Central Valley Project (CVP). It is also unlikely that any of the water in Reach 83 of the LSJR, even if water rights were

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obtained, would be available for diversion for municipal or domestic uses because, in a letter to the Stanislaus County Department of Environmental Resources (California Department of Health Services, 1996), the California Department of Public Health's Drinking Water Division stated the following: *"Our Department objects to possible consideration of the San Joaquin River as a domestic water supply source for new public water systems. Any and all available alternatives must be evaluated because we will not support issuance of a domestic water supply permit for the San Joaquin River."* This department (now a division of the State Water Board) regulates all public municipal and domestic water supply systems. Stanislaus County encompasses almost 95 percent of the LSJR in Reach 83.

4.1.2.2 Agricultural Use (AGR)

Agricultural use, which includes both irrigation and stock watering, is designated in Table II-1 of the Basin Plan as an existing beneficial use in Reach 83. A review of potential agricultural diversions and use was conducted along Reach 83 by the Central Valley Water Board (Central Valley Water Board, 1989). During this review, a total of 46 points of diversion for irrigation were identified in Reach 83. Based on a review of water right applications, permits and statements, these diversion points are capable of irrigating slightly over 50,000 acres. There are four major diverters in Reach 83:

1. West Stanislaus Irrigation District, which diverts irrigation water for approximately 21,666 acres;
2. Patterson Irrigation District, which diverts irrigation water for approximately 13,555 acres;
3. Twin Oaks Irrigation Company, which diverts irrigation water for approximately 2,550 acres; and
4. El Solyo Water District, which diverts irrigation water for approximately 3,780 acres.

These four diverters deliver water to over 90% of the land potentially irrigated from water diverted from Reach 83. This level of use shows that the AGR beneficial use is a major use in Reach 83 and will continue to be in the foreseeable future.

The AGR beneficial uses continues to be the dominant use made of the river and, therefore, there was no recommendation by the committee to change the present "existing" beneficial use designation.

4.1.2.3 Industrial Process Supply (PRO)

Industrial Process Supply (PROC) is designated as an existing beneficial use of Reach 83. Surveys of Reach 83 in 1950, 1975, and again in 1985 showed that no such uses or diversions were being made of the River for industrial process supply, although none

of these surveys confirmed whether incidental use is being made as part of agricultural harvest and processing.

There were originally two tallow plants along the river, but these went out of business prior to the development of the original Basin Plan in 1975. One of these former plants upstream of the mouth of the Merced River, was previously dewatered during development of the Friant Dam under the federal Central Valley Project.

Even though the beneficial use has been listed as “existing” for almost 40 years, the sites of these former tallow plants have either been removed or are abandoned with no entity or plan in the works to restore these sites for such a use. In addition, there are no known plans to develop new sites along the river and there are no water right permits or applications pending for industrial process supply use.

In addition, Reach 83 is highly regulated and made up primarily of operational releases for irrigation use, groundwater accretions from poor quality groundwater, and agricultural return flows of varying quality. Reach 83 flow and water quality are highly variable, thus not a potential constant industrial supply source. Although it was not recommended to remove the present “existing” use designation, users of the Basin Plan should be made aware that the likelihood of a consistent use of river water for Industrial Process Supply is low and that the only PROC uses in the foreseeable future are incidental uses as part of the agricultural harvest and processing associated with diversions for other agricultural uses.

4.1.2.4 Water Contact (REC-1) and Non-Contact Recreation (REC-2)

Reach 83 is a major local recreational site, including both contact and non-contact-type uses. Major uses on Reach 83 include, but are not limited to, swimming, wading, diving, boating, rafting, canoeing, and fishing. Because of the high temperatures in the summer time, Reach 83 is a magnet-type recreational area because of the presence of the water and the large shady riparian growth along the river’s edge.

Reach 83 is also a major area of indirect contact with the water, including many recreational activities that take place in and near the water where there is generally no body contact with water, nor any likelihood of ingestion of water. These include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities. These activities will continue due to presence of the San Joaquin River in an area of elevated temperatures.

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Both REC-1 and REC-2 uses are present and will remain strong within Reach 83 the LSJR. Therefore, there was no recommended change to the present "existing" beneficial use designation by the committee.

4.1.2.5 ***Warm and Cold Freshwater Habitat (WARM and COLD)***

Reach 83 supports a warm water ecosystem. The quality of the water supply must support, preserve and enhance aquatic habitats, vegetation, fish, or wildlife, including invertebrates. Normally a WARM water habitat implies resident species and does not include the short-term migration of anadromous species. This is supported by footnote (2) to Table II-1 of the Basin Plan. Numerous reports support the presence of resident warm water species, including those that are introduced species such as striped bass. Reach 83 is presently designated as a WARM water habitat. This designation should not be changed.

The WARM characteristic of Reach 83, however, does not support cold water ecosystems (COLD) as the substrate does not support optimum habitat and environment for egg development (pre-spawning), spawning, juvenile development and rearing and migration of smolts or young. Several of the tributaries to Reach 83 support COLD uses, which are markedly different from those that support WARM-water species. At present Reach 83 is not designated as a COLD-water habitat. It was recommended to continue to not list this reach as a COLD-water habitat.

4.1.2.6 ***Migration of Aquatic Organisms (MIGR)***

In California, the migratory fish species are principally steelhead and rainbow trout (*Oncorhynchus mykiss gairdneri*), white sturgeon *Acipenser transmontanus*), American Shad (*Alosa sapidissima*), and Chinook salmon (*Oncorhynchus tshawytscha*). All of these species could potentially use Reach 83 since the tributaries to Reach 83 provide habitat for both cold and warm water anadromous species. It was recommended by the committee that both the cold and warm-water migration beneficial use be maintained for Reach 83.

Another species known to migrate is Striped Bass (*Morone saxatilis*). Striped bass generally reside in estuaries and in seawater during a portion of their adult phase and migrate in the spring to large rivers to spawn. Striped bass have been identified in the San Joaquin River, including in Reach 83, however, it is unknown if they currently spawn within the Reach (see discussion under Warm-Water Spawning)..

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Striped bass are a non-native predator that may impact salmon and other California native anadromous fish. The Warm Water Migration (MIGR-WARM) designation in Table II-1 of the Basin Plan, footnote 3 reads: Striped bass, sturgeon and shad. Although outside the scope of the current project, the LSJR Committee recommended that the Central Valley Water Board consider modifying this footnote in the future to remove the phrase “striped bass” to focus on native species over introduced species, although no change is recommended at this time.

The Cold-Water Migration (MIGR-COLD) designation in Table II-1 of the Basin Plan, footnote 4 reads: Salmon and steelhead. This footnote does apply to Reach 83 and reflects current information that shows both steelhead and salmon use Reach 83 on their migration routes to the tributaries of Reach 83. However, footnote 4 may not be correct for those reaches upstream of the Merced River inflow. Table II-1 of the Basin Plan shows the three reaches of the San Joaquin River upstream of the Merced River confluence (Reach 69 Friant Dam to Mendota Pool, Reach 70 Mendota Dam to Sack Dam and Reach 71 Sack Dam to Mouth of Merced River) as critical habitat for steelhead and this is inconsistent with finding of the National Marine Fisheries Service of the National Oceanographic and Atmospheric Administration (National Oceanographic and Atmospheric Administration, 2005). NOAA concluded in 2005 that the upstream boundary for critical habitat in the San Joaquin River is at the Merced River confluence, due in part to the diversion of natural headwaters out of the San Joaquin Basin thru the Friant-Kern Canal.

The committee felt that showing steelhead in footnote 4 of Table II-1 of the Basin Plan may assert that the species is present and that habitat in the San Joaquin River from Friant Dam to Merced River confluence is critical habitat. Although not part of the present project, the committee recommended that the Central Valley Water Board consider modifying this footnote in the future to better describe the habitat of steelhead in the San Joaquin River.

4.1.2.7 Warm-Water Spawning, Reproduction and/or Early Development (SPWN-Warm)

Reach 83 is an environment favorable to spawning of a variety of warm-water species. Warm water habitat, suitable water temperatures, and substrate makes this reach of the river generally suitable for spawning of many warm-water species that are present in the river reach. Therefore, warm water SPWN beneficial use is an existing use and the designation in Table II-1 in the Basin Plan should not be modified.

Warm-Water Spawning (SPWN-WARM) designation in Table II-1 of the Basin Plan, footnote 3 reads: Striped bass, sturgeon and shad. Striped bass generally reside in estuaries and in seawater during a portion of their adult phase and migrate in the spring

to large rivers to spawn. Striped bass have been identified in the San Joaquin River, including in Reach 83, however, it is unlikely that their presence was due to migration for spawning purposes. Successful spawning of striped bass is dependent on the interaction of three factors: temperature, flow, and salinity. Striped bass generally prefer to spawn in large rivers that have optimum spawning flows. Sufficient flow is required to maintain eggs and larvae suspended, but not too high that eggs are washed into quiet waters. It is also possible that the higher salinity levels in Reach 83 could impede striped bass spawning, but additional research would be needed to confirm this. Because of the narrow tolerance of striped bass to these three factors, there are only two principal spawning areas and these are in the Bay-Delta. They are the Sacramento River from Isleton to Butte City and the San Joaquin River and its sloughs from Venice Island to Antioch (Moyle, 1976).

A review of the Bay-Delta Plan in 1991, confirmed the salinity objective of 0.44 mmhos/cm for the period April 1 to May 31 (0.55 mmhos/cm during dry and critical years) at Prisoners Point on Venice Island to delimit the upstream end of the San Joaquin River striped bass spawning area (State Water Resources Control Board, 1991). The objective was reviewed and retained along with a water quality objective of 1.0 mmhos/cm during the same time period upstream of the spawning area in the LSJR at Vernalis. The Bay-Delta Plan recognizes that the higher salinity level at Vernalis creates a salinity barrier to spawning except during wetter years when concentrations may remain below 0.44 mmhos/cm during April and May.

In addition, striped bass are a non-native predator that may impact salmon and other anadromous fish. As part of the efforts to meet the goals of the San Joaquin River Restoration Program to increase natural production of anadromous fish, fisheries agencies are currently evaluating optimum management of fish species including striped bass (Gordus, 2017). The LSJR Committee recommended that the Central Valley Water Board consider modifying this footnote in the future to remove the phrase “striped bass”, however, no change is proposed at this time. Recommendations to modify flows or lower salinity levels to enhance striped bass spawning would need further study and would be dependent on the findings from the fisheries agencies.

4.1.2.8 ***Cold-Water Spawning, Reproduction and/or Early Development (SPWN-Cold)***

Cold-water spawning is not presently designated as a beneficial use for Reach 83 in Table II-1 in the Basin Plan. This is the result of the river being on the Valley floor and lacking substrate and conditions, including water temperatures, which would be suitable for cold-water spawning. It is also unlikely that these conditions would change in the foreseeable future as climate change models presently show that the San Joaquin River

and the San Joaquin River Basin will be warmer in the future ((U.S. Bureau of Reclamation, 2014). No change to the present non-designation was recommended.

4.1.2.9 ***Wildlife Habitat (WILD) and Biological Habitats for Special Significance (BIOL)***

The large variation in river flow in the LSJR has resulted in a large river flood plain that is constricted between flood control levees. This area, however, has become a magnet for wildlife as the river has a continuous flow during most years. The riparian corridor has become fairly mature in vegetation and provides considerable habitat for terrestrial, avian and other terrestrial organisms, including invertebrates. The changes in flow regime being considered by the State Water Board may enhance and support this riparian corridor.

WILD is presently a designated beneficial use for Reach 83 in Table II-1 in the Basin Plan. This use is not expected to change in the foreseeable future and there was no recommendation to modify or change this beneficial use designation.

An increasing wildlife use of Reach 83 may occur with the future development of the San Joaquin River National Wildlife Refuge on what was the Faith Ranch. The U.S. Fish and Wildlife Service purchased a conservation easement on most of the Faith Ranch in 1997. At that time, the Faith Ranch was owned by Robert Gallo. The place of use designation for the RJ Gallo statement of water use (Application S014002) now shows that part of the San Joaquin River National Wildlife Refuge is included in the place of use.

Because of the expanding use of water on the San Joaquin River National Wildlife Refuge and the need to protect critical riparian habitat, it was recommended that the Central Valley Water Board consider a new beneficial use of BIOL be designated for Reach 83 in Table II-1 in a future Basin Plan amendment. The present beneficial use definition for Preservation of Biological Habitats of Special Significance (BIOL) serves and describes the uses that need to be protected. The present definition of “Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection” serves this need.

4.1.2.10 ***Industrial Service Supply (IND)***

There are no known or planned industrial service supply uses foreseen for Reach 83. Therefore, it was not recommended for inclusion as a “potential” or “existing” beneficial use.

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4.1.2.11 ***Industrial Power Supply (POW)***

There are no known or planned power uses foreseen for Reach 83 and it is unlikely that any will be developed in the foreseeable future due to the variable flow and quality, especially sediment quality. Therefore, it was not recommended for inclusion as a "potential" or "existing" beneficial use.

4.1.2.12 ***Commercial and Sport Fishing (COMM)***

The definition in the Basin Plan for this beneficial use is "Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes". Sport and recreational fishing is widespread along Reach 83. This use has been present for several decades and, as urbanization of the areas to the east and west of the river continues, this use can be expected to increase as well. The quality of this use may vary or be limited by flow variations, including low-flow conditions, but it will not preclude the attainment of this use. Based on this observation, it was recommended that the Central Valley Water Board add the existing sport and recreational beneficial (COMM) use be added to Table II-1 in a future Basin Plan amendment for Reach 83.

4.1.2.13 ***Navigation (NAV)***

The present definition in the basin plan for the NAV beneficial use states that it is intended for "Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels". Due to the nature of the San Joaquin River, including depth, changes in flow, and shifting bottom material, the use of the river in Reach 83 for any type of shipping, travel or transportation will be severely limited. The continued use of the river for recreational boating, including fishing will continue but will always be limited in size and depth of draw of the water craft used. These latter types of use are covered under the REC-1 and REC-2 beneficial use designations in Table II-1 of the Basin Plan. It is unlikely that larger commercial or transportation-type vessels will be utilizing Reach 83 in the foreseeable future. The NAV beneficial use is not presently designated in Table II-1 of the Basin Plan and it was not recommended to modify the present non-listing.

4.1.3 **Final Recommendation for Beneficial Uses in the LSJR**

In summary, the LSJR committee found that the majority of current beneficial use designations listed in the Basin Plan were appropriate for Reach 83. While the committee did consider options to add and/or provide clarifying language to several of the beneficial uses like Commercial and Sport Fishing (COMM) and Industrial Process Supply (PROC), a final recommendation was made that no changes to the Basin Plan's designations were needed as part of the current project to establish salinity objectives.

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The reasons for this final recommendation were provided as follows:

1. The changes were not essential to the immediate interests of the committee to establish salinity objectives in the Reach 83.
2. The technical and CEQA information required to support such an effort was not available or scoped, and
3. The time required to develop such information was not consistent with the desired time schedule associated with the current effort to adopt salinity objectives for the LSJR

4.2 Identification of the Most Salt-sensitive Beneficial Uses

With a final recommendation to maintain the Basin Plan's current list of designated uses in Reach 83, the LSJR committee's next step in the development of appropriate salinity objectives was to identify the most salt sensitive beneficial uses. Aquatic life uses are typically identified as the most sensitive uses when considering beneficial uses designations for surface waters. However, a literature review commissioned by CV-SALTS in 2010 examined salinity and nutrient water quality criteria assigned to beneficial uses at the state, national and international levels and concluded that irrigation and municipal water supply beneficial uses generally have the lowest limits (Kennedy/Jenks Consultants, 2010). Nonetheless, that report recommended that the "Water quality data gaps related to beneficial uses other than agriculture and municipal need to be assessed for relevance." (Kennedy/Jenks Consultants, 2010, page 6-1, recommendation number 3).

Between May 2010 and the end of 2015, the LSJR Committee conducted reviews of beneficial uses and water quality data for the LSJR, including white papers on Aquatic Life (Buchwalter, David, Ph.D., North Carolina State University, 2014) and Stock Watering sensitivity to salinity (Kennedy/Jenks Consultants, 2013). Based on studies evaluated in the white papers, agricultural irrigation supply appears the most sensitive to salinity, followed by municipal and domestic supply.

Further review of potential salinity limitations on striped bass, sturgeon and American shad spawning (noted as an existing use in Reach 83), identified limitation to striped bass at salinity levels greater than 440 umhos/cm EC during April and May (State Water Resources Control Board, 1991). Sturgeon and American shad have broader tolerance. (Klimley, A. Peter, et al., 2015) (Stier, 1985). As discussed in more detail in the Warm-Water Spawning beneficial use review, striped bass spawning in Reach 83 have been small runs limited to the wettest Water Years. The establishment of a 1,000 uS/cm EC WQO at Vernalis by the State Water Board in 1991 that applies during April and May,

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effectively created a salinity barrier to stiped bass migration and spawning into Reach 83 (State Water Resources Control Board, 1991).

Irrigation has historically been considered the most sensitive beneficial use for salt and boron in Reach 83 of the LSJR. The establishment of WQOs for salinity at the Airport Way Bridge near Vernalis (an EC objective of 700 µS/cm during the irrigation season and 1000 µS/cm during the non-irrigation season) for protection of Southern Bay-Delta agriculture is an example of this. However, the salt tolerance of crops varies between different crops and requirements may change throughout the growing season, so careful consideration must be given to which salt-sensitive crops require protection for the AGR beneficial use in the LSJR Basin.

Water that is used for municipal and domestic supply can also be a driving force in establishment of salinity criteria in the Central Valley region. Water from Reach 83 of the LSJR flows into the Bay-Delta, which provides drinking water to over 22 million people in California. The Basin Plans identify the primary and secondary Maximum Contaminant Levels (MCLs) specified in Title 22 of the California Code of Regulations, which were developed for the protection of potable water at the tap after receiving conventional treatment, as the appropriate WQOs to protect the MUN use, including its potential use. Table 64449-B in Title 22 of the California Code of Regulations contains consumer acceptance contaminant level ranges for a number of salinity constituents. For specific conductivity, the table contains a recommended value of 900 µS/cm,an upper value of 1600 µS/cm and a short-term value of 2200 µS/cm.

The next chapter provides an in-depth review of how protection of the MUN and AGR beneficial uses were considered during the development of salinity objectives in Reach 83 of the LSJR.

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5 DEVELOPMENT OF WATER QUALITY OBJECTIVES

Water quality objectives (WQOs) adopted by the Central Valley Water Board must ensure the reasonable protection of designated beneficial uses and the prevention of nuisance. The Lower San Joaquin River (LSJR) Committee worked collaboratively with Board staff to identify water quality criteria for consideration as proposed WQOs. The Central Valey Water Board staff is proposing salinity WQO for the LSJR. If adopted, the objectives would be forwarded to the State Water Resources Control Board, State Office of Administrative Law, and US EPA for approval. If approved by these agencies, the objectives would be incorporated into the Basin Plan.

The previous chapter recognized AGR and MUN as the most salt-sensitive beneficial uses in the LSJR. This chapter first describes the selection process that identified electrical conductivity[5] (EC) as the appropriate salinity constituent to protect AGR and MUN. Next, the chapter describes how alternative EC criteria for consideration as WQOs were developed. The chapter concludes with an evaluation of the EC alternatives using established selection criteria and regulatory mandates to substantiate the selection of the preferred project alternative, including consideration of Water Code section 13241 factors. See Chapter 3 for more information on the federal and state laws and policies pertinent to the establishment of WQOs.

5.1 Selection of the Appropriate Salinity Constituent

5.1.1 Evaluation of Potential Salinity Constituents

The LSJR (LSJR) Committee reviewed and compiled salinity criteria, guidelines, and proposed protective values identified in several beneficial use source documents[6] commissioned by CV-SALTS. The Committee presented its findings in the following document prepared by Larry Walker Associates, dated November 12, 2014, and titled *Final Memorandum –Summary of Work Completed: Tasks 2, 3, and 8b* (Larry Walker Associates (LWA), 2014d).

Eleven salinity constituents were reviewed and criteria compiled and are presented in Table 5-1. Bicarbonate was the only salinity constituent for which only a single potential criterion value was identified. Also, no values were identified for potassium and carbonate. As shown in Table 5-1, numeric ranges for the following nine (9) salinity constituents were identified:

- Electrical conductivity (EC),

[5] An EC measurement made or corrected to 25 °C is equivalent to specific conductance. Subsequent references to EC in this document shall be assumed to be equivalent to specific conductance.

[6] CV-SALTS Beneficial Use Source documents include:

1.1 CDM Salinity Effects on MUN-Related Uses of Water, July 2012.
1.2 CDM Salinity Effects on AGR Irrigation-Related Uses of Water, August 2012.
1.3 Kennedy/Jenks Consultants Salt and Nutrients: Literature Review for Stock Watering Water, Final Report, 20 May 2013.
1.4 Aquatic Life Study Final Report January 6, 2014, prepared by Dr. David Buchwalter, Ph.D.

- Total dissolved solids (TDS),
- Sodium,
- Magnesium,
- Calcium,
- Bicarbonate,
- Chloride,
- Sulfate, and
- Boron.

These numeric ranges had been developed for the protection of the following beneficial uses: municipal drinking water, irrigation supply water, stock watering, and aquatic life. Proposed protective numeric values found in peer-reviewed journal articles that have not ever been used to regulate surface water quality were not included in Table 5-1, with the following exceptions:

1. EC and TDS for AGR (irrigation) beneficial use-related proposed protective values associated with, derived from, or informing the work of Dr. Glenn J. Hoffman (Hoffman, Glenn J., 2010); and
2. All constituents except potassium, carbonate and bicarbonate for AGR (stock watering) beneficial use-related proposed protective values suggested by (Kennedy/Jenks Consultants, 2013).

5.1.2 Selection of Electrical Conductivity for Development of Water Quality Objectives

The preliminary ranges of potential salinity criteria identified in Table 5-1 were reviewed against state and federal regulations including the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) (Central Valley Water Board, 2016a), the *Sources of Drinking Water Policy*, state and federal drinking water regulations, and other state and federal requirements relevant to the two most salinity-sensitive uses, drinking water and agricultural irrigation uses, as well as stock drinking water and aquatic life protection.

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Table 5-1 Preliminary Range of Potential Salinity Criteria for Reach 83[1] by Beneficial Use.

Beneficial Use	EC[2]	TDS	Sodium	Magnesium	Calcium	Potassium	Carbonate	Bicarbonate	Chloride	Sulfate	Boron[3]
	dS/m	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MUN	0.9 - 1.6 (2.2 short-term)	500 - 1000	100 - 200	---	---	---	---	---	250 - 500	250 - 500	---
AGR (Irrigation)	1.01 - 1.55	450 - 961	69 - 115	---	---	---	---	90	106 - 178	---	
AGR (Stock Water)	1.5 - 4.0	500 - 2000	50 - 2000	250 - 500	500 - 1000	---	---	---	250 - 1500	250 - 1000	5
PROC	---	---	---	---	---	---	---	---	---	---	---
IND	---	---	---	---	---	---	---	---	---	---	---
POW	---	---	---	---	---	---	---	---	---	---	---
REC-1 (Contact)	---	---	---	---	---	---	---	---	---	---	---
REC-2 (Non-contact)	---	---	---	---	---	---	---	---	---	---	---
WARM	---	---	---	---	---	---	---	---	230	124	1.13
COLD	---	---	---	---	---	---	---	---	230	124	1.13
MIGR-WARM	---	---	---	---	---	---	---	---	*	*	*
MIGR-COLD	---	---	---	---	---	---	---	---	**	**	**
SPWN-WARM	---	---	---	---	---	---	---	---	*	*	*
SPWN-COLD	---	---	---	---	---	---	---	---	**	**	**
WILD	---	---	---	---	---	---	---	---	---	---	---
NAV	---	---	---	---	---	---	---	---	---	---	---

- Reach 83 is defined as that segment of the San Joaquin River from the mouth of the Merced River to Vernalis.
- Seasonal EC WQOs for the LSJR at Vernalis (bottom of Reach 83) to protect the AGR (irrigation) beneficial use:

Apr 1 - Aug 31: 700 µS/cm as a 30-day running average.
Sep 1 - Mar 31: 1,000 µS/cm as a 30-day running average.

- Seasonal boron objectives for the protection of the AGR (irrigation) beneficial in Reach 83 are:

Irrigation season (Mar 15-Sep 15): 0.8 mg/L maximum monthly average and 2.0 mg/L maximum single sample concentration.
Non-irrigation season (Sep 16-Mar 14): 1.0 mg/L maximum monthly average and 2.6 mg/L maximum single sample concentration.
Critically Dry Water Years (both seasons): 1.3 mg/L maximum monthly average and 2.6 mg/L maximum single sample concentration. Sep 1 - Mar 31: 1.0 dS/m as a 30-day running average.

Symbols:

* = Used to denote that salinity criteria for protection of the WARM beneficial use would also be protective of the MIGR WARM and SPWN WARM beneficial uses.

** = Used to denote that a salinity criteria for protection of the COLD beneficial use would also be protective of the MIGR COLD and SPWN COLD beneficial uses.

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The LSJR Committee evaluated several documents, prepared for AGR and MUN beneficial use, on behalf of the CV-SALTS Technical Advisory Committee that contained potentially applicable criteria that might be protective of the AGR and MUN Beneficial Uses. Table 5-1 summarizes the criteria that could reasonably be considered as candidate parameters for further evaluation as WQOs. The Committee's evaluations, findings, and references for the Beneficial Use documents are presented in the LWA report titled *Development of a Basin Plan Amendment for Salt and Boron in the Lower San Joaquin River (LSJR) Task #4 – Implementation Planning for Proposed Salinity Objectives* (Larry Walker Associates (LWA), 2015a).

The LSJR Committee found that the MUN criteria for sodium, chloride and sulfate are at or below the stock water criteria and already incorporated as WQOs in the Basin Plans. Also, background concentrations of magnesium, calcium and bicarbonate in the LSJR are below the irrigation and stock watering criteria noted. Finally, boron WQOs already exist for the LSJR and are lower than the criteria for aquatic life.

Therefore, the LSJR Committee found that EC and TDS were constituents of salinity that still required numeric salinity WQOs. Furthermore, the Committee determined that EC could be used as a surrogate for both boron and TDS. Data from the Central Valley Water Board's water quality database collected from the LSJR at the Airport Way Bridge near Vernalis had been used to develop a linear correlation between EC and boron during development of the Control Plan amended to the Basin Plan in September 2004 (Central Valley Water Board, 2004). The regression equation obtained from that analysis was used to calculate the expected boron concentration from predicted EC of the LSJR at the Airport Way Bridge. Similarly, it was determined that TDS concentrations could be estimated using site-specific linear corrections of EC and TDS after the methodology employed by the Central Valley Water Board.

Using the relationships between EC and TDS, and EC and boron, it is possible to use EC to estimate concentrations for TDS and boron. Measured EC levels can be translated into estimated TDS and boron concentrations that can then be compared, for compliance purposes. For this reason, TDS and boron were not considered further as direct candidates for salinity parameters used to protect the AGR beneficial use in Reach 83. The LSJR Committee decided to select EC as the candidate salinity water quality criterion to be evaluated further for salinity WQOs in Reach 83 of the LSJR.

5.2 Determination of Potential EC Criteria

Six factors identified in Water Code section 13241 must be considered when developing WQOs. The first factor pertains to past, present, and probable future beneficial uses of the

water. The Beneficial Use chapter of this staff report (Chapter 4) identified the existing AGR and potential MUN uses as the most appropriate to evaluate to develop reasonably protective salinity WQOs in Reach 83. The previous sections of this chapter document the LSJR Committee's decision to choose EC as the best criterion for development of WQOs for Reach 83. Next, the Committee determined EC values that would be protective of these uses.

5.2.1 **Irrigated Agriculture**

As described in Chapter 1 (Section 1.2.1), the initial effort to establish WQOs protective of irrigated agriculture in the LSJR was conducted by Central Valley Water Board staff, from 2006 to 2010. In 2010, the project was turned over to the LSJR Committee for additional policy and technical work needed to inform recommendations for a Basin Plan Amendment to establish salinity objectives in the LSJR. The following sections describe these efforts in more detail.

*5.2.1.1 **Initial Crop Salt Tolerance Evaluations (2006-2010)***

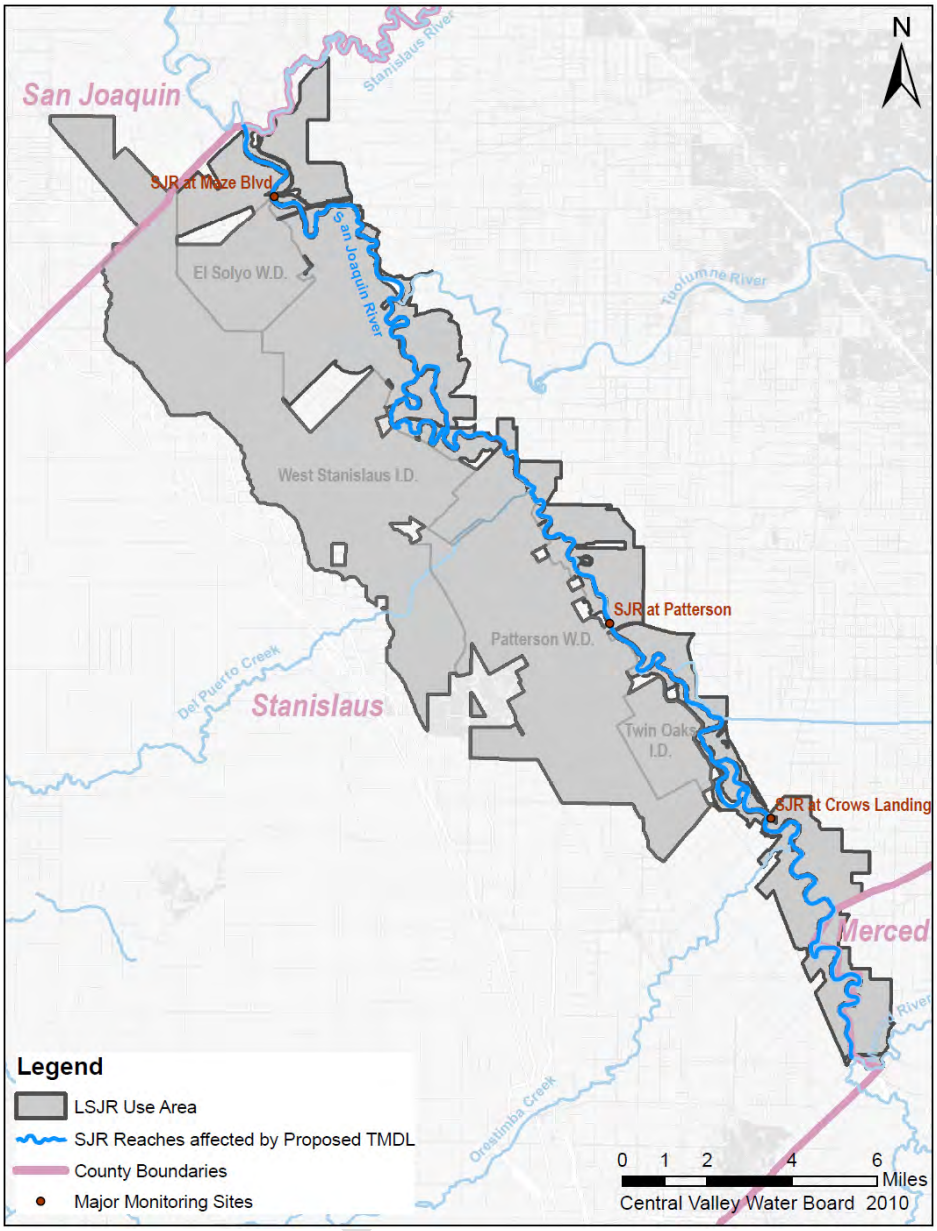
In 2010, prior to the formation of the LSJR Committee, Central Valley Water Board staff released the draft report titled *Salt Tolerance of Crops in the Lower San Joaquin River (Merced to Stanislaus River Reaches)* (Salt Tolerance Report) for public review and comment (Central Valley Water Board, 2010b). The report documented the staff's use of the Hoffman model to estimate irrigation-water salinity concentrations protective of irrigated agriculture in the LSJR Irrigation Use Area. Previously, Dr. Glenn J. Hoffman, on behalf of the State Water Board, had developed this model for estimating EC values protective of salt-sensitive crops grown in the Southern Sacramento-San Joaquin Delta (Southern Delta) (Hoffman, 2010). Tailored to information available for the LSJR Irrigation Use Area, Central Valley Water Board staff followed the technical and formatting approach used by Dr. Hoffman in the Southern Delta to calculate EC values protective of salt sensitive crops irrigated with LSJR water.

The draft Salt Tolerance Report identified the LSJR Irrigation Use Area, irrigated all or in part by water from the LSJR. The area, shown highlighted in grey on Figure 5-1, extends from the mouth of the Merced River at the southeastern end of the use area to San Joaquin County and the mouth of the Stanislaus River area at the northwestern end. The report utilized the California Department of Water Resources (DWR) land use surveys conducted in Stanislaus and San Joaquin Counties during the 1990s and 2000s. Staff accessed these surveys through the DWR website in October 2009 (California Department of Water Resources, 2009).

The draft Salt Tolerance Report presented the areal extent of each commercially important crop grown in the Irrigation Use Area that occupied more than one percent of the irrigated acreage. The three most salt sensitive crops were identified: bean, which was the most sensitive, as well as alfalfa and almonds. The report proposed protective salinity thresholds for each, developed through a series of crop tolerance modeling runs which assumed 100 percent crop-yield protection. Dry beans were estimated to occupy approximately 22 percent of the Irrigation Use Area in the 1990s and approximately 12 percent in the 2000s; alfalfa

approximately 15 and 19 percent in the 1990s and 2000s, respectively; and almonds approximately 4 and 9 percent in the 1990s and 2000s, respectively.

Figure 5-1 Map of LSJR Irrigation Use Area and monitoring stations.



The report also presented Hoffman model results under a range of conditions by varying some of the model parameters (such as leaching faction and annual rainfall). Staff ran the model multiple times for dry beans, alfalfa, and almonds over a range of EC values from 500 to 2,000 µS/cm. For the dry bean model runs, the leaching fraction ranged from 15 to 25 percent, for alfalfa runs from 7 to 25 percent, and for almond runs from 10 to 20 percent. The results were presented with the assumption that 100 percent yields would be necessary during the driest 5th

percentile of historic annual rainfall years. Full explanations of the 2010 modeling runs are presented in the draft Salt Tolerance Report (Central Valley Water Board, 2010a).
In March 2010 as part of the public comment process, the Central Valley Water Board staff presented the draft of the Salt Tolerance Report to a joint meeting of CV- SALTS Executive and Technical Advisory Committees. Following the meeting, and a public review and comment period, staff incorporated some of the minor comments received into a June 2010 revised draft Salt Tolerance Report and posted it on the Central Valley Water Board internet site for public review (Central Valley Water Board, 2010b). Subsequently, responsibility for addressing the remaining substantive comments was transferred to the LSJR Committee.

*5.2.1.2 **LSJR Committee Efforts***

After the LSJR Committee took lead of the project, it evaluated the public comments on the draft Salt Tolerance Report and provided the Central Valley Water Board staff with responses to comments (Larry Walker Associates (LWA), 2014b). Also, the Committee developed a work plan for the development of a Basin Plan Amendment for establishing salinity objectives in the LSJR (Lower San Joaquin River Committee, 2012). The recommendations included the identification of EC water quality criteria using of a soil salinity model and the incorporation of additional scientific data and new policies. The LSJR Committee agreed that a soil salinity model could estimate the EC values that growers require to prevent unacceptable salinity impact to crops, recognizing that acceptable values can vary during the growing season, and may be less important than availability of water during prolonged dry periods lasting several years. The additional scientific data that was needed to updated the model included the results of a crop acreage survey of the Irrigation Use Area conducted by the Committee in 2013 and 2014 (East and West Stanislaus Resource Conservation Districts, 2014), which is documented in Table 5-2.

The committee debated the transient and steady state models available to determine resulting soil salinity related to quality of irrigation supply water, and recognized the general state of flux of these models. Although it was argued that transient models could be more accurate, it was recognized that a peer-reviewed transient model was not available. The LSJR Committee acknowledged that Dr. Glenn J. Hoffman's steady-state model had been peer-reviewed and successfully used for the State Water Board to inform decisions regarding salinity WQOs in the Southern Delta.

In 2013, the LSJR Committee decided that the Hoffman model was the best tool to develop potential EC water quality criteria. As described in the previous section, in order to model soil water salinity in the crop root zone, Hoffman model parameters must be selected. These parameters include: the crops most sensitive to salinity, leaching fractions representative of irrigation practices, the appropriate minimum annual precipitation, and acceptable crop yields.

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5.2.1.3 ***Policies to Inform Hoffman Model Parameters***

To inform the decisions needed for the different Hoffman model parameters, the LSJR Committee worked with local growers to develop policies that could be translated into specific values. The steps used to identify these parameter values are described below.

5.2.1.3.1 Crops Most Sensitive to Salinity and in Need of Protection

The LSJR Committee decided that salt-sensitive crops that are relatively rare should not drive analyses that will inform AGR thresholds. Instead, consideration should be given to salt-sensitive crops that make up greater than 5 percent of the commercial acreage in an irrigation use study area. This value was deemed appropriate to encompass "common crops" that are sufficiently widespread in a study area

5.2.1.3.2 Identification of Representative Leaching Fraction

To the extent practicable, leaching fractions should be informed by field observations of actual practices. The model should assume fractions that are representative of the most conservative (i.e. lowest leaching fraction) condition that is widely represented in the study area. The LSJR Committee decided that the best means of determining representative leaching fractions, and determining how to best represent realistic irrigation methods, was to consult directly with irrigators in the Irrigation Use Area. During several LSJR Committee meetings, irrigation stakeholders representing major water agencies agreed that 15 percent is a reasonable default assumption.

5.2.1.3.3 Minimum Precipitation

The LSJR Committee evaluated different minimum precipitation parameter values by reviewing historic precipitation data in the San Joaquin Basin. The 5th percentile of the driest historic annual precipitation measured in the 1952 through the 2013 Water Years was calculated to be 6.1 inches. Rainfall in three (3) Water Years of the 61 years selected for modeling was below the 5th percentile: 1976 had 4.3 inches, 1977 had 5.7 inches, and 2007 had 4.3 inches. The LSJR Committee determined that using the 5th percentile rainfall years was sufficiently conservative for the LSJR Irrigation Use Area.

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Table 5-2 Summary of Irrigated Crop Surveys in the LSJR Irrigation Use Area.

Crop	Salt Tolerance[1]	Salinity Threshold[2] (TDS mg/L)	acreage			percentage of acreage		
			1990s Surveys	2000s Surveys	2013-2014 Survey	1990s Surveys	2000s Surveys	2013-2014 Survey
Almonds	S	752	2,091	4,343	13,497	3.65%	8.58%	28.91%
Apples	S	unknown	92	53	81	0.16%	0.10%	0.17%
Apricots	S	772	4,779	2,776	1,242	8.34%	5.48%	2.66%
Cherries	S	-	372	207		0.65%	0.41%	-
Eucalyptus	MT	-	6	-		0.01%	-	-
Figs	MT	-	-	-		-	-	-
Grapefruit	S	-	-	-		-	-	-
Kiwis	S	-	-	-		-	-	-
Lemons	S	-	-	-		-	-	-
Olives	T	-	-	-		-	-	-
Oranges	S	-	-	-		-	-	-
Peaches/Nectarines	S	827	21	345	213	0.04%	0.68%	0.46%
Pears	S	-	-	-		-	-	-
Pistachios	MS	unknown	16	31	5	0.03%	0.06%	0.01%
Plums	MS	-	150	34		0.26%	0.07%	-
Prunes	MS	-	-	33		-	0.07%	-
Walnuts	S	unknown	1,902	2,338	3,390	3.32%	4.62%	7.26%
Misc. Deciduous Fruits & Nuts	S	-	-	44		-	0.09%	-
Misc. Subtropical Fruits	S	-	-	-		-	-	-
Unspecified Deciduous Fruits & Nuts	S	-	-	-		-	-	-
Castor Beans	S	-	-	3,019		-	5.96%	-
Corn	MS	1,056	5,592	318	4,416	9.76%	0.63%	9.46%
Cotton	T	-	-	16		-	0.03%	-
Dry Beans	S	539	12,623	5,893	1,400	22.03%	11.64%	3.00%
Flax	MS	-	-	-		-	-	-
Safflower	MT	-	65	-		0.11%	-	-
Sorghum	MT	-	-	-		-	-	-
Sudan	MT	-	69	613		0.12%	1.21%	-
Sugar Beets	T	-	-	-		-	-	-
Sunflowers	MT	-	-	-		-	-	-
Unspecified Field Crops	MT	-	1,305	486		2.28%	0.96%	-
Barley	T	-	-	-		-	-	-

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Table 5-2 (continued). Summary of Irrigated Crop Surveys in the LSJR Irrigation Use Area.

Crop	Salt Tolerance[1]	Salinity Threshold[2] (TDS mg/L)	acreage			percentage of acreage		
			1990s Surveys	2000s Surveys	2013-2014 Survey	1990s Surveys	2000s Surveys	2013-2014 Survey
Oats	T	unknown	-	-	1,745	-	-	3.74%
Wheat	MT	2,860	-	33	2,772	-	0.07%	5.94%
Misc. & Mixed Grain/Hay	MT	-	-	110		-	0.22%	-
Unspecified Grain/Hay Crops	MT	1,691	1,923	5,609	127	3.36%	11.08%	0.27%
Alfalfa	MS	1,146	8,839	9,398	8,468	15.43%	18.56%	18.14%
Clover	MS	-	-	-		-	-	-
Induced High Water Table Native Pasture	MS	-	-	-		-	-	-
Mixed Pasture	MS	-	3,444	3,190		6.01%	6.30%	-
Native Pasture	MS	-	-	-		-	-	-
Turf Farms	MT	unknown	426	379	22	0.74%	0.75%	0.05%
Misc. Grasses	MS	-	-	-		-	-	-
Unspecified Pasture	MS	2,067	-	-	514	-	-	1.10%
Artichokes	MT	-	-	183		-	0.36%	-
Asparagus	T	-	-	17		-	0.03%	-
Broccoli	MS	-	-	122		-	0.24%	-
Bush Berries	S	-	12	422		0.02%	0.83%	-
Cabbage	MS	-	-	606		-	1.20%	-
Carrots	S	-	27	124		0.05%	0.24%	-
Cauliflower	MS	-	282	6		0.49%	0.01%	-
Celery	MS	-	-	7,455		-	14.72%	-
Cherries	S	unknown	-	277	236	-	0.55%	0.51%
Cole Crops	MS	-	51	-		0.09%	-	-
Flowers/Nursery/Christmas Tree Farms	S	-	13	-		0.02%	-	-
Green Beans	S	-	126	-		0.22%	-	-
Lettuce	MS	-	29	-		0.05%	-	-
Melons/Squash/Cucumbers	MS	681	2,426	-	724	4.23%	-	1.55%
Mixed Truck Crops (four or more)8	MS	-	95	-		0.17%	-	-
Onions/Garlic	S	-	151	-		0.26%	-	-
Pea	MS	-	-	-		-	-	-
Peppers	MS	792	452	-	20	0.79%	-	0.04%
Potatoes	MS	-	-	-		-	-	-
Spinach	MS	-	-	-		-	-	-

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Table 5-2 (continued). Summary of Irrigated Crop Surveys in the LSJR Irrigation Use Area.

Crop	Salt Tolerance[1]	Salinity Threshold[2] (TDS mg/L)	acreage			percentage of acreage		
			1990s Surveys	2000s Surveys	2013-2014 Survey	1990s Surveys	2000s Surveys	2013-2014 Survey
Strawberries	S	-	-	-		-	-	-
Sweet Potatoes	MS	-	-	-		-	-	-
Tomatoes	MS	1,282	9,391	481	7,094	16.39%	0.95%	15.20%
Misc. Truck Crops	MS	-	-	-		-	-	-
Unspecified Truck Crops	MS	-	-	604		-	1.19%	-
Unspecified Rice	S	-	-	-		-	-	-
Raisin Grapes	MS	-	-	-		-	-	-
Unspecified Grapes	MS	862	59	512	716	0.10%	1.01%	1.53%
Idle Field	Other	-	459	564		0.80%	1.11%	-
		Totals	57,288	50,641	46,682	1.00	1.00	1.00

[1]Salt tolerance categories: S = Sensitive; MS = Moderately Sensitive; MT = Moderately Tolerant; T = Tolerant.

[2]Approx. AW TDS for 95% MRY, 15% LF = approximate applied water total dissolved solids (mg/L) for 95% maximum relative yield, assuming 15% leaching fraction. This quantity can be calculated from Mass-Hoffman coefficients alone, providing a more precise index of sensitivity than the four, broad classifications. It is a useful means to rank crop's levels of salt sensitivity (specifically to a 5% yield reduction), where Mass-Hoffman coefficients are available. It is not a substitute for a site-specific analysis with a more detailed set of calculations, such as a Hoffman Model run.

5.2.1.3.4 Acceptable Crop Yields

The LSJR Committee recommended 95 percent as a reasonable level of crop yield protection. However, the LSJR Committee recognized that crop yields may be less important than the availability of water during prolonged dry periods lasting several years. During such times, the LSJR Committee recommended that the EC input value selected for salinity protection result in a model output crop yield of 75 percent during "Extended Dry Periods". The definition of Extended Dry Periods is presented in Chapter 6: the *Program of Implementation* chapter of this staff report.

After vetting these policy decisions with the LSJR Irrigation Use Area stakeholders, the LSJR Committee sent a letter to the CV-SALTS Executive Committee (Lower San Joaquin River Committee, 2013b) outlining their agricultural policy recommendations as described above and the CV-SALTS Executive Committee concurred with their recommendations. In summary, the LSJR Committee's policy recommendations where applied to the Hoffman model as follows:

1. *Consideration should be given to salt-sensitive crops that make up greater than 5 percent of the acreage in an irrigation use study area.* Using the survey data presented in Table 5-2, the LSJR Committee recommended that almonds be selected as the most salt sensitive crop requiring protection in Reach 83 of the LSJR.

2. *Site-specific leaching fractions should be considered if those data are available, if not available a default leaching fraction of 15 percent should be used.* The LSJR Committee applied the 15 percent leaching fraction to the Hoffman model.
3. *Protection to sensitive crops should be provided during all but the 5th percentile of driest historic annual precipitation years*. In the LSJR Irrigation Use Area, this equated to the fifth percentile historic rainfall of 6.1 inches.
4. *The crop protection threshold should be 95% of maximum relative yield during timeframes that are not considered part of an Extended Dry Period.* The LSJR Committee applied the 95% crop yield to the Hoffman model. The acceptable yield was adjusted for the LSJR Irrigation Use Area to 75 percent during Extended Dry Periods, which is discussed in more detail in the Chapter 6, Program of Implementation

5.2.1.4 ***Subsequent LSJR Committee Evaluations***

As described above, the LSJR Committee's Hoffman modeling effort utilized the new crop survey and the new policies which included a leaching fraction representing irrigation practices in the LSJR Irrigation Use Area when site-specific data are not available, crop yield values acceptable to the LSJR stakeholders under certain conditions, and revised parameters for identifying the most salt sensitive commercial crop that requires protection.

Additional modeling recommendations made by the LSJR Committee included the use of data collected only near the Crows Landing and Patterson sampling locations, and not near Maze Road. Modeling results presented in the Central Valley Water Board draft Salt Tolerance Report showed that crops were less tolerant to salt when using the Crows Landing/Patterson data, due to lower rainfall patterns, and therefore would result in more conservative WQ criteria than use of Maze Road data. The LSJR Committee decided that it is reasonable to assume that the same holds true of the subsequent modeling results. Also, the LSJR Committee decided that it was appropriate to apply the exponential water uptake patternto the model, as was recommended by various parties during the 2010 public comment period for the draft Salt Tolerance Report {Section 5.2.1.1 Initial Crop Salt Tolerance Evaluations (2006-2010)}. These and other Hoffman model parameters used by the Committee are presented in Table 5-3. The Committee presented its 2013 to 2014 survey in the following document prepared by Larry Walker Associates, dated June 19, 2014, and titled *Memorandum –Task 1: Finalize Draft Agricultural Supply (AGR) EC Objectives*.

For the final crop salt tolerance modeling, the LSJR Committee asked Central Valley Water Board staff to update the model spreadsheets used to estimate almond soil water salinity values presented in the draft Salt Tolerance Report. Table 5-3 compares the ranges of EC, leaching fraction, crop yield and other model parameters utilized during the 2010 original study and the 2016 revision. To calculate the salinity of irrigation water for crop yields of 95 and 75 percent, staff ran the model 26 times, each time varying the irrigation-water salinity EC value by 0.100 µS/cm, from an initial value of 0.500 µS/cm through a final value of 3,000 µS/cm.

The resulting soil-water salinity and crop yield values estimated by the model for each of the 26 runs are presented in Table 5-4. Figure 5-2 is a plot of irrigation-water salinity versus soil water salinity presented in Table 5-4. Figure 5-3 is a plot of irrigation-water salinity versus relative crop yield presented in Table 5-4.

Table 5-3 Parameters Comparison: 2010 and 2014 Soil Salinity Modeling

Parameter Name	2010 Modeling Parameters	2014 Modeling Parameters
Historic model period	Jan 1, 1952 - Sep 30, 2008	Jan 1, 1952 - Sep 30, 2013
Locations of historic EC data	Crows Landing/Patterson, Maze	Crows Landing/Patterson
Sensitive crops modeled	bean, alfalfa, almond	almond
Model run with and without precipitation?	yes	no (precipitation only)
Leaching Fractions (almond)	0.10, 0.15, 0.20	0.10, 0.15
Historic precipitation stations	NCDC Newman C, Modesto C	NCDC Newman C
Historic temperature stations	NCDC Newman C, Modesto C	NCDC Newman C
Fifth percentile annual rainfall	5.98 inches (1952-2008 annual)	6.07 inches (1952-2013)
Crop uptake patterns	Exponential and 40-30-20-10	Exponential
Soil-water EC threshold (almond)	3.0	3.0
Minimum acceptable crop yield	100%	95% (75% for extended dry periods)
Bare soil ET inches/month	0.7	0.7
Runoff coefficient	77	77
Crop growth stage coefficients (almond)	B: Kc1 = 0.5 C: Kc2 = 0.9 E: Kc3 = 0.5	B: Kc1 = 0.5 C: Kc2 = 0.9 E: Kc3 = 0.5
Crop growth stage dates (almond)	A: 15-Feb B: 15-Feb C: 1-Jun D: 1-Sep E: 10-Nov	A: 15-Feb B: 15-Feb C: 1-Jun D: 1-Sep E: 10-Nov
Extraterrestrial radiation latitude	37º north latitude	37º north latitude

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Table 5-4 Predicted Soil-Water Salinity and Almond Crop Yield in the LSJR Irrigation Use Area

Irrigation Water EC (dS/m)	Soil-Water EC (dS/m)	Crop Yield (percentage)
0.5	1.14	100
0.6	1.37	100
0.7	1.60	100
0.8	1.82	100
0.9	2.05	100
1.0	2.28	100
1.1	2.51	100
1.2	2.74	100
1.3	2.96	100
1.4	3.19	98.2
1.5	3.42	96.0
1.6	3.65	93.8
1.7	3.88	91.6
1.8	4.10	89.6
1.9	4.33	87.4
2.0	4.56	85.2
2.1	4.8	83.0
2.2	5.0	80.9
2.3	5.2	78.7
2.4	5.5	76.5
2.5	5.7	74.4
2.6	5.9	72.2
2.7	6.2	70.0
2.8	6.4	67.9
2.9	6.6	65.7
3.0	6.8	63.5

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Figure 5-3 shows that the estimated irrigation-water salinity necessary for an almond crop yield of 95 percent is slightly more than 1,500 µS/cm when the leaching fraction is set at 15 percent. Through an iteration process with additional model runs, staff determined that the estimated value is approximately 1,550 µS/cm. Table 5-5 presents the model input and output values for that run: irrigation-water salinity set at 1,550 µS/cm and the leaching fraction set at 15 percent. The bottom cell of the total annual precipitation column near the left side of both Tables 5-5 and 5-6 shows that the computed 5th percentile annual rainfall total from the 1952 through the 2013 water years was 6.07 inches. The bottom cell of the far right column in Table 5-5 shows that the model estimates a soil-water salinity of 3,530 µS/cm during a 5th percentile annual rainfall year.

Figure 5-2 Almond Soil Water Salinity (5th percentile Annual Rainfall and 15% LF)

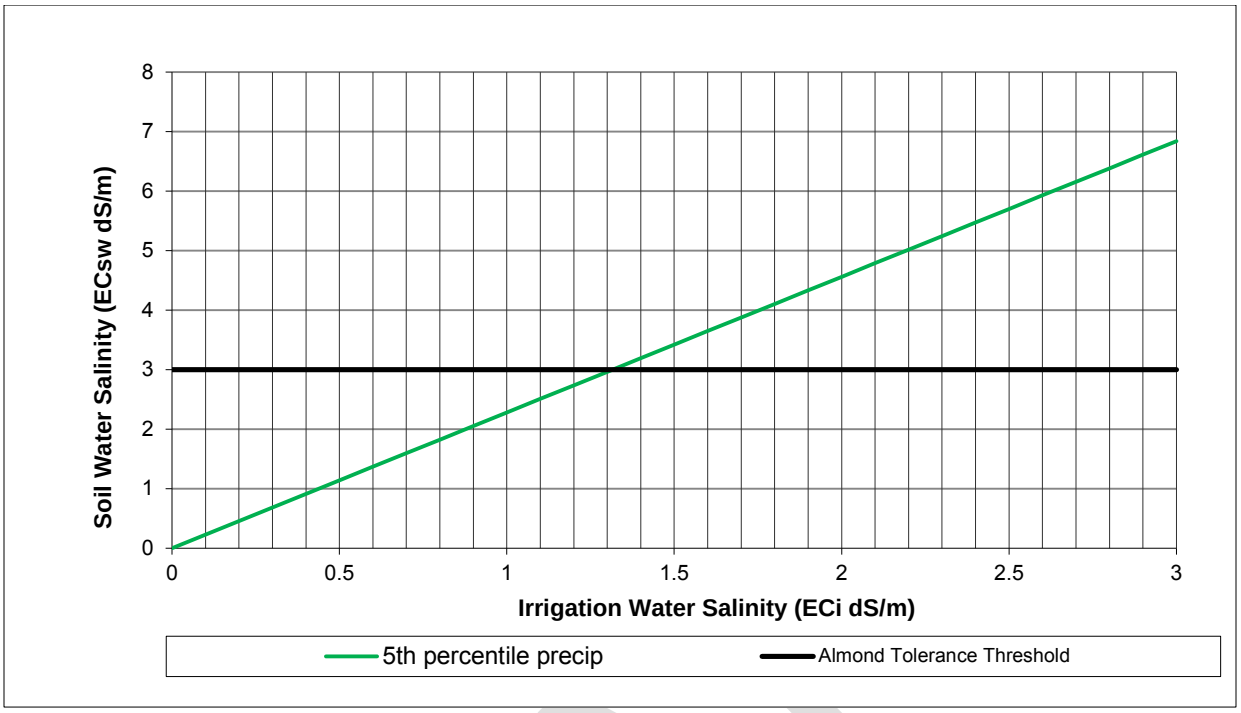

Figure 5-3 Relative Almond Crop Yield (5th percentile Annual Rainfall and 15% LF)

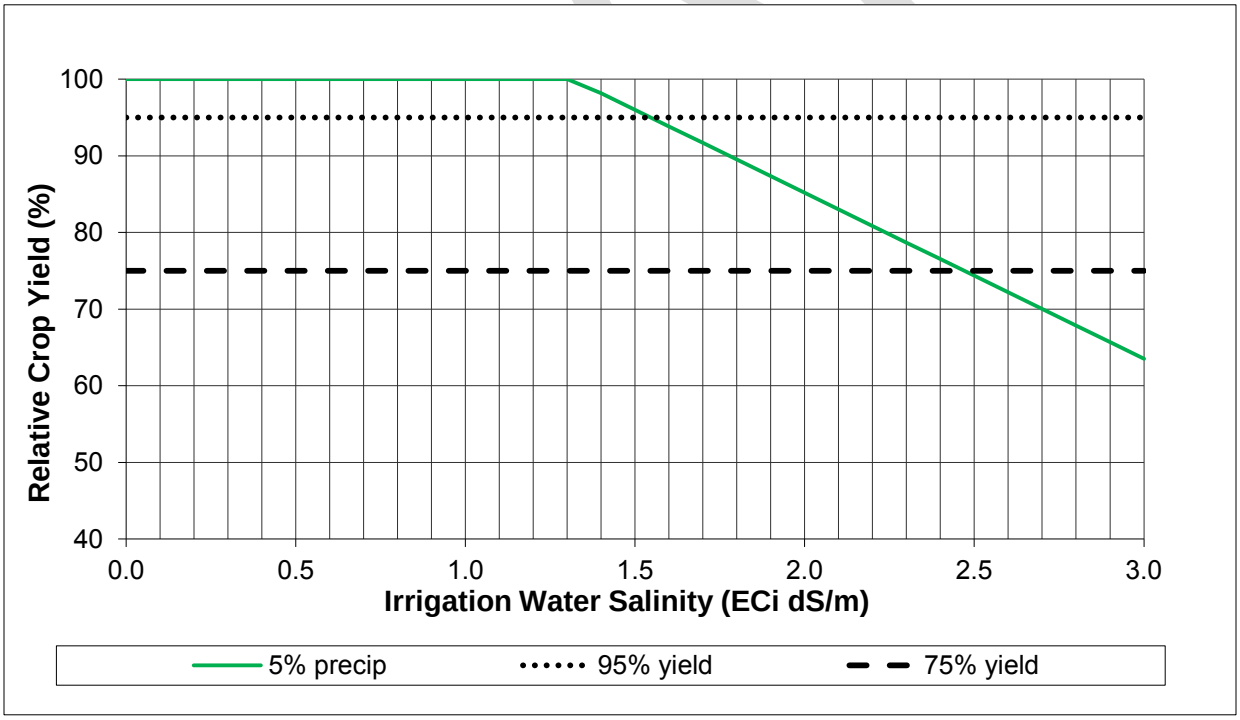

Table 5-5 Model Output: Irrigation Water EC=1.55 dS/m and LF=0.15.

	Input						Output
Water Year	P_T (in.)	P_{NG} (in.)	E_S (in.)	P_{GS} (in.)	P_{EFF} (in.)	ET_C (in.)	EC_{SWb-2} (dS/m)
1952	16.89	8.72	2.2093	8.17	14.6807	46.9106	2.7949
1953	6.78	5.09	2.2323	1.69	4.5477	44.7044	3.4786
1954	6.51	2.69	2.2093	3.82	4.3007	44.3594	3.4940
1955	9.75	6.15	2.2093	3.6	7.5407	45.9497	3.2767
1956	10.89	8.09	2.2093	2.8	8.6807	46.2963	3.2010
1957	8.68	2.85	2.2323	5.83	6.4477	45.9620	3.3538
1958	19.69	6.92	2.2093	12.77	17.4807	45.5127	2.5647
1959	10.84	5.12	2.2093	5.72	8.6307	45.5745	3.1949
1960	6.61	5.29	2.2093	1.32	4.4007	44.9699	3.4911
1961	7.11	5.08	2.2323	2.03	4.8777	44.0289	3.4493
1962	12.00	9.58	2.2093	2.42	9.7907	44.2539	3.0918
1963	14.02	8.48	2.2093	5.54	11.8107	41.3296	2.8829
1964	6.47	2.55	2.2093	3.92	4.2607	42.5748	3.4839
1965	10.28	4.78	2.2323	5.5	8.0477	41.9786	3.1873
1966	10.57	8.86	2.2093	1.71	8.3607	44.9451	3.2058
1967	13.48	7.94	2.2093	5.54	11.2707	43.2268	2.9639
1968	6.06	3.3	2.2093	2.76	3.8507	44.3121	3.5266
1969	18.84	11.23	2.2323	7.61	16.6077	43.5097	2.5724
1970	8.64	5.19	2.2093	3.45	6.4307	44.4480	3.3396
1971	13.36	7.84	2.2093	5.52	11.1507	42.6483	2.9616
1972	6.16	5.56	2.2093	0.6	3.9507	44.5548	3.5208
1973	17.01	11.18	2.2323	5.83	14.7777	43.6354	2.7117
1974	11.53	5.46	2.2093	6.07	9.3207	44.1445	3.1245
1975	10.73	5.72	2.2093	5.01	8.5207	44.9755	3.1947
1976	4.31	0.86	2.2093	3.45	2.1007	44.7450	3.6559
1977	5.66	2.72	2.2323	2.94	3.4277	44.9956	3.5613
1978	17.25	9.61	2.2093	7.64	15.0407	45.0319	2.7268
1979	10.38	5.91	2.2093	4.47	8.1707	46.4518	3.2385
1980	13.03	6.63	2.2093	6.4	10.8207	43.4361	3.0015
1981	8.24	4.47	2.2323	3.77	6.0077	46.0953	3.3860
1982	14.81	6.54	2.2093	8.27	12.6007	43.3500	2.8670
1983	19.78	8.37	2.2093	11.41	17.5707	42.9837	2.4848
1984	8.42	6.56	2.2093	1.86	6.2107	46.8274	3.3786
1985	8.22	4.8	2.2323	3.42	5.9877	45.1595	3.3787

Table 5-5 (continued): Model Output: Irrigation Water EC=1.55 dS/m and LF=0.15.

	Input						Output
Water Year	P_T (in.)	P_{NG} (in.)	E_S (in.)	P_{GS} (in.)	P_{EFF} (in.)	ET_C (in.)	EC_{SWb-2} (dS/m)
1986	12.90	6.15	2.2093	6.75	10.6907	44.8472	3.0363
1987	6.32	3.63	2.2093	2.69	4.1107	46.4298	3.5213
1988	11.02	6.92	2.2093	4.1	8.8077	46.4231	3.1938
1989	8.15	4.74	2.2323	3.41	5.9177	45.7273	3.3890
1990	6.50	3.11	2.2093	3.39	4.2907	45.5038	3.5027
1991	8.77	2.31	2.2093	6.46	6.5607	42.6840	3.3104
1992	10.80	5.63	2.2093	5.17	8.5907	44.8405	3.1878
1993	17.84	10.9	2.2323	6.94	15.6077	42.2683	2.6127
1994	8.93	4.44	2.2093	4.49	6.7207	43.2184	3.3045
1995	18.72	9.71	2.2093	9.01	16.5107	40.9028	2.5013
1996	14.15	7.66	2.2093	6.49	11.9407	43.9054	2.9276
1997	13.61	11.97	2.2323	1.64	11.3777	44.2045	2.9748
1998	26.02	16.59	2.2093	9.43	23.8107	40.4260	1.9015
1999	8.70	3.71	2.2093	4.99	6.4907	42.4877	3.3134
2000	11.51	5.83	2.2093	5.68	9.3007	43.9027	3.1222
2001	11.14	4.46	2.2323	6.68	8.9077	45.0462	3.1678
2002	7.61	6.09	2.2093	1.52	5.4007	45.0023	3.4194
2003	10.45	4.97	2.2093	5.48	8.2407	43.3956	3.1932
2004	9.77	5.76	2.2093	4.01	7.5607	46.0418	3.2763
2005	15.29	7.11	2.2323	8.18	13.0577	43.2947	2.8317
2006	12.10	5.48	2.2093	6.62	9.8907	47.3294	3.1315
2007	4.34	3.05	2.2093	1.29	2.1307	48.1548	3.6646
2008	8.76	6.84	2.2093	1.92	6.5507	48.9043	3.3743
2009	6.54	3.78	2.2323	2.76	4.3077	42.5211	3.4799
2010	13.99	6.46	2.2093	7.53	11.7807	37.9015	2.8018
2011	12.95	5.46	2.2093	7.49	10.7407	37.4409	2.8793
2012	6.28	1.51	2.2093	4.77	4.0707	40.5814	3.4832
2013	7.74	6.31	2.2323	1.43	5.5077	40.6549	3.3694
5th Percentile	**6.07**						**3.53**

Notes: ET_C = crop evapotranspiration; E_S = off-season surface evaporation

P_{GS} = precipitation during growing season; P_T = total annual (infiltrating) precipitation

Also, Figure 5-3 shows that the estimated irrigation water salinity necessary for an almond crop yield of 75 percent is approximately 2,500 µS/cm when the leaching fraction is set at 15 percent. Through an iteration process with additional model runs, staff determined that the estimated value is approximately 2,470 µS/cm. Table 5-6 presents the model input and output values for that run: irrigation water salinity set at 2,470 µS/cm and the leaching fraction set at 15 percent. The bottom cell of the far right column in Table 5-6 shows that the model estimates a soil water salinity of 5,630 µS/cm during a 5th percentile annual rainfall year.

The 2010 Central Valley Water Board draft Salt Tolerance Report was updated with the revised cropping patterns and Hoffman modelling runs, and finalized in 2016 (Central Valley Water Board, 2016b).

5.2.1.5 Comparison of Initial and Subsequent Modeling Results

Some of the modeling and cropping assumptions made for both the 2010 draft Salt Tolerance Report and the 2016 final Salt Tolerance Report are presented in Sections 5.1.1 and 5.1.2 of the final Salt Tolerance Report (Central Valley Water Board, 2016b). Also, references for setting model crop coefficients and growth periods for estimating crop evapotranspiration requirements are presented in Section 5.1.3 of the final Salt Tolerance Report. Table 5-3 presents the almond crop coefficients and growth periods that were used in both draft and final reports.

Table 5-7 compares selected Hoffman modeling parameters and results from both the 2010 draft Salt Tolerance Report and the 2016 final Salt Tolerance Report's addendum. In general, the initial runs used more conservative parameter values, such as a 100 percent crop yield, and the 2010 report provided a range of salinity threshold values, such as the EC criteria of 800 µS/cm to protect dry beans and 1200 µS/cm to protect almonds. The LSJR Committee's subsequent evaluations modified the Hoffman model parameters based on the policy decisions discussed in Section 5.2.1.1. As a result, the LSJR Committee identified an EC criterion of 1,550 µS/cm during all months of the year to protect almonds, with the exception of Extended Dry Period years when an EC criterion of 2,470 µS/cm was found to protect 75% yield.

The final Salt Tolerance Report (Central Valley Water Board, 2016b) includes an addendum that details how the Central Valley Water Board staff incorporated technical and policy recommendations established by the LSJR Committee into crop salt tolerance modeling and the calculations of proposed EC water quality criteria that would be protective of irrigated agriculture in the LSJR Irrigation Use Area.

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Table 5-6 Model Output: Irrigation Water EC=2.47 dS/m and LF=0.15

	Input						Output
Water Year	P_T (in.)	P_{NG} (in.)	E_S (in.)	P_{GS} (in.)	P_{EFF} (in.)	ET_C (in.)	EC_{SWb-2} (dS/m)
1952	16.89	8.72	2.2093	8.17	14.6807	46.9106	4.4630
1953	6.78	5.09	2.2323	1.69	4.5477	44.7044	5.5547
1954	6.51	2.69	2.2093	3.82	4.3007	44.3594	5.5794
1955	9.75	6.15	2.2093	3.6	7.5407	45.9497	5.2323
1956	10.89	8.09	2.2093	2.8	8.6807	46.2963	5.1114
1957	8.68	2.85	2.2323	5.83	6.4477	45.9620	5.3554
1958	19.69	6.92	2.2093	12.77	17.4807	45.5127	4.0954
1959	10.84	5.12	2.2093	5.72	8.6307	45.5745	5.1017
1960	6.61	5.29	2.2093	1.32	4.4007	44.9699	5.5747
1961	7.11	5.08	2.2323	2.03	4.8777	44.0289	5.5079
1962	12.00	9.58	2.2093	2.42	9.7907	44.2539	4.9370
1963	14.02	8.48	2.2093	5.54	11.8107	41.3296	4.6035
1964	6.47	2.55	2.2093	3.92	4.2607	42.5748	5.5633
1965	10.28	4.78	2.2323	5.5	8.0477	41.9786	5.0897
1966	10.57	8.86	2.2093	1.71	8.3607	44.9451	5.1191
1967	13.48	7.94	2.2093	5.54	11.2707	43.2268	4.7329
1968	6.06	3.3	2.2093	2.76	3.8507	44.3121	5.6314
1969	18.84	11.23	2.2323	7.61	16.6077	43.5097	4.1077
1970	8.64	5.19	2.2093	3.45	6.4307	44.4480	5.3327
1971	13.36	7.84	2.2093	5.52	11.1507	42.6483	4.7292
1972	6.16	5.56	2.2093	0.6	3.9507	44.5548	5.6222
1973	17.01	11.18	2.2323	5.83	14.7777	43.6354	4.3301
1974	11.53	5.46	2.2093	6.07	9.3207	44.1445	4.9892
1975	10.73	5.72	2.2093	5.01	8.5207	44.9755	5.1013
1976	4.31	0.86	2.2093	3.45	2.1007	44.7450	5.8378
1977	5.66	2.72	2.2323	2.94	3.4277	44.9956	5.6868
1978	17.25	9.61	2.2093	7.64	15.0407	45.0319	4.3542
1979	10.38	5.91	2.2093	4.47	8.1707	46.4518	5.1714
1980	13.03	6.63	2.2093	6.4	10.8207	43.4361	4.7929
1981	8.24	4.47	2.2323	3.77	6.0077	46.0953	5.4069
1982	14.81	6.54	2.2093	8.27	12.6007	43.3500	4.5782
1983	19.78	8.37	2.2093	11.41	17.5707	42.9837	3.9678
1984	8.42	6.56	2.2093	1.86	6.2107	46.8274	5.3950
1985	8.22	4.8	2.2323	3.42	5.9877	45.1595	5.3952
1986	12.90	6.15	2.2093	6.75	10.6907	44.8472	4.8484

Table 5-6 Model Output: Irrigation Water EC=2.47 dS/m and LF=0.15

	Input						Output
Water Year	P_T (in.)	P_{NG} (in.)	E_S (in.)	P_{GS} (in.)	P_{EFF} (in.)	ET_C (in.)	EC_{SWb-2} (dS/m)
1987	6.32	3.63	2.2093	2.69	4.1107	46.4298	5.6229
1988	11.02	6.92	2.2093	4.1	8.8077	46.4231	5.0999
1989	8.15	4.74	2.2323	3.41	5.9177	45.7273	5.4116
1990	6.50	3.11	2.2093	3.39	4.2907	45.5038	5.5931
1991	8.77	2.31	2.2093	6.46	6.5607	42.6840	5.2861
1992	10.80	5.63	2.2093	5.17	8.5907	44.8405	5.0903
1993	17.84	10.9	2.2323	6.94	15.6077	42.2683	4.1720
1994	8.93	4.44	2.2093	4.49	6.7207	43.2184	5.2768
1995	18.72	9.71	2.2093	9.01	16.5107	40.9028	3.9942
1996	14.15	7.66	2.2093	6.49	11.9407	43.9054	4.6749
1997	13.61	11.97	2.2323	1.64	11.3777	44.2045	4.7502
1998	26.02	16.59	2.2093	9.43	23.8107	40.4260	3.0363
1999	8.70	3.71	2.2093	4.99	6.4907	42.4877	5.2909
2000	11.51	5.83	2.2093	5.68	9.3007	43.9027	4.9856
2001	11.14	4.46	2.2323	6.68	8.9077	45.0462	5.0585
2002	7.61	6.09	2.2093	1.52	5.4007	45.0023	5.4602
2003	10.45	4.97	2.2093	5.48	8.2407	43.3956	5.0990
2004	9.77	5.76	2.2093	4.01	7.5607	46.0418	5.2318
2005	15.29	7.11	2.2323	8.18	13.0577	43.2947	4.5217
2006	12.10	5.48	2.2093	6.62	9.8907	47.3294	5.0004
2007	4.34	3.05	2.2093	1.29	2.1307	48.1548	5.8518
2008	8.76	6.84	2.2093	1.92	6.5507	48.9043	5.3882
2009	6.54	3.78	2.2323	2.76	4.3077	42.5211	5.5569
2010	13.99	6.46	2.2093	7.53	11.7807	37.9015	4.4740
2011	12.95	5.46	2.2093	7.49	10.7407	37.4409	4.5978
2012	6.28	1.51	2.2093	4.77	4.0707	40.5814	5.5620
2013	7.74	6.31	2.2323	1.43	5.5077	40.6549	5.3803
5th Percentile	**6.07**						**5.63**

Notes: ET_C = crop evapotranspiration; E_S = off-season surface evaporation

P_{GS} = precipitation during growing season; P_T = total annual (infiltrating) precipitation

Table 5-7 LSJR Irrigation Use Area Hoffman Modeling Results

Crop	Leaching Fraction	Crop Yield	Crop Salinity Threshold	Report Date	Data Range
Dry beans	15%	100%	800	2010	1951-2008
Dry beans	20%	100%	1,200	2010	1951-2008
Almonds	15%	100%	1,200	2010	1951-2008
Alfalfa	10%	100%	1,000	2010	1951-2008
Alfalfa	15%	100%	1,600	2010	1951-2008
Almonds	15%	95%	1,550	2016	1951-2013
Almonds	15%	75%	2,470	2016	1951-2013

Notes: Crows Landing/Patterson monitoring stations

Effective precipitation

5th percentile annual rainfall

Exponential water uptake pattern

5.2.2 Municipal Supply

In addition to identifying potential criteria for the protection of the AGR beneficial use, the LSJR Committee also evaluated possible criteria to protect the Municipal and Domestic Supply (MUN) beneficial use. The Basin Plan identifies the primary and secondary Maximum Contaminant Levels (MCLs) specified in Title 22 of the California Code of Regulations, developed for the protection of potable water at the tap after receiving conventional treatment, as the appropriate WQOs to protect the MUN use. Table 64449-B in Title 22 of the California Code of Regulations contains consumer acceptance secondary MCL ranges for a number of salinity constituents. Secondary MCLs are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. These contaminants are not considered to present a risk to human health at the levels specified in the secondary MCL table. For specific conductivity, Table 64449-B contains a specific conductivity Secondary MCL recommended value of 900 µS/cm, an upper value of 1,600 µS/cm and a short-term value of 2,200 uS/cm.

5.2.3 EC Criteria Range

Upon completion of their salinity criteria evaluations, the LSJR Committee was able to identify an upper range of EC values for consideration as potential salinity WQOs to protect the AGR and MUN beneficial uses.

For the lower end of the range, the Committee considered the existing EC WQOs of 700 µS/cm and 1,000 µS/cm in the LSJR at the Airport Way Bridge near Vernalis, established by the State Water Board to protect Southern Delta agriculture (State Water Board, 2000). As a

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comparison, Central Valley Water Board staff conducted a follow-up Hoffman model run using all of the same parameter values discussed in section 5.2.1.1, with the exception of a more conservative leaching fraction of 10 percent (Central Valley Water Board, 2014b). The Central Valley Water Board Memorandum is presented in Appendix B. The resulting salinity threshold value of EC to protect almond crops was 1,010 µS/cm, essentially equivalent to the Vernalis EC objective of 1,000 µS/cm. The lower Vernalis objective of 700 µS/cm was equivalent to Ayers and Westcot's recommended salinity guideline for "Unrestricted Use" (Ayers, R.S. and Westcot, D.W., 1985). To protect the AGR beneficial use, this salinity guideline has been historically used by the Central Valley Water Board to interpret a narrative objective in the Basin Plan (*"Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses")*. However, concerns have long been raised by Central Valley irrigators over the application of the 700 µS/cm as an EC regulatory threshold to protect agriculture, since this value assumes that highly salt sensitive crops occur in all areas of the Central Valley and must be protected during all water-year types. In addition, the value does not take in to account the mitigation of some salinity impacts by modern irrigation strategies (U.S. Bureau of Reclamation, 2010). With these considerations in mind, the LSJR Committee's primary focus was an EC criteria range of 1,010 to 1,550 µS/cm to protect AGR which falls below the upper Secondary MCL value of 1,600 uS/cm, which is considered protective of the MUN use.

In terms of averaging periods for the criteria identified, the LSJR Committee decided to remain consistent with the WQOs and sampling regimes established in the San Joaquin River at the Airport Way Bridge nearVernalis for the protection of agricultural beneficial uses of water entering the Delta, and recommended using the same water quality compliance period of a 30-day running average of mean daily EC for Reach 83 of the LSJR (State Water Board, 2000). For values specific to the protection of the MUN use, the LSJR Committee recommended the Title 22 method of using an annual average using at a minimum the previous four consecutive quarterly samples.

5.3 Development of Project Alternatives

With a potential range of EC criteria identified, the LSJR Committee turned their attention to issues relating to feasibility. Two factors in Water Code section 13241 that must be considered in establishing WQOs for the Basin Plan pertain to the environmental characteristics of the hydrographic unit and reasonably achievable water quality conditions (Wat. Code, § 13241, subds. (b) and (c).) In order to identify project alternatives that could be reasonably achieved within the identified range of criteria, the LSJR Committee chose to evaluate existing conditions and potential management or implementation actions that reduce salinity in the LSJR, and apply a watershed model that could forecast salinity conditions that result from implementation of these actions.

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The Watershed Analysis Risk Management Framework (WARMF) model was selected by the LSJR Committee as the best available tool to predict the potential impacts of different management or implementation actions on salinity levels in the river. WARMF is a physically-based watershed model capable of simulating watershed hydrology and water quality on a daily or shorter time step. WARMF has been used in the San Joaquin River Basin in the past (Herr and Chen, 2008; Herr, Chen, and Van Werkhoven, 2008; Kratzer, et al, 2008; LWA, et al, 2010; and Systech, 2011). Brief summaries of these publications are presented in the 4 March 2014 Larry Walker Associates Memorandum, commissioned by the LSJR Committee, and titled: *Task 2a: Compile and Update Water Quality and Salt Loading Data* (LWA, 2014a). The WARMF tool was used first to establish baseline conditions in the LSJR based on historic data and then applied as a forecasting tool to predict potential impacts of different management or implementation actions on salinity levels in the river.

5.3.1 Process to Identify and Evaluate the Effectiveness of Potential Management Actions

The LSJR Committee initially identified a large number of potential management actions available to control salinity (Larry Walker Associates (LWA), 2015a), and decided to combine existing and potential implementation actions into bundles of potential activities. The bundles of implementation actions were then modeled. The LSJR Committee modeled the LSJR baseline conditions and three bundles of management actions. From the modeling results, the LSJR Committee could better assess the overall feasibility of potential management actions to meet salinity criteria in the river and then develop specific project alternatives. The following steps were taken by the LSJR Committee to identify a set of management actions:

a) Identify management actions that can be used to manage salt in the Irrigation Use Area,
b) Develop selection criteria for screening the management actions,
c) Screen management actions for inclusion in each WARMF modeling bundle,
d) Evaluate historic flow and water quality data, and run the WARMF model to establish baseline conditions,
e) Run the WARMF model on the bundles of management actions, and
f) Evaluate results on bundled management actions and compare them to modeled baseline conditions.

For a more detailed explanation of these steps, refer to the LWA report titled: *Task 4 - Implementation Planning for Proposed Salinity Objectives* (Larry Walker Associates (LWA), 2015a).

5.3.1.1 Available Management Actions

The LSJR Committee realized that there are numerous salinity control measures that could potentially be implemented in the Irrigation Use Area. The Committee directed LWA to identify

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management actions ranging from large regional controls to more localized actions. Fifteen (15) management actions were identified and grouped into 2 categories: 1) Actions that reduce salt load into the LSJR and; 2) Actions that export salt from the LSJR watershed. The identified management actions and the methods under which they were categorized are summarized in Table 5-8 which was originally presented in a 2015 LWA report (Larry Walker Associates (LWA), 2015a). While Table 5-8 focuses on salinity, the implementation actions described will be similar for boron and other ions. The implementation actions represent a range of potential actions for consideration during the development of three alternative management scenarios. Each alternative management scenario contains a combination of several implementation actions, and it should be noted that some of the actions listed (i.e. Salinity Real Time Management Program, Active Alternative Land Management, etc.) by definition already involve a combination of actions.

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Table 5-8 Range of Potential Implementation Actions

METHODS	IMPLEMENTATION ACTIONS	EXAMPLES	DESCRIPTION OF IMPLEMENTATION ACTIONS
MANAGE SALT DISCHARGES TO LSJR TO MATCH ASSIMILATIVE CAPACITY	1. Controlled Timing of Salinity Discharges (RealTime Management Program)**		Would take advantage of assimilative capacity in the river to export salt to the Delta and ocean. Requires a coordinated program to manage discharges, diversions, and river and tributary releases to enable timed releases of drainage. Also requires real-time monitoring of flow and EC at selected sites, real-time data QA and a means of information sharing and dissemination
REDUCE SALT AND BORON LOADING TO THE LSJR (LOAD REDUCTION)	2. Reduce Point Sources of Salts	a. Self Regenerating Water Softener Ban or Restrictions**	Would reduce salt loads from POTWs that have self regenerating water softeners in their service areas
		b. New or Improved (less saline) Surface Water Supply**	Would reduce salt loads from POTWs that can substitute new surface water supplies for existing groundwater supplies
		c. Ind/Food Processing Source Control (and/or Pretreatment)**	Would reduce salt loads from POTWs by requiring industrial control of salts in discharges to sewer system. For specific industries discharging to land, source reductions may potentially benefit the LSJR through reduced salt loadings via groundwater accretion. Includes, but is not limited to, product substitution, process modification, and solids removal.
		d. Desalination of POTW Effluent	Would reduce salt loads to the river from POTWs through installation of desalination facilities. Requires brine handling/disposal.
	3. Reduce Nonpoint Sources of Salts	a. Reduce application of salts contained in fertilizers and soil amendments	Would reduce salt loads through high efficiency irrigation, improved fertilizer management, or other measures aimed at reduced application of chemicals containing salt.
	4. Evaporation Ponds (lined)	a. Evaporation Ponds	Would reduce loads by capturing all or portion of drainage flows and diverting to evaporation ponds. Requires brine or salt handling/disposal.
		b. Solar Evaporators	Alternative means to further evaporate drainage water (from evaporation or recirculation practices) for harvesting or disposal of salt.
		c. Salt Energy Ponds	Alternative means to further evaporate drainage water (from evaporation or recirculation practices) and generate energy during the course of the natural evaporation of water.
	5. Water Treatment (drainage)**	a. Satellite or regional treatment facilities	Would reduce salt loads through installation of desalination facilities. Requires brine handling/disposal.
	6. Land Retirement**	a. Retired lands as Reuse Facilities	Would reduce salt loads associated with drainage and also functions to retain salt by accepting recycled water, along with its salt load. Regional reuse could include active alternative land management or use of lands for drainage, treatment and disposal, etc.
		b. Retire lands to non-irrigated uses	Would reduce salt loads by reduction in applied water and associated drainage. Lands could be converted to commercial, industrial purposes, flood control, habitat purposes, etc.
		c. Temporary Land Retirement (Fallowing)	Would reduce salt loads by reduction in applied water and associated drainage. The decision to fallow land would be made at the beginning of a season. Fallowing could be seasonal or could continue for longer durations.
	7. Water Supply Improvement	a. Delta Corridors Plan	Would reduce salt loads into the LSJR by eliminating the recirculation of SJR water back into the Delta Mendota Canal. Irrigation with lower saline DMC water would result in lower concentrations of salinity in the drainage water discharged from the west side of the basin.

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Table 5-8 Range of Potential Implementation Actions

METHODS	IMPLEMENTATION ACTIONS	EXAMPLES	DESCRIPTION OF IMPLEMENTATION ACTIONS
		b. Bay Delta Conservation Plan	Would reduce salt loads by importing less saline water into the Delta Mendota Canal for irrigation of land on the west side of the basin, ultimately resulting in lower concentrations of salinity in the drainage water.
REDUCE SALT AND BORON LOADING TO THE LSJR (LOAD REDUCTION) continued	8. Water Conservation	a. Replace Infrastructure (pipelines to replace canals)**	Would conserve water by reducing seepage to reduce diversion of tributary flows. Reduction in salt loading would depend on whether water conserved would be applied to other land in the basin. If not re-applied, conservation would result in reduction in salt loading. If re-applied, net reduction in loading would be minimal. Incidental benefits of seepage (groundwater recharge and canal-dependent vegetation) will be lost.
		b. Optimize existing irrigation efficiency	Similar to 8(a). Note that irrigation systems are being updated at a rapid pace, primarily because the production benefits of drip and microspray systems on certain crops have proven to be very significant, and the cost of the systems has come down. While the total salt load is the same, salts are precipitated and retained near the root zone, so the total salt load to the aquifer is episodic, occurring during periods of infrequent seasonal flushing.
	9. New high-efficiency irrigation systems, per se	a. Increase retention of soluble salts	Would reduce loading through reduction in drainage volume. Conventional notions of leaching excess salt through the soil to maintain production change somewhat with drip and microspray irrigation, in which salts may accumulate harmlessly beyond the soil zone accessed by plants to uptake water.
	10. Sequential Reuse & volume Reduction (Salt sensitive crops & solar evap)**	a. Integrated Farm Drainage Management (IFDM)	Would reduce the volume discharged; results in an increase in concentration. Relies on eventual salt export to an alternative sink. Reuse occurs on dedicated facilities with attendant costs. Feasibility would be enhanced by a reliable market for the recovered salt products.
		b. Salt accumulation area (SJRIP)	Would reduce the volume discharged from the Grasslands Drainage Area (GDA). Grow salt tolernat crops, install tile drains and collection systems, solar evap or treatment of drainage water and disposal at Kettleman Hills landfill or a possible in-basin salt sink.
	11. Active Alternative Land Mgmt (sequential reuse/crop selection etc.)		Would reduce the volume discharged. A blend of 10 and 12b, mainly distinguished by the intentional nature of land management through crop selection and irrigation practices, without creating a dedicated facility.
	12. Drainage Water Recirculation	a. Tailwater Recovery	Would reduce loadings through reuse and volume reduction. Where reuse replaces irrigation with imported water, would reduce salt load associated with that supply. This practice relies on ultimate salt disposal for long term sustainability.
		b. Tilewater Recovery - Re-route drainage water (Grasslands Bypass)	Similar to 12a., but entails recirculation of greater salt concentration from the outset. (Grasslands Bypass)

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Table 5-8 Range of Potential Implementation Actions

METHODS	IMPLEMENTATION ACTIONS	EXAMPLES	DESCRIPTION OF IMPLEMENTATION ACTIONS
	13. Reduce Impact of Groundwater as a Source of Salinity to LSJR		General category which may include: (a) reduction in shallow groundwater levels to reduce subsurface drainage (and salt) loading into subsurface drain systems (areas where this is hydrogeologically feasible may be fairly limited) and (b) reduction in groundwater as water supply or reduction in salt loadings in groundwater though well-head treatment.
MANAGE SALT LOADS VIA SEQUESTRATION/ TRANSPORT/ DISPOSAL	14. Salt Disposal/Out of Basin Transport (Supports Actions #2-6, 12 that create a brine)**	a. Brine Line to Ocean	Alternative means of salt transport and out-of-basin disposal
		b. Truck to WWTP with ocean or bay outfall	Similar to 14a.
		c. Landfill disposal	Alternative means of in-basin or out-of-basin disposal of crystallized salt
		d. Out of Basin Salt Sink	Similar to 14c.
		e. Commercial market for reclaimed salt	Alternative means of out-of-basin disposal of salt.
		f. Direct Well Injection	Alternative means of In-basin disposal of concentrated salts or brines
		g. Brine line to WWTP with ocean or bay outfall	Similar to 14.a
ADAPTIVE WATER SUPPLY MGMT	15. SJR water diversions during periods of excess SJR flows		Would take advantage of excess flows in SJR during wet years or wet seasons to provide irrigators with low salinity water to better manage salts (i.e., following periods of high salinity due to drought or other factors, to better control the leaching process, to alternate with irrigation using higher salinity water, etc.)

**Action considered as a part of SSALTS.

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5.3.1.2 Development of Management Action Screening Criteria

Screening criteria were developed to help guide the selection of the management actions presented in Table 5-8 to be included in the three bundles of actions for modeling. The screening criteria, presented in Table 5-9, were developed to allow for a qualitative evaluation of potential management actions and were based upon a review of the approaches and considerations used in the *LSJR Salt and Boron TMDL* (Central Valley Water Board, 2004), the *Draft Final Phase 2 Report – Development of Potential Salt Management Strategies* (CDM Smith, 2014), and *The Rainbow Report* (California Department of Water Resources, 1990). The screening criteria include three main categories and several sub-categories as shown in Table 5-9, developed by the LSJR Committee (Larry Walker Associates (LWA), 2015a). The categories are technical feasibility, economic viability, and ability to implement.

Each of the sub-categories was used to further characterize the relative merits of a particular management action. The sub-categories were useful in evaluating the presumed effectiveness and shortcomings of a given action with respect to the quantity and timing of salt loads that the action could reasonably address and the potential costs/impacts that could occur with implementation of the management action.

5.3.1.3 Management Action Screening

Using the screening criteria, the LSJR Committee evaluated the 15 identified management actions, and earmarked each for inclusion or exclusion within a bundle to be modeled. Management actions considered to have numerous poor performing qualitative assessments (e.g. unproven technology, low flexibility, high costs, difficult to model, etc.) were eliminated altogether from inclusion in the bundles of management actions.

Out of the 15 management actions listed in Table 5-8, six were screened out and nine were carried forward for potential inclusion in one or more of the bundles to be modeled using the WARMF model. The following lists the nine actions, each with its Table 5-8 alpha-numeric designation and description:

1. Action 1 – Controlled Timing of Salinity Discharges
2. Action 2c – Reduce Point Sources – existing industrial/food processing sources control and/or pretreatment
3. Action 3a – Reduce Nonpoint Sources – Reduce application of salts in fertilizers and soil amendments
4. Action 5a – Water Treatment – Regional Facility
5. Action 8b – Water Conservation – Optimize Existing Irrigation Efficiency
6. Action 9a – Installation of New High Efficiency Irrigation and Delivery Systems
7. Action 10b – Sequential Reuse and Volume Reduction – Salt Accumulation Area similar to the San Joaquin River Water Quality Improvement Project (SJRIP)

8. Action 12a – Drainage Water Recirculation – Tailwater Recovery
9. Action 12b – Drainage Water Recirculation – Tilewater Recovery

Table 5-9 Screening Criteria Used in the Evaluation of Management Alternatives

Goal	Criteria	Sub-Criteria	Assessment Range			Suggested Metrics
Address a Significant Source of Salt Loading to the LSJR	1. Technical Feasibility	a. Technologies are readily available/adaptable	Unproven	Proven, not available and/or not adaptable	Proven, readily available and adaptable	Qualitative
		b. Ability to meet WQOs and load allocations or WQO achieved in river	Low rate of compliance	Med rate of compliance	High rate of compliance	Predicted rate of LSJR compliance with WQO
		c. Provides for flexibility to growers and wetland operators	Low flexibility	Medium flexibility	High flexibility	Qualitative
		d. Flexible/adaptable to climate changes/water year types	Low flexibility	Medium flexibility	High flexibility	Qualitative
	2. Economic Viability	a. Relative Capital and O&M costs	Highest costs	Medium costs	Lowest costs	Estimated costs. Metric to be determined (i.e., millions/year, dollars/ton of salt removed or dollars/ac-ft, etc.)
	3. Ability to Implement	a. Potential environmental issues	High issues/delays	Med issues/delays	Low issues/delays	Qualitative
		b. Time period for planning/design/construction	Most time to implement	Medium time to implement	Least time to implement	Qualitative
		c. Legal/regulatory/institutional hurdles	High potential for hurdles	Medium hurdles	Little to no hurdles	Qualitative
		d. Time to implement	Most time to implement	Medium time to implement	Least time to implement	Years
		e. Action within authority of implementing agency	No authority exists	Some authority	Full authority exists	Qualitative

The Committee evaluated the nine management actions carried forward using the screening criteria above to develop three salinity management bundles for detailed evaluation. The bundles were designed to serve as "book-ends" to achieve the lower and upper ends of the

criteria range. The planned plus extreme management bundle and the Planned plus extreme treatment bundle were designed to demonstrate the level of agricultural drainage water quality achievable with management actions that involve significant effort, with the intent to meet or remain below an EC value of 1,010 µS/cm. The planned bundle was run to determine if the upper end of 1,550 µS/cm or better could be achieved with existing and planned management actions already developed and in the process of being implemented in the LSJR Basin. The following are brief descriptions of the three bundles:

1. The planned management bundle was designed to encompass existing salinity control activities and those planned for implementation within the next 5 – 10 years.
2. The planned plus extreme management bundle was designed to demonstrate the level of agricultural drainage water quality achievable with management actions that involve significant management effort such as expanded areas of salt containment areas.
3. The planned plus extreme engineered treatment bundle was also designed to demonstrate the level of agricultural drainage water quality achievable with management actions that involve significant engineering effort such as collection for treatment at a desalting facility with the clean water returned to the river.

The three salinity management bundles are described in detail in the LWA report prepared for the LSJR Committee, (LWA, 2015a). Tables 3, 4, and 5 of that memorandum summarize the management actions included in each bundle.

5.3.1.4 Identification of Historic Conditions and Baseline Modeling

The LSJR Committee directed LWA to use historic EC concentrations at locations on the river and its tributaries to characterize historic conditions and model baseline EC and flow conditions in the river.

5.3.1.4.1 Historic Conditions

The Committee realized that an understanding of historic conditions would assist in identification of the level of management or implementation actions that could result in attainment of EC concentrations within the range of EC criteria concentrations. Available surface water quality and salt loading data relevant to the LSJR, both within and upstream of Reach 83, were identified and compiled. Appendix A presents the process undertaken to identify and compile the data. The data and data sources were housed within the WARMF model. The WARMF database served as the overall project database. Understanding of historic conditions identified the salt loads that exist upstream of Reach 83. These upstream loads constitute a significant portion of the salinity measured in the reach.

Historical ambient water quality data within Reach 83 of the LSJR were characterized and plotted against the proposed range of EC criteria (1,010 – 1,550 µS/cm). Two important

historical monitoring locations on the LSJR were selected for further evaluation: (1) Maze Road, used to characterize water quality between the Tuolumne and Stanislaus Rivers, and (2) Crows Landing, used to characterize water quality between the Merced and Tuolumne Rivers. Data collected at an additional location, Patterson Bridge, were used to supplement data gaps at Crows Landing after determining that water quality at the two locations was similar based on a strong linear relationship for EC (R^2 = 0.92466). The linear relationship analysis is presented an LWA report prepared for the LSJR Committee (Larry Walker Associates (LWA), 2014d).

Water quality conditions at Maze Road and Crows Landing were characterized on the basis of month, season, and water-year type for the water years 1977 through 2013. These water quality conditions were then utilized in determining the rates of compliance with the proposed range of WQOs. Compliance comparisons of historical 30-day running average EC levels measured at the Maze Road and Crows Landing-Patterson locations were made for the criteria range of 1,010 to 1,550 µS/cm, in 100 µS/cm increments. These characterizations of historical water quality and their comparisons to the range of EC criteria showed improved water quality and increasing compliance starting in 1995 with the implementation of the Grassland Bypass Project (GBP). The GBP systematically reduces loads of selenium and salt from 90,000 acres of commercial farmland from entering the LSJR upstream of the Merced River. Considering that the operational conditions and water quality of the LSJR differ from pre-GBP and post-GBP, the LSJR Committee focused on evaluation and modeling of the 1995 through 2013 time period. This decision established the baseline salinity conditions in Reach 83 which could be used to compare with model results of potential future management actions.

5.3.1.4.2 Baseline Modeling

The LSJR Committee directed LWA to perform WARMF baseline modeling of historic flow and EC for the LSJR. LWA's modeling results are presented in its memorandum, titled *Summary of Work Completed: Tasks 2, 3, and 8b*, dated 12 November 2014 (Larry Walker Associates (LWA), 2014d). The WARMF model was run using historic data collected from the LSJR monitoring stations at Maze Road and Crows Landing to establish "Baseline" model simulations of flow and EC upon which later model simulations could be developed and compared. These model results were plotted against the historical ambient water quality to evaluate model performance. The Baseline modeling results for flow compared well to historical flow data from both monitoring locations. Model EC results compared well to historical data at Maze Road. However, comparisons to historical EC at Crows Landing were not as strong. The effects of discrepancies between historical and WARMF- simulated baseline EC conditions at Crows Landing are further discussed in the LWA report titled: *Task 4 - Implementation Planning for Proposed Salinity Objectives* (LWA, 2015a). In addition, the WARMF simulated output and historical ambient water quality were plotted to evaluate the model fit on the one-to-one linear regression line, which shows where model simulated results

match historical ambient data. The results are shown in Figures 5-5 through 5-10, originally presented in the LWA report (Larry Walker Associates (LWA), 2015a).

The baseline WARMF simulations provided a representative characterization of the significant salt sources in the LSJR Basin, quantification of salt loadings from the various sub-watersheds, and descriptions of the timing of salt loading to the LSJR. The results provide information on the regions, sources, and timing of salt loading within the watershed where management measures could be employed to provide the greatest reductions in salt loads to the river. Model results showed that the highest salt loads occur from February through May with relatively higher loads present through late August. East side riverine inputs provide dilution flows with low TDS loads relative to upstream sources. Although west side and upstream salt sources have decreased over time, west side salt sources upstream of the Merced River confluence (i.e., upstream of Reach 83) are significant, and are the best targets for implementation of salinity management actions. Reduction of sources upstream of the Merced River has the greatest influence on modeling baseline ambient salinity concentrations observed in Reach 83. This information allowed for selection of the most appropriate salinity control measures for modeling.

Qualitative review of the results shows that the model performs well in simulating flow at the various monitoring locations along the LSJR. Simulated data closely follow the observed hydrograph and results plot closely along the one-to-one regression line except during periods of high observed flow (Figures 5-4 through 5-6). During these periods, the river's observed measurements may not be accurate due to flood flows, and the model may be a more accurate representation of actual flow in the river. Although the simulated results for EC trend along the one-to-one regression line, the model shows more variability in simulated EC at the various monitoring locations (Figures 5-7 through 5-9).

5.3.1.5 Modeling of Three Management Action Bundles

Three management bundles were modeled using WARMF to determine compliance with the range of potential salinity WQOs (1,010 – 1,550 µS/cm) (Larry Walker Associates (LWA), 2015a). The WARMF model produces daily output for flow, EC, and TDS. Statistics for the three modeled alternatives for individual water years were calculated using 30-day running average EC values. Individual water year results were generated to compare the three management alternatives with the historical data and the WARMF model baseline output based on water-year type. Water years are classified as either critical, dry, below normal, above normal, or wet, and are based on the San Joaquin Valley Water Year Index, as defined in State Water Board Revised Water Right Decision 1641 (D-1641) (State Water Resources Control Board, 2000). For each water-year type, a 12-month time series of average values was generated. Average values were determined on a daily basis by first classifying each year of model output by water-year type and then averaging the 30-day running average values for each day from each modeling run.

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Figure 5-4 WARMF Simulated (black) and Historical Observed (blue) Flow at Maze Road

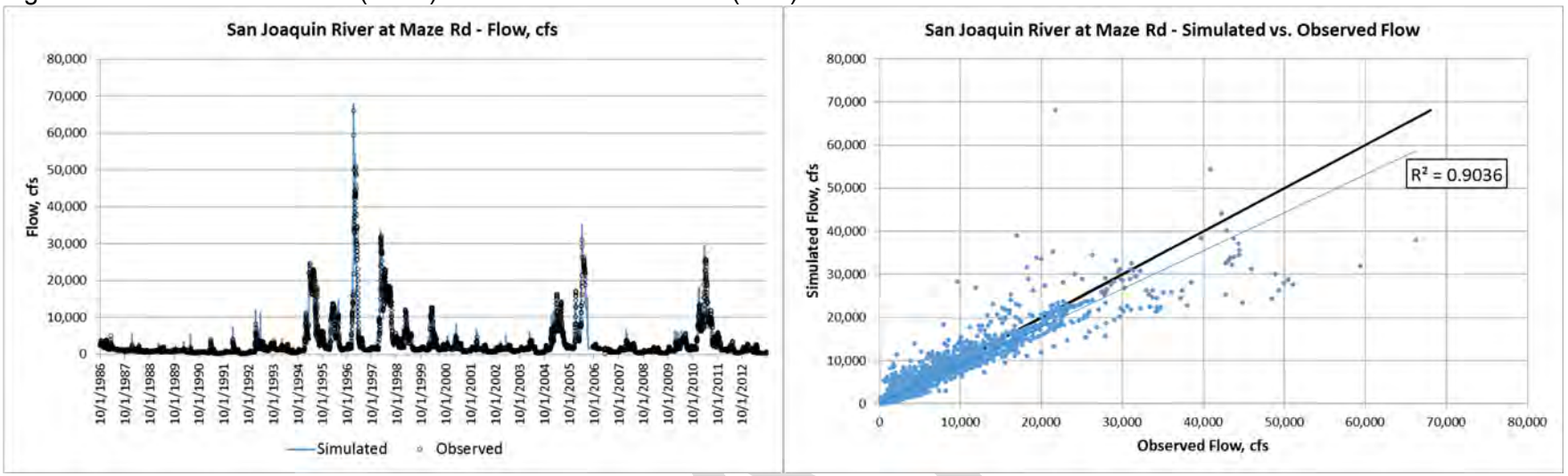


Figure 5-5 WARMF Simulated (black) and Historical Observed (blue) Flow at Patterson Bridge

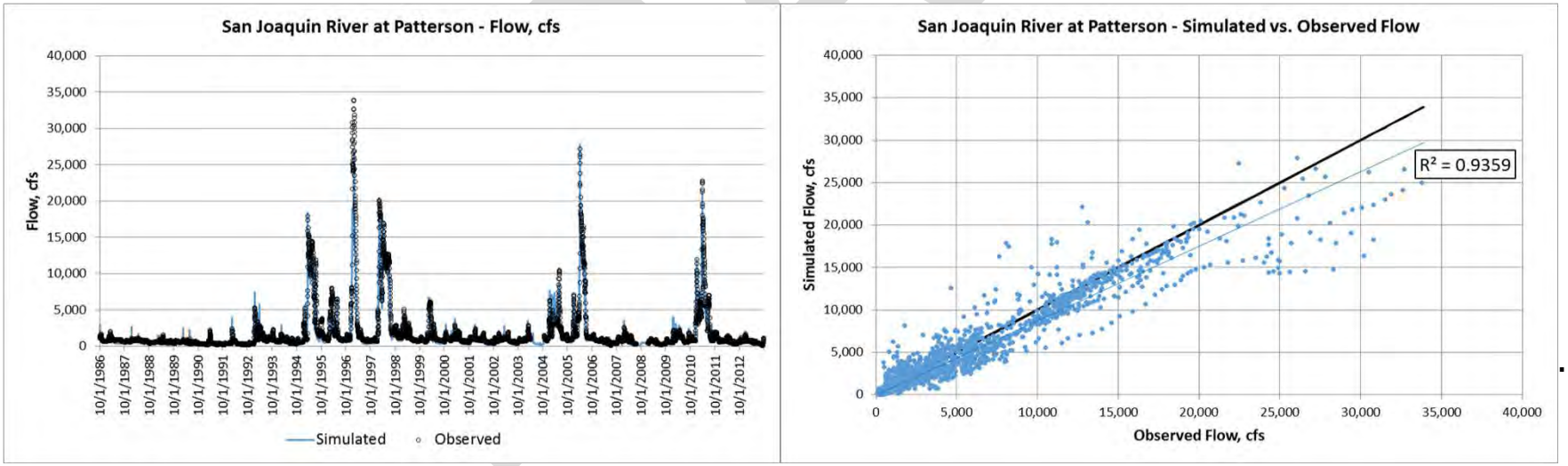


Figure 5-6 WARMF Simulated (black) and Historical Observed (blue) Flow at Crows Landing

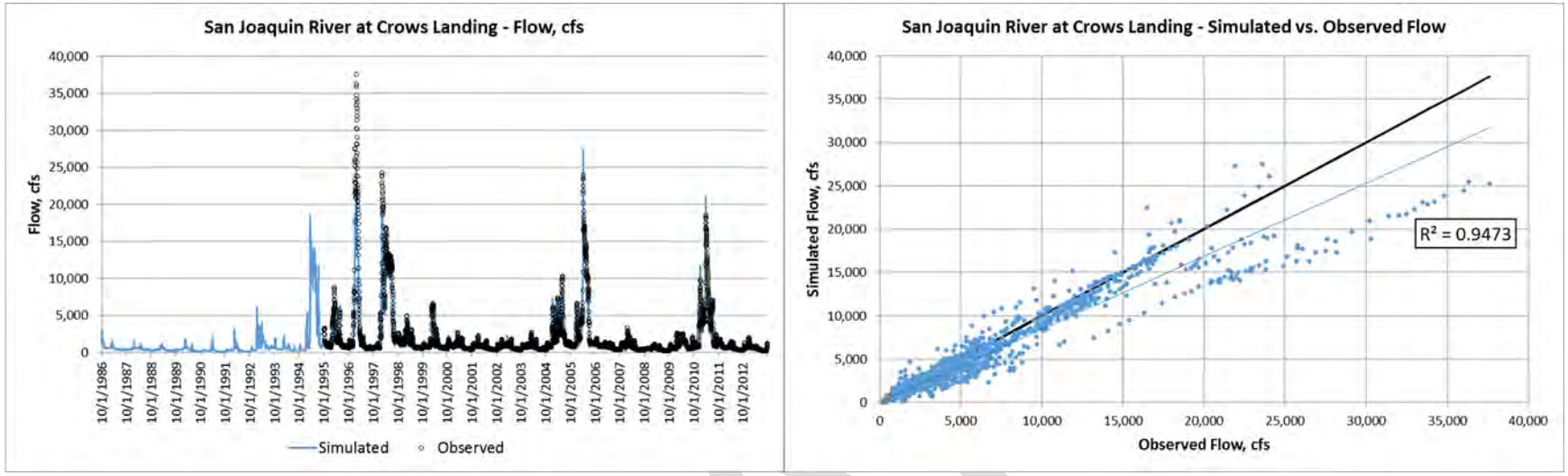


Figure 5-7 WARMF Simulated (black) and Historical Observed (blue) EC at Maze Road.

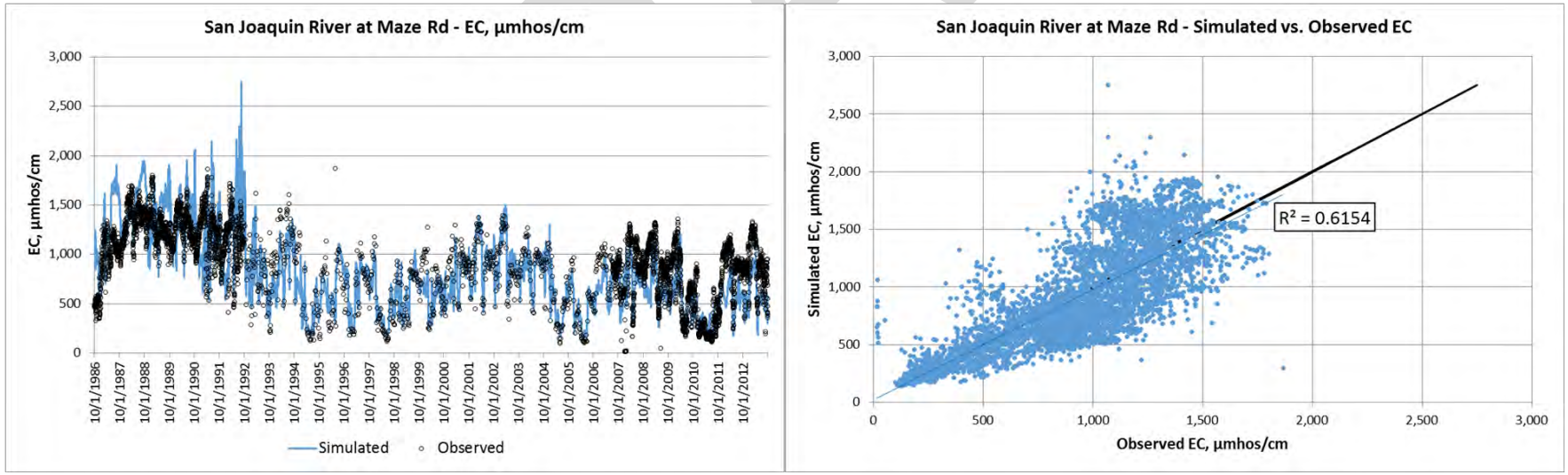


Figure 5-8 WARMF Simulated (black) and Historical Observed (blue) EC at Patterson B

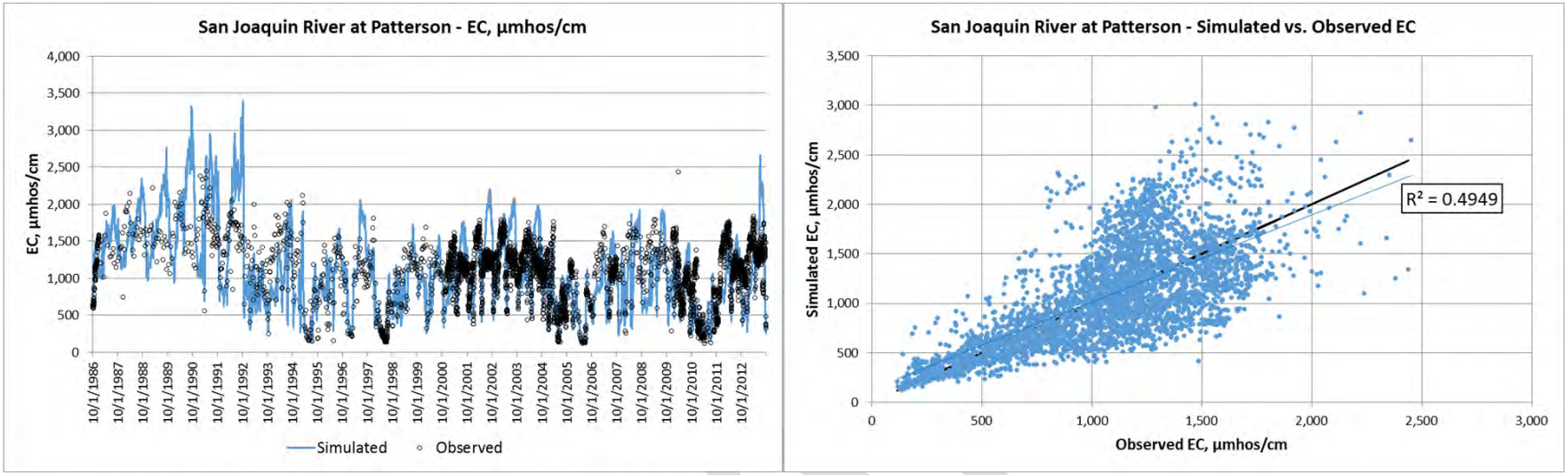
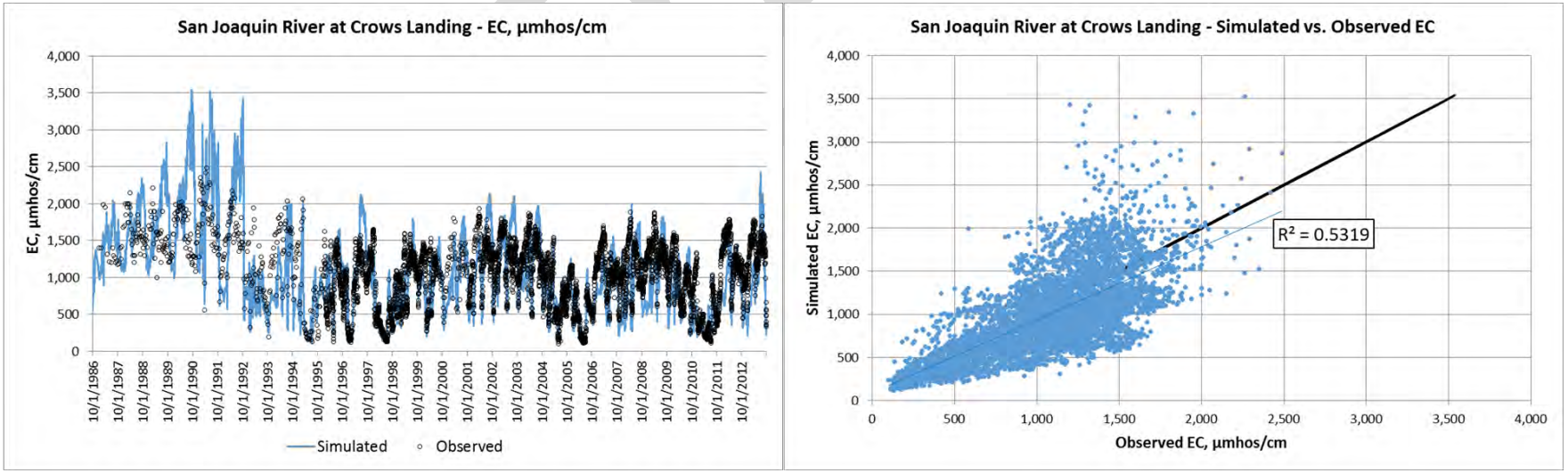


Figure 5-9 WARMF Simulated (black) and Historical Observed (blue) EC at Crows Landing Bridge



5.3.1.5.1 Planned Bundle of Management Actions

The Planned Bundle of Management Actions is defined in Table 3 of the LWA Task 4 report (Larry Walker Associates (LWA), 2015a). The most substantial in terms of salt load reduction is the completion of the Grasslands Bypass Project, which will result in a cessation of agricultural discharges to Mud Slough by the end of 2019 (except for flooding events). The WARMF modeling simulated flow and EC conditions expected to occur as a result of implementation of salinity control actions that are currently in effect or planned for implementation, with two exceptions. The first exception is regarding treated effluent discharges from the Cities of Modesto and Turlock wastewater treatment plant discharges. The model assumed a 3 percent reduction in salt loads. The second exception is regarding salts in fertilizers and soil amendments. A 10 percent reduction in the application of nitrogen-based fertilizers in select subareas was modeled. As relatively minor inputs to the WARMF model in terms of overall salt load reduction, these values served as conservative predictions for these actions.

The highest pre-processed WARMF model results for the Planned Bundle at Crows Landing were all less than 1,550 µS/cm for all water year types (Figure 5-19). Pre-processed WARMF model results for below normal, dry, and critical water years show peaks in EC levels between August and September at around 1,500 µS/cm. When the Planned Bundle pre-processed WARMF model results at Crows Landing are adjusted to match the timing and magnitude of historical EC levels, modeled results for all water-year types again fall below 1,550 µS/cm (Figure 5-20). Adjusted Planned Bundle WARMF model results are actually reduced for below normal, dry, and critical water years, with peak values in EC levels between February and May at around 1,350 µS/cm. All adjusted WARMF EC results at Crows Landing for wet and above normal water years fall under 1,010 µS/cm.

5.3.1.5.2 Planned plus Maximum Treatment Bundle of Management Actions

The Planned plus Maximum Treatment Bundle of Management Actions is defined in Table 4 of the LWA Task 4 report (Larry Walker Associates (LWA), 2015a). The modeling simulated the same conditions as those in the Planned Bundle with the addition of a reverse osmosis (RO) treatment facility. The RO facility would treat drainage diverted from Mud and Salt Sloughs and return the high quality treated water back to these water bodies just upstream of their confluence with the San Joaquin River. The treatment facility was designed to support the achievement of a 1,010 µS/cm EC target at Crows Landing. The RO facility would have a maximum treatment capacity of 160 million gallons per day (mgd) and would return 80 percent of diverted flows back to the two diversion points as a low salinity mixture of treated water.

The highest pre-processed WARMF model results for the Maximum Treatment Bundle at Crows Landing for all but critical water years were under 1,010 µS/cm (Figure 5-21). Additionally, pre-processed WARMF model results for the critical water year peak at around

1,200 µS/cm between August and September. When the Maximum Treatment Alternative pre-processed WARMF model results at Crows Landing are adjusted to match the timing and magnitude of historical EC levels, modeled results for all water-year types are observed to fall below 1,010 µS/cm (Figure 5-22). Critical water year adjusted average EC levels peak at around 1,010 µS/cm in August.

5.3.1.5.3 Planned plus Maximum Management Bundle of Management Actions

The Planned plus Maximum Management Bundle of Management Actions is defined in Table 5 of the LWA Task 4 report (Larry Walker Associates (LWA), 2015a). The modeling simulated the conditions modeled in the Planned Bundle with the addition of a SJRIP-like project that diverts flows from Mud and Salt Sloughs to progressively irrigate salt tolerant crops. Under the Maximum Management Bundle, all flows (and their corresponding salt loads) would be discharged to land and would not directly reach the San Joaquin River. The pre-processed WARMF model results for the Maximum Management Bundle at Crows Landing indicated that in dry, wet, and above normal water years the EC would be less than 1,010 µS/cm (Figure 5-23). For critical and below normal water years, pre-processed WARMF model results indicated EC levels could be as high as 1,800 µS/cm between August and September at Crows Landing.

When the Maximum Management Bundle WARMF results at Crows Landing are adjusted to match the timing and magnitude of historical EC levels, modeled results for all water-year types are observed to fall below 1,350 µS/cm (Figure 5-24). Results indicate that the permanent diversion of water from the system, as opposed to modeled the Maximum Treatment Bundle that returns treated water to the river, provides little to no additional EC improvement compared to the Planned Bundle. The highest adjusted EC values are estimated to occur during critical and below normal water years when EC levels peak at around 1,350 µS/cm from July through September.

5.3.1.6 ***Evaluation of WARMF Bundle Results and Comparison with Baseline Modeling***

Ambient historical results and Baseline model results at Maze Road show a relatively good match when comparing EC levels (Figure 5-10 and Figure 5-11). However, Baseline model results at Crows Landing show discrepancies in both the magnitude and timing of peak EC levels when comparing them to historical EC levels in below normal, dry, and critical water years (Figure 5-12 and Figure 5-13). Ambient historical results and Baseline model results at Crows Landing show a relatively good match when comparing flow (Figure 5-14 and Figure 5-15), indicating that the discrepancy between historical and modeled results is due to differences in the TDS mass loads.

The results of each of the modeled alternatives were plotted for critical water years to compare each alternative at Crows Landing. Figure 5-16 shows pre-processed WARMF model output

and Figure 5-17 presents modeled results adjusted to historical output. Critical water year results were chosen because this water year type proved to be the most challenging in terms of modeling to meet the EC targets. For both the pre-processed WARMF model output and the adjusted WARMF model output at Crows Landing, the Maximum Treatment Alternative was observed to provide the lowest EC levels. Details of the results of each of the three modeled management alternatives are described below

Figure 5-10 Maze Road Historical Daily Average of 30-day Running Average EC by Water Year Type

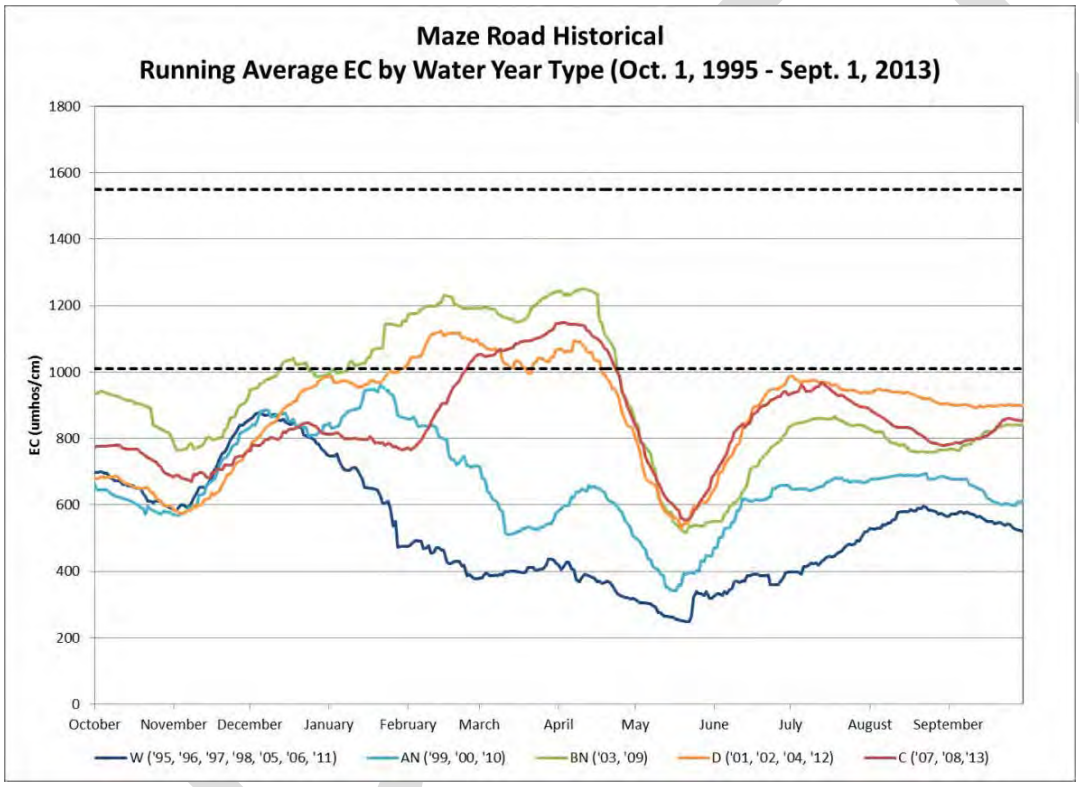


Figure 5-11 Maze Road Baseline Daily Average of 30-day Running Average EC by Water Year Type

Figure 5-12 Crows-Patterson Historical Daily Average of 30-day Running Average EC by Water Year Type

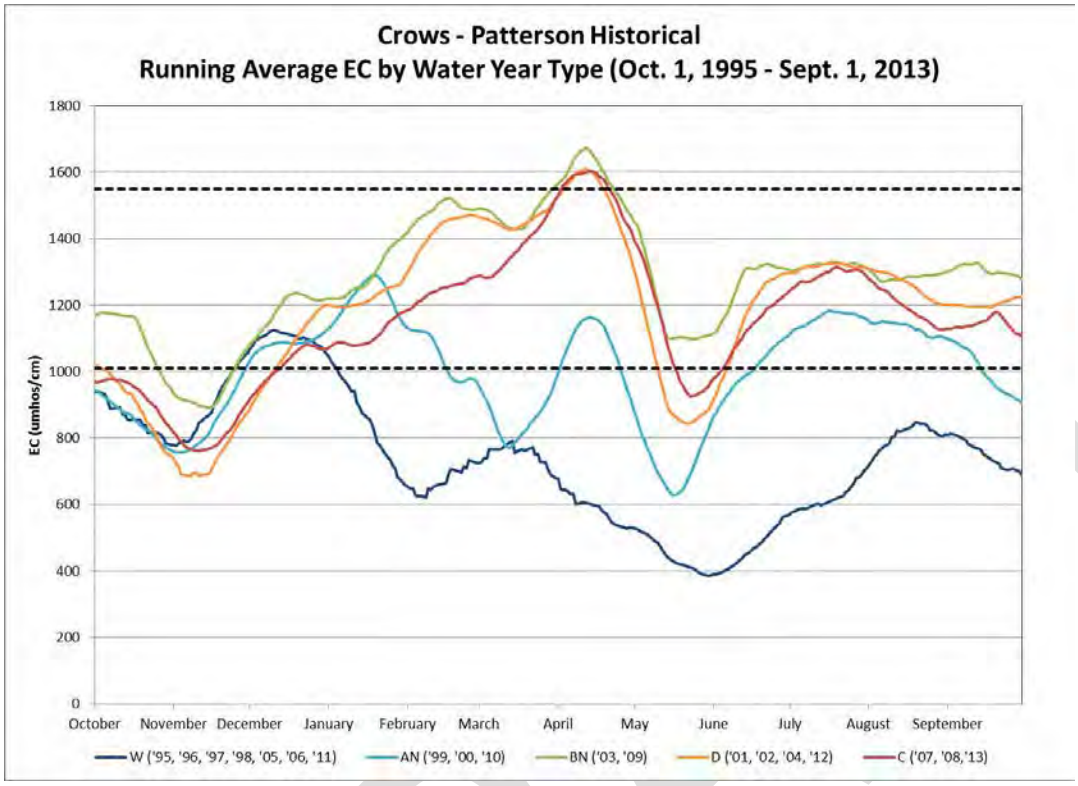


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Figure 5-13 Crows Landing Baseline Daily Average of 30-day Running Average EC by Water Year Type

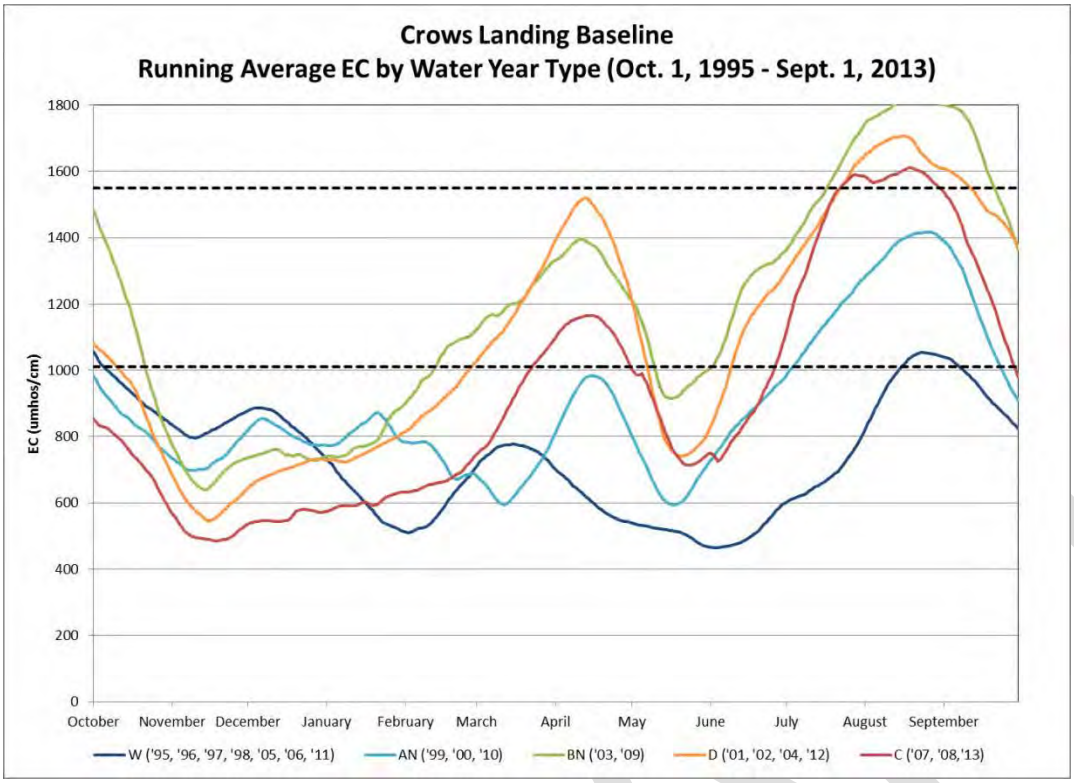


Figure 5-14 Crows-Patterson Historical Daily Average of 30-day Running Avg Flow by Water Year Type

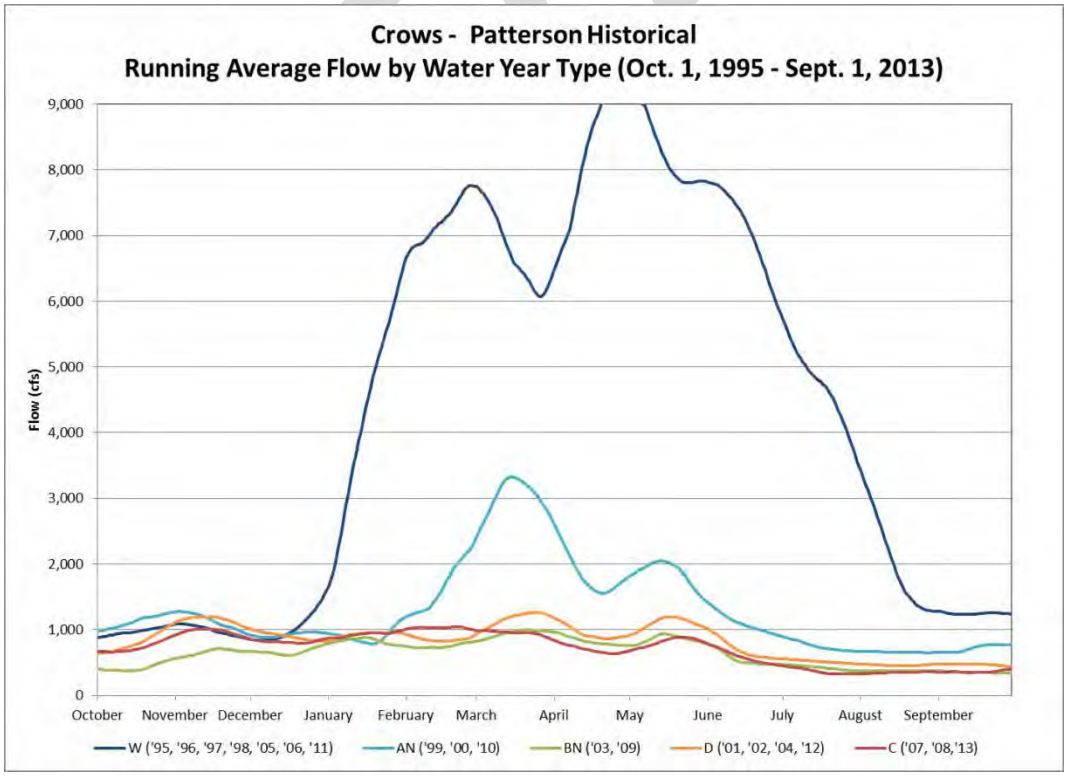


Figure 5-15 Crows Landing Baseline Daily Average of 30-day Running Average Flow by Water Year Type

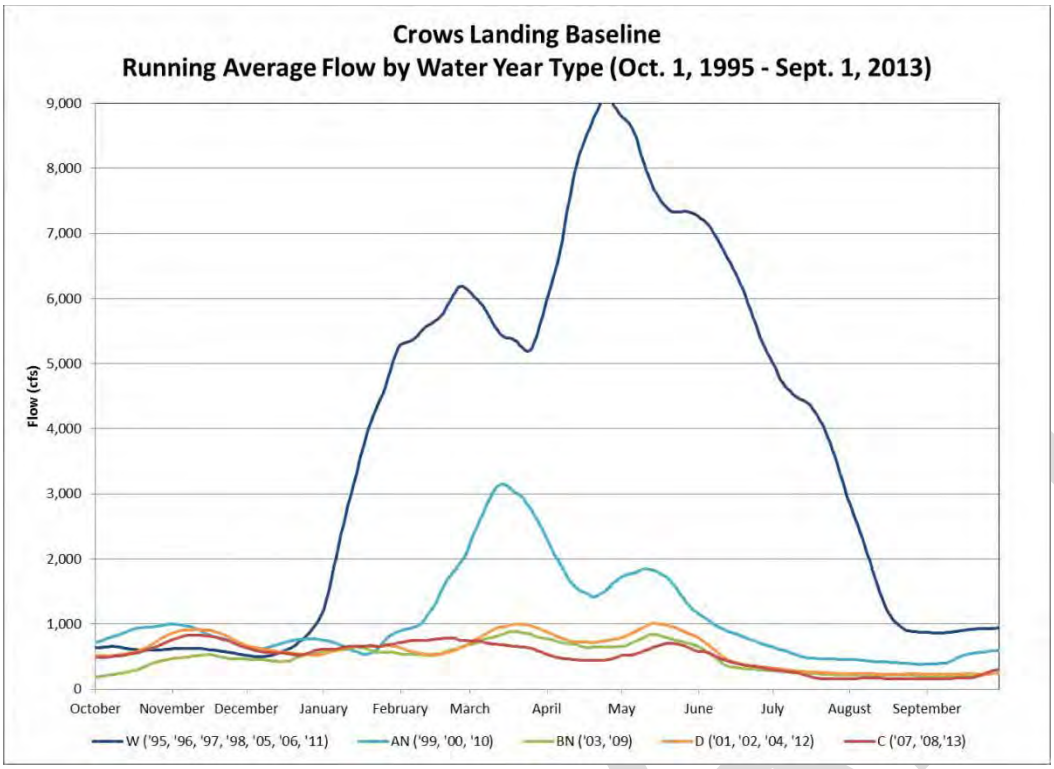


Figure 5-16 Crows Landing Critical Water Year Daily Average of 30-day Running Average EC for Management Alternatives - Pre-processed WARMF

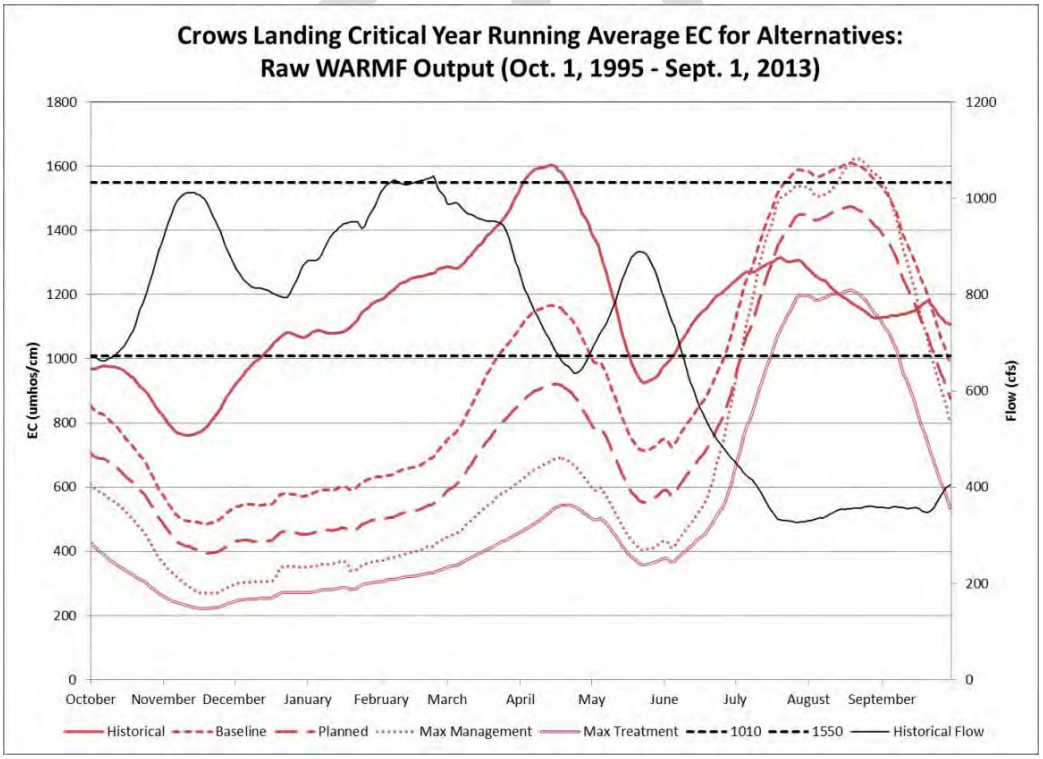
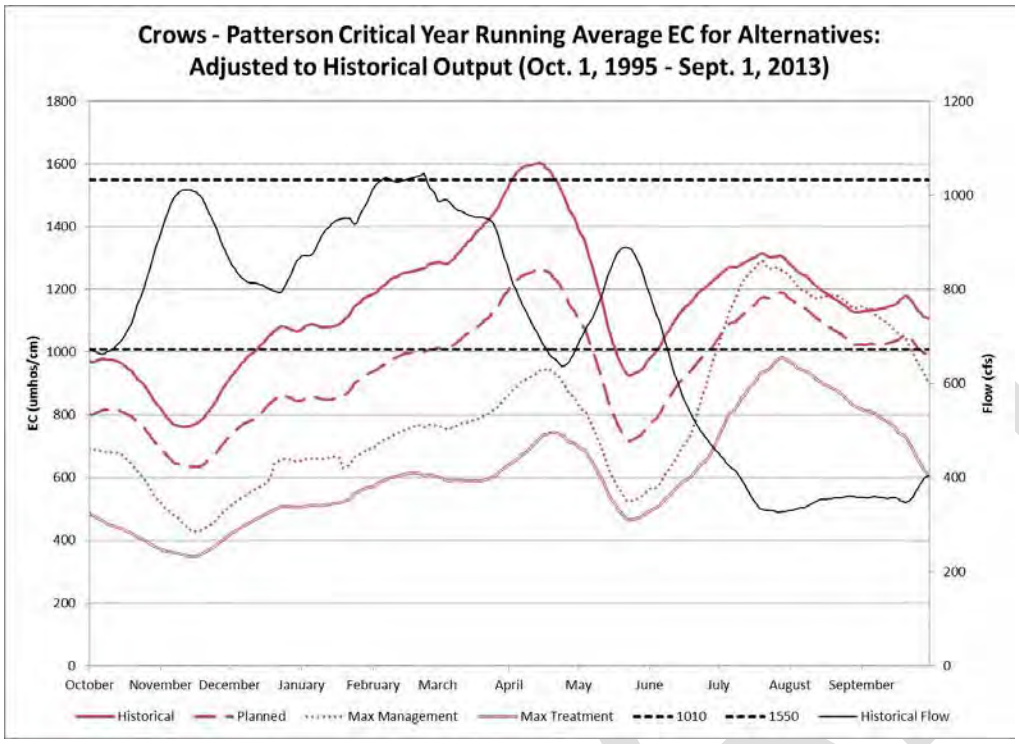


Figure 5-17 Crows-Patterson Critical Water Year Daily Average of 30-day Running Average EC for Management Alternatives - Adjusted to Historical Output



As mentioned earlier, differences in the timing and magnitude of simulated EC levels at Crows Landing were observed when comparing historical results (Figure 5-12) to Baseline simulation results (Figure 5-13). Because the modeled management alternatives depict incremental changes from the modeled baseline simulation, the difference in simulated EC between the modeled management alternatives and the baseline was adjusted using a correction factor applied to historical data The methodology for development and application of the correction factor to results at Crows Landing is described in more detail in the LWA Task 4 report (LWA, 2015b). Figure 5-16 depicting the pre-processed WARMF output at Crows Landing is provided for scenario simulation reference. The adjusted simulation pre-processed results, adjusted from historical data, are presented in Figure 5-17. The adjusted results should be the basis for discussion of the achievability of objectives with implementation of a management alternative as they are more accurate estimates of EC under the conditions represented by each scenario. No adjustments were made to WARMF modeling results for Maze Road due to the good match between historical EC observations and Baseline model results at this location.

5.3.2 Potential Operational Changes at New Melones Reservoir

One of the concerns of the LSJR Committee was the potential that the Project Alternatives could increase the frequency of water releases from the New Melones Reservoir by the U.S.

Bureau of Reclamation necessary to meet the Vernalis WQOs. To address this issue, the LSJR Committee coordinated with Dan Steiner, a modeling expert retained by the San Joaquin Tributaries Authority. In order to evaluate this potential, Mr. Steiner used the New Melones Operational Model (Steiner, 2015) to estimate changes in New Melones Reservoir releases related to compliance with Vernalis WQOs that would have been required during the 1995-2013 time period had the bundles of management alternatives been in place.

To address the effect of management measures in and above Reach 83 on EC conditions at Vernalis, Results of WARMF modeling at Maze Road were provided to Mr. Steiner, who then used his calibrated New Melones Operational Model worksheet to predict resultant flow and water quality conditions at Vernalis and to assess changes in required releases from New Melones Reservoir to meet Vernalis EC objectives. The model accounts for the complexities of operation of New Melones Reservoir and Goodwin Dam. The results of the analyses performed by Mr. Steiner are summarized below (Steiner, 2015).

The New Melones Operational Model results for the Planned Bundle showed either no change in some years to a maximum reduction in water quality releases of 56,000 acre-feet in the amount of water released from the reservoir to meet current Vernalis EC Objectives compared to releases estimated by the Baseline model simulation.

The New Melones Operational Model results for the Maximum Treatment Bundle showed either no change in some years to a maximum reduction in water quality releases of 68,000 acre-feet in the amount of water released to meet the current Vernalis EC objective compared to the Baseline WARMF model simulation. This estimate represents an additional 12,000 acre-feet reduction in release requirements as compared to the reductions estimated for the Planned Alternative. Results for the Maximum Treatment Alternative simulation indicate that the construction and operation of a 160 mgd RO facility that returns 80 percent of the treated effluent back to the LSJR upstream of Reach 83 may reduce EC levels in Reach 83 to levels that support a potential EC objective of 1,010 µS/cm in all water years.

The New Melones Operational Model results for the Maximum Management bundle showed either no change in some years to a maximum reduction in water quality releases of 65,000 acre-feet in the amount of water released to meet the current Vernalis EC objective compared to releases estimated by the Baseline WARMF model simulation. This estimate represents an additional 9,000 acre-feet savings as compared to the Planned Bundle.

In summary, none of the bundled management implementation actions, as modeled by New Melones Operational Model, demonstrated that an increase of water releases from the New Melones Reservoir would be required to meet the salinity objectives at Vernalis. On the contrary, all of the options showed that there would either be no change or a reduction in releases from New Melones Reservoir, depending on type of water year (Steiner, 2015).

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5.4 Identification and Selection of Project Alternatives

The WARMF modeling of the implementation of the three bundles of management actions described above provided an indication of the range of ambient salinity levels estimated to be achievable in Reach 83. This information was used to assist in the development of five distinct project alternatives for EC WQOs in Reach 83 between the range of 1,010 and 1,550 µS/cm. Also, a No Action Alternative (i.e. establish no EC objective in Reach 83), as required by CEQA, and a year-round 700 µS/cm WQO (based on Ayers and Westcot, 1985) were added for a total of seven potential project alternatives for further evaluation. The alternatives, listed in Table 5-10, are as follows:

1) No EC Objective

2) 1,550 µS/cm Objective

3) Tiered Objective – 1,350 µS/cm, except during Critically Dry Water Years (WY) 1,500 µS/cm

4) 1,500 µS/cm Objective and a 1,350 µS/cm Performance Goal for certain seasons and WY types

5) 1,350 µS/cm Objective

6) 1,010 µS/cm Objective

7) 700 µS/cm Objective

The LSJR Committee also included the option of setting different WQOs for Extended Dry Periods.

These potential project alternatives were examined using a set of evaluation criteria that were developed by the LSJR committee specifically for this purpose. The following evaluation criteria presented in Table 5-10 were built upon the Table 5-8 screening criteria:

1) Consistent with federal/state laws, plans and policies,

2) Consistent with other relevant WQOs (e.g., existing Reach 83 boron WQOs; Vernalis WQOs),

3) Reduces dependency on New Melones Reservoir water quality releases,

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4) Supports salt transport out of basin,

5) Scientifically Defensible (protects beneficial uses),

6) Meets CV-SALTS Goals, and

7) Feasible to Implement.

An evaluation of the selection criteria was determined to be necessary for any project alternative to be advanced. The LSJR Committee applied a “yes” or “no” approach to indicate whether a given project alternative would be expected to reasonably meet a given criterion (Table 5-10). For additional detail on the development of selection criteria, see the LWA Task 4 report (Larry Walker Associates (LWA), 2015a)

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Table 5-10 LSJRC Basin Plan Amendment Project Alternative Matrix

Project Alternatives	Technical Basis for Alternatives Electrical Conductivity (EC) Water Quality Objectives (WQOs)	Evaluation Criteria: Ratings: Y=Criteria are fully met, N=Criteria are partially or not met						
		A. Consistent with federal/state laws, plans and policies	B. Consistent with other relevant WQOs (e.g., Boron, Vernalis EC)	C. Reduced dependency on New Melones Water Quality Releases	D. Supports salt transport out of basin	E. Scientifically Defensible (protects Beneficial Uses)	F. Meets CV-SALTS Goals	G. Feasible to Implement
1 No EC Water Quality Objectives	Basin Plan: Continue to regulate dischargers pursuant to the Control Program for Salt and Boron Discharges into the Lower San Joaquin River.	N	N	N	Y	N	N	Y
2 1,550 µS/cm EC Water Quality Objective	Hoffman Model: Run output for almond crop yield of 95% when applied irrigation results in 15% leaching fraction and annual precipitation equals the dryest 5% historical precipitation in the LSJR Basin.	Y	Y	Y	Y	Y	Y	Y
3 Tiered Water Quality Objectives for Water Year Considerations: 1,350 µS/cm and during critically dry water years 1,550 µS/cm	1,350 µS/cm: WARMF Model: Run output for the Planned Bundle of Management Actions. 1,550 µS/cm: Same technical basis as WQO option #2.	Y	Y	Y	N	Y	N	N
4 1,550 µS/cm EC Water Quality Objective and 1,350 µS/cm EC Performance Goal for Seasonal and Water Year Considerations (see Table 10)	1,550 µS/cm: Same technical basis as WQO option #2. 1,350 µS/cm: WARMF Model: Run output for the Planned Bundle of Management Actions.	Y	Y	Y	Y	Y	Y	Y
5 1,350 µS/cm Water Quality Objective	WARMF Model: Run output for the Planned Bundle of Management Actions.	Y	Y	Y	N	Y	Y	N
6 1,010 µS/cm Water Quality Objective	Hoffman Model: To consider drought conditions, run output for almond crop yield of 95% when applied irrigation results in 10% leaching fraction and annual precipitation equals the dryest 5% historical precipitation in the LSJR Basin. (Also, approximately equal to nongrowing season Vernalis EC WQO of 1,000 µS/cm.)	N	Y	Y	N	Y	N	N
7 700 µS/cm Water Quality Objective	Ayers and Westcot. (Also, equal to growing season Vernalis EC WQO.)	N	Y	Y	N	Y	N	N

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5.4.1 Final Selection of Project Alternatives

During two meetings held on March 17 and March 26, 2015, the LSJR Committee considered the seven project alternatives, the evaluation criteria, the WARMF modeled baseline, and the modeled management alternative bundles. Some of the key questions that tied into the selection criteria listed above included:

- Does the alternative provide reasonable protection of the AGR and MUN uses in Reach 83?
- Will the alternative reduce releases from New Melones Reservoir to meet the Vernalis EC Objective?
- Can the alternative accommodate current and future Real-Time Salinity Management Program activities to meet Vernalis salinity objectives and support the objective to move salts out of the basin?
- Did the uncertainty analyses on the WARMF modeling output indicate a reasonable likelihood that the WQO was achievable?

As a result, the LSJR Committee identified a Preferred Alternative (#4) and three other alternatives (#1, #2, and #6) for a more detailed examination and consideration in the Basin Planning process.

Likewise, the initial screening also resulted in three potential project alternatives being rejected for further consideration in the Basin Planning process for the following reasons:

- Project alternative #3 (Tiered Objective – 1,350 µS/cm, except during Critically Dry Water Years) 1,500 µS/cm
  This alternative was eliminated because there was too much uncertainty with the WARMF model output of the planned actions to set an objective of 1,350 µS/cm in all but the critical water years. This alternative would also constrain the ability to export salts out of the basin when available assimilative capacity exists.

- Project alternative # 5 (1,350 µS/cm)
  This alternative was rejected for the same reasons as noted for #3.

- Project alternative # 7 (700 µS/cm)
  This alternative was rejected from further consideration because it was believed to be overly protective of the AGR (irrigation water supply) beneficial use in Reach 83 and would effectively eliminate the ability to export salts out of the basin. In addition, WARMF modeling demonstrated that it was not feasible to achieve for all water-year types even with the implementation of extensive treatment actions.

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It should be noted that while similar arguments for eliminating alternatives #3, #5, and #7 also exist for alternative #6 (1,010 µS/cm), the committee felt that it was important to include at least one value on the lower end of the criteria range for further evaluation and feasibility analysis.

Extended Dry Periods

The Preferred Alternative proposes adjusting WQOs during time periods when environmental conditions result in agricultural producers placing a higher value on water quantity then water quality in order to maintain a viable operation (i.e. an Extended Dry Period). The San Joaquin River Basin streams are subject to large fluctuations in flow, especially during drought periods. During these periods, the Committee was faced with two basic questions: 1) what level of agricultural beneficial use protection is needed and 2) how should Extended Dry Periods be identified to protect the agricultural use.

To answer the first question, the Committee worked with the agricultural water users to discuss levels of salinity protection needed. The Committee identified the following overriding concerns expressed by the users:

1. During drought periods quantity of water overrides quality; excess salt accumulated in soil can be addressed after these periods,
2. Any water is better than no water; salinity control can be managed by blending other water supplies,
3. Crop survival may become more important than crop yield, and
4. The periods of relaxed salinity standards should be minimized and not permanent.

After discussions with the agricultural water users, it was determined that a 75% crop yield level of protection could be tolerated during extended dry periods. The LSJR Committee used the Hoffman model to determine that an EC of 2,470 µS/cm in the irrigation water would provide this protection level. The Committee recognized that such a relaxation for crop survival would begin to store salt in the basin and would need to be dealt with at a later time. Therefore, a continued period of higher salinity objectives was recommended for the first year following an extended dry period in order to allow salt to be flushed from the soil profile and out of the river basin.

To define an Extended Dry Period, the LSJR Committee utilized the State Water Resources Control Board's San Joaquin Valley "60-20-20" Water Year Hydrologic Classification as a foundation. Details on the methodology to determine Extended Dry Periods are provided in the Implementation Chapter in Section 6.2.3.

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Comparison of the EC concentration protective of AGR during Extended Dry Periods (2,470 uS/cm) with existing WQOs to protect MUN (ranging from a recommended EC of 900 uS/cm to a short-term EC of 2,200 uS/cm), clarified that during these time periods, MUN use may be more sensitive to salinity than AGR use. While crop growth and production occur primarily during the irrigation season and is best protected utilizing a 30-day running average concentration objective, the objectives to protect MUN are based on continued use over a lifetime. Title 22 recommends evaluating attainment of secondary maximum contaminant levels including salinity, as an annual average using at a minimum the previous four consecutive quarterly samples. Therefore, the recommended salinity objective for Extended Dry Periods is 2,470 uS/cm as a 30-day running average and 2,200 uS/cm as an annual average using at a minimum the previous four consecutive quarterly samples.

5.4.2 Evaluation of Water Code Section 13241 Factors for the Final Alternatives

Water Code section 13241 requires the Central Valley Water Board to consider the following factors in establishing WQOs: (a) past, present, and probable future beneficial uses of water, (b) environmental characteristics of hydrographic unit, including quality of water available to it, (c) water quality conditions reasonably achievable through coordinated control of all factors that affect water quality in the area, (d) economic considerations, (e) the need for developing housing within the region, and (f) the need to develop and use recycled water. After considering these, and possibly other factors, the Central Valley Water Board may establish appropriate water quality criteria as WQOs. The following sections discuss the factors as they relate to the final alternatives.

5.4.2.1 Beneficial Uses

The beneficial uses of Reach 83 are described in detail in Chapter 4, Beneficial Uses. The beneficial uses that are most sensitive to salinity are AGR and MUN. The final alternatives represent a reasonable range of possible WQOs protective of both of those uses.

5.4.2.2 Environmental Characteristics of the Hydrographic Unit

Review of historic data showed clear variability in salinity both seasonally and between different water-year types (from critically dry to wet). Freshwater dilution flows from the eastside tributaries are critical to providing assimilative capacity for salt. Flows from upstream of the Merced River provide the majority of salt loading to Reach 83. The distinct characteristics of the hydrograph support consideration of seasonal and water-year type dependent WQOs.

5.4.2.3 Water Quality Conditions That Could Reasonably Be Achieved

WARMF modeling of the planned actions in the San Joaquin River watershed, primarily the completion of the Grassland Bypass Project at the end of 2019, show an overall decrease in

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EC for Reach 83 compared to historical EC levels and achievement of a 1,550 µS/cm WQO in all water year types. An EC value of 1,350 µS/cm may also be achievable in the river with planned actions, especially during wetter years. However, model uncertainty must be taken into consideration, supporting the use of 1,350 µS/cm as a performance goal rather than a WQO. Meeting the WQO for Alternative #6 (1,010 µS/cm) may be achieved through the substantial management action of installing a reverse-osmosis treatment facility, but as described below, that would not be an economicaly reasonable option to consider. Similarly, a WQO of 1,550 µS/cm will provide more assimilative capacity in the water body to move salts out of the basin as compared to a WQO of 1,010 µS/cm.

5.4.2.4 Economic Considerations

Chapter 9 provides a detailed Economic Analysis for the final project alternatives. In summary, project Alternative #6 (1,010 µS/cm year-round) would require the most costly management actions with the installation of a reverse-osmosis treatment facility as compared to the other alternatives that rely primarily on planned actions within the watershed.

5.4.2.5 Need for Housing

Adopting an EC objective below 1,350 µS/cm may restrict the development of housing in the Cities of Turlock and Modesto as their current effluent concentrations approach 1,200 uS/cm and may not be able to adjust to lower limits.

5.4.2.6 Need to Develop and Use Recycled Water

An objective of 1,010 µS/cm may decrease the ability of agricultural users to recycle and conserve water within their irrigation districts in order to meet the lower objective in their discharge as compared to an objective of 1,550 µS/cm. The 1,010 uS/cm may also affect the Cities of Turlock and Modesto's ability to expand current conservation efforts as their discharge is approaching 1,200 uS/cm. The proposed objective of 1,550 uS/cm with an Extended Dry Period adjustment to 2,270 uS/cm as a 30-day running average and 2,200 uS/cm as an annual average (using at a minimum the previous four consecutive quarterly samples) provides the most flexibility to allow for reuse and conservation in both agricultural and urban environments while reasonably protecting beneficial uses.

5.5 Selection of Preferred Alternative

Among the four potential project alternatives selected by the LSJR Committee for consideration in the Basin Planning process, project alternative #4 was selected as the Preferred Alternative because it was determined to best meet the seven evaluation criteria and provide the greatest operational flexibility to export salts out of the basin while promoting the best possible water quality for the protection of both the AGR and the MUN beneficial uses in Reach 83.

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The three other potential project alternatives did not rank as high as alternative #4 on an aggregate basis for the following reasons:

- Project alternative # 1 (No Action Alternative)
  Under this alternative, the Board would continue to evaluate, on a case-by-case basis, whether permit requirements regulating salinity discharges to the LSJR required by waste discharge requirements issued under Water Code section 13260 or NPDES permits issued under Water Code section 13370 et seq. would be sufficiently protective of beneficial uses and would be consistent with the Control Program for Salt and Boron Discharges to the LSJR. This case-by-case evaluation would necessarily require a re-evaluation of applicable numeric and narrative water quality criteria/objectives whenever a permit was issued or revised. This alternative was not selected as the Preferred Alternative because it would be contrary to the directive of the Control Program for Salt and Boron Discharges to the LSJR, which requires establishment of a WQO for salinity upstream of the Airport Way Bridge near Vernalis; continuing to perform such an evaluation on a case-by-case basis would not result in the coordinated and consistent approach to regulating salinity required by the Control Program for Salt and Boron Discharges to the LSJR.

- Project alternative #2 (1,550 µS/cm)
  This alternative was not selected as the Preferred Alternative since it does not recognize the potential to achieve better water quality during some water-year types.

- Project alternative #6 (1,010 µS/cm)
  This alternative was not selected as the Preferred Alternative because it would require the implementation of a significantly more costly management action (reverse-osmosis treatment included in the Maximum Treatment Bundle), as compared to the Preferred Alternative, and its water quality benefits in terms of protection of the AGR irrigation water supply beneficial use were not considered to be commensurate with its costs.

The Preferred Alternative (#4) includes an EC WQO of 1,550 µS/cm (at 25 degrees Celsius) and an EC Performance Goal[7] of 1,350 µS/cm for the irrigation season during certain water-year types (more information on the implementation of the Performance Goal is presented in Chapter 6). The LSJR Committee agreed that an EC WQO of 1,550 µS/cm provided reasonable protection of AGR in the LSJR Irrigation Use Area, based on the results of the Hoffman model for the protection of almond crops. The 1,550 µS/cm EC WQO also provides protection of the potential MUN use because it is less than the upper Secondary MCL value specified for specific conductivity in Title 22 of the California Code of Regulations. By also

[7] The Performance Goal would be used to measure progress towards achievement of EC levels during certain water-year types and times of the year that are of higher quality than the proposed EC WQO for Reach 83 of the LSJR. See the Implementation Chapter for more information on the application of the Performance Goal.

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including an implementation EC Performance Goal, Alternative #4 will promote achievement of the best possible water quality under variable conditions. The LSJR Committee recommended utilizing a maximum 30-day running average of mean daily EC as the averaging period for both the WQO and Performance Goal

The LSJR Committee also recommended that the Preferred Alternative include the option of utilizing Extended Dry Period WQOs. Based on Hoffman model results for the protection of almond crops with a lower crop yield parameter (75%), the committee recommended an EC WQO that does not exceed 2,470 µS/cm as a 30-day running average. In conjunction with this WQO that is reasonably protective of AGR, the LSJR Committee recommended the use of the short term secondary MCL for specific conductivity of 2,200 µS/cm to provide a reasonable level of protection for the potential MUN use. This short-term value is calculated by using an annual average (with a minimum of the previous four consecutive quarterly samples). The definition and implementation requirements of the Extended Dry Period is detailed in Chapter 6.

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6 PROGRAM OF IMPLEMENTATION

This section describes the proposed program of implementation for the Preferred Alternative for EC water quality objectives (WQOs) in the LSJR identified in Chapter 5. Chapter 3 (Section 3.4) describes the laws and policies that apply to implementation and these include actions necessary to achieve the WQOs, a time schedule and a monitoring and surveillance program (described in more detail in Chapter 7).

6.1 Preferred Alternative

Based on the information developed in previous sections of this staff report, the proposed action (Preferred Alternative) is to adopt an EC WQO and an EC Performance Goal that contains seasonal and water-year considerations in Reach 83 of the LSJR, as shown in Table 6-1.

The proposed Basin Plan amendments would establish a EC WQO that would require EC at 25 degrees Celsius not exceed 1,550 µS/cm as a 30-day running average in Reach 83, except during Extended Dry Periods, when the WQO would require that EC not exceed 2,470 µS/cm as a 30-day running average and 2,200 µS/cm as an annual average using at a minimum the previous four consecutive quarterly samples. The Preferred Alternative also includes the implementation of an EC Performance Goal of 1,350 µS/cm for certain seasonal and water-year types.

6.2 Proposed Program of Implementation for Preferred Alternative

6.2.1 Management Actions to Achieve Water Quality Objectives

While the LSJR Committee considered a number of potential implementation management actions during the WARMF modeling and feasibility analysis phase of the project (see Section 5.3), the selection of the Preferred Alternative means implementation of the management actions that have been planned during the next 5 to 10 years should achieve the proposed WQOs in the river. The planned salinity management actions modeled by the LSJR Committee should dramatically improve salinity levels to below those previously measured and modeling results indicated that 1,550 µS/cm EC at Crows Landing is attainable through implementation of those planned actions. Modeling also indicated that if a WQO was met at Crows Landing, planned management should alsoreduce the amount of water released from New Melones Reservoir to achieve the Venalis EC WQO. The most prominent impact to

salinity upstream of Crows Landing will be the completion of the final phase of the Grassland Bypass Project, scheduled for the end of 2019.

It should be emphasized that the continued implementation of components of the Real Time Management Program (RMTP) will also benefit salinity management in the river and assist with overall compliance. The RTMP facilitates the control and timing of wetland and/or agricultural drainage to the LSJR to coincide with periods when dilution flows are sufficient to meet salinity objectives.

Routine EC and boron monitoring should be conducted in the LSJR at Crows Landing and EC monitoring at Maze Road in order to assess compliance with the proposed EC and the existing boron WQOs for Reach 83, and to determine the effectiveness of the management actions. More information regarding the monitoring program is in Chapter 7.

6.2.2 Special Consideration for Point-Source NPDES discharges

Upon adoption and implementation of the proposed EC WQOs, changes to NPDES permits may be necessary. The Central Valley Water Board will consider the requirements of the EC WQOs when the NPDES permits are renewed or reopened. Water quality-based effluent limitations will be required in NPDES permits for dischargers that have reasonable potential to cause or contribute to an instream excursion above the EC WQOs in the LSJR based on the monthly average receiving water EC at the first diversion point downstream of their outfall providing AGR irrigation supply or MUN beneficial use. When conducting a Reasonable Potential Analysis, the Central Valley Water Board shall consider available dilution of the effluent in the receiving water, as determined at the first downstream diversion that provides AGR irrigation supply or MUN beneficial use.

If an NPDES point source discharge is deemed to have reasonable potential to cause or contribute to an instream excursion of the EC WQOs at the first diversion that occurs downstream that provides AGR irrigation supply or MUN beneficial use, water quality-based effluent limits shall be required. For publicly-owned treatment works (POTWs) the water quality-based effluent limitations may be established in terms of EC concentration or total dissolved solids (TDS) loading to account for site-specific consideration of dry weather versus wet weather conditions. However, concentration and loading limits shall not be applied at the same time. When establishing water quality-based effluent limitations for POTWs in terms of TDS loading, an EC to TDS ratio of 0.64 shall be used to convert EC concentrations to TDS concentrations, unless a discharger-specific ratio can be demonstrated. The design average dry weather flow of the POTW shall be used to calculate the TDS loading limits.

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6.2.3 Extended Dry Period Definition

The Preferred Alternative requires the use of an Extended Dry Period definition for the implementation of proposed alternative WQOs during time periods when environmental conditions result in agricultural producers placing a higher value on water quantity than water quality in order to maintain a viable operation. The San Joaquin River Basin is subject to large fluctuations in flow, especially during drought periods. During these periods, the Committee was faced with two basic questions: 1) what level of agricultural beneficial use protection is needed and 2) how should Extended Dry Periods be identified to protect the agricultural use.

To answer the first question, the Committee sat down with the agricultural water users to discuss levels of salinity protection needed. The Committee identified the following overriding concerns expressed by the users:

1. During drought periods quantity of water overrides quality; salt buildup can be addressed after these periods,
2. Any water is better than no water; salinity control can be managed by blending other water supplies,
3. Crop survival is more important that crop yield, and
4. Relaxation of salinity standards need to be short-term, not permanent.

After discussions with the agricultural water users, it was determined that a 75% crop-yield level of protection could be tolerated during these short-term periods. The LSJR Committee used the Hoffman model to determine that EC of 2,470 µS/cm in the river would provide this protection level. The Committee recognized that such a relaxation for crop survival would begin to store salt in the basin and would need to be dealt with at a later time.

In order to answer the second question (how to identify an Extended Dry Period), the Committee determined when Extended Dry Periods would have occurred in the past had the WQO been in place, and compared those periods to the actual historical water quality at the Crows Landing monitoring station. Figure 6-1 plots the 30-day running average EC at Crows Landing and the WQOs of 1,550 µS/cm and 2,470 µS/cm during the 2005 through 2016 Water Years. Next, the Committee used this evaluation to help establish a definition for Extended Dry Periods.

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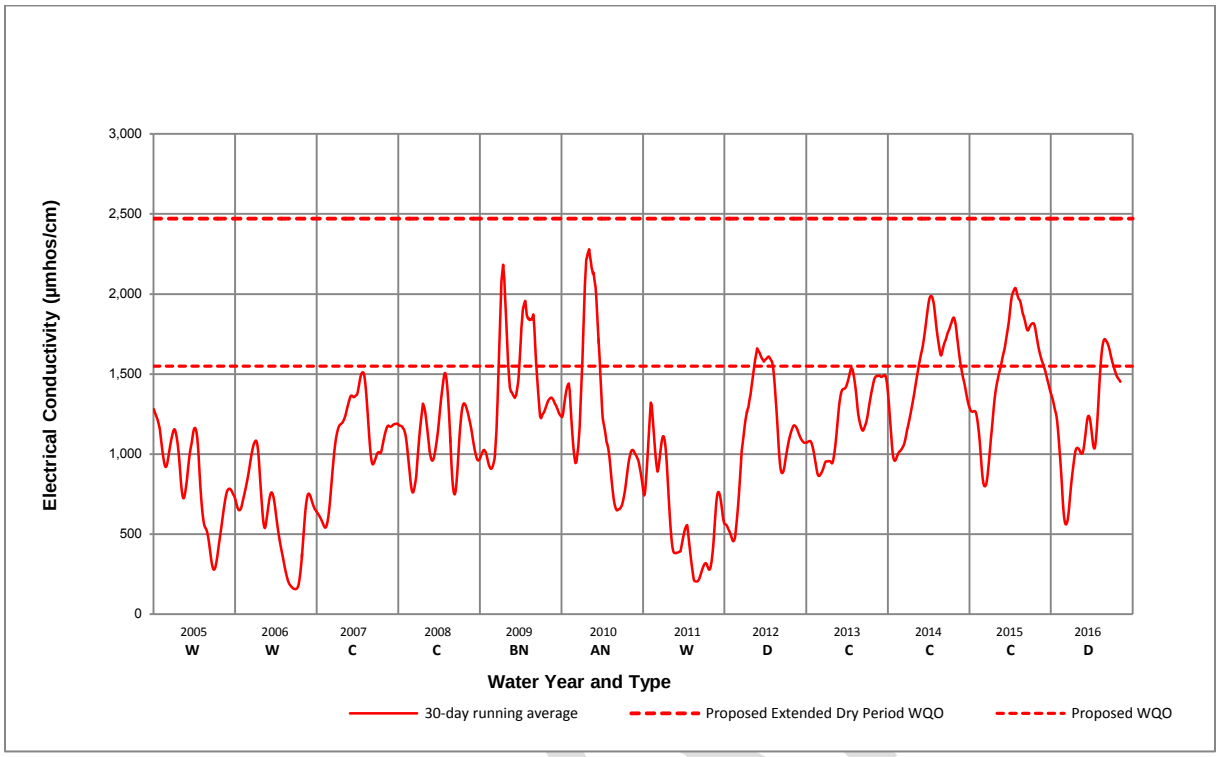
Figure 6-1 Electrical Conductivity 30-day running average at Crows Landing: WY2005 – 2016 and the Hoffman Model established Protection for AGR Beneficial Use.



Through the LSJR Committee efforts, an Extended Dry Period definition was established using the State Water Board's San Joaquin Valley "60-20-20" Water Year Hydrologic Classification[8] included in revised Water Right Decision 1641 to assign a numeric indicator to a water-year type as follows-(State Water Resources Control Board, 2000):

- Wet – 5
- Above Normal – 4
- Below Normal – 3
- Dry – 2
- Critically Dry – 1

[8] The method for determining the San Joaquin Valley Water Year Hydrologic Classifications (e.g., critical, dry, below normal, above normal, wet) is defined in the SWRCB Revised Decision 1641, March 2000, Figure 2, page189. This method uses the best available estimate of the 60-20-20 San Joaquin Valley water year hydrologic classification at the 75% exceedance level using the best available data published in the California Department of Water Resources' ongoing Bulletin 120 series.

The indicator values would be used to determine when an Extended Dry Period is in effect:

- An Extended Dry Period shall begin when the sum of the current year's 60-20-20 indicator value and the previous two year's 60-20-20 indicator values total six (6) or less.
- An Extended Dry Period shall be deemed to exist for one water year (12 months) following a period with an indicator value total of six (6) or less.

Figure 6-2 plots the 30-day running average EC at Crows Landing and the proposed WQOs of 1,550 µS/cm and 2,470 µS/cm that would have been in place during the 2005 through 2016 water years had the proposed WQOs been required. The figure shows that the proposed WQOs would have protected the agricultural beneficial use during these water years.

Figure 6-2 shows for water years 2007, 2008 and 2009 there would have been two critical and one below normal water years. Beginning in water year 2009, the sum would have been 5 and thus an extended dry period would have existed. The figure also shows that water year 2010 was above normal. The sum for defining an extended dry period would have been 8 during that water year, but it would still have been an extended dry period according to the definition above. During this year, the high salt load that was in the river could still be removed without exceeding the WQO.

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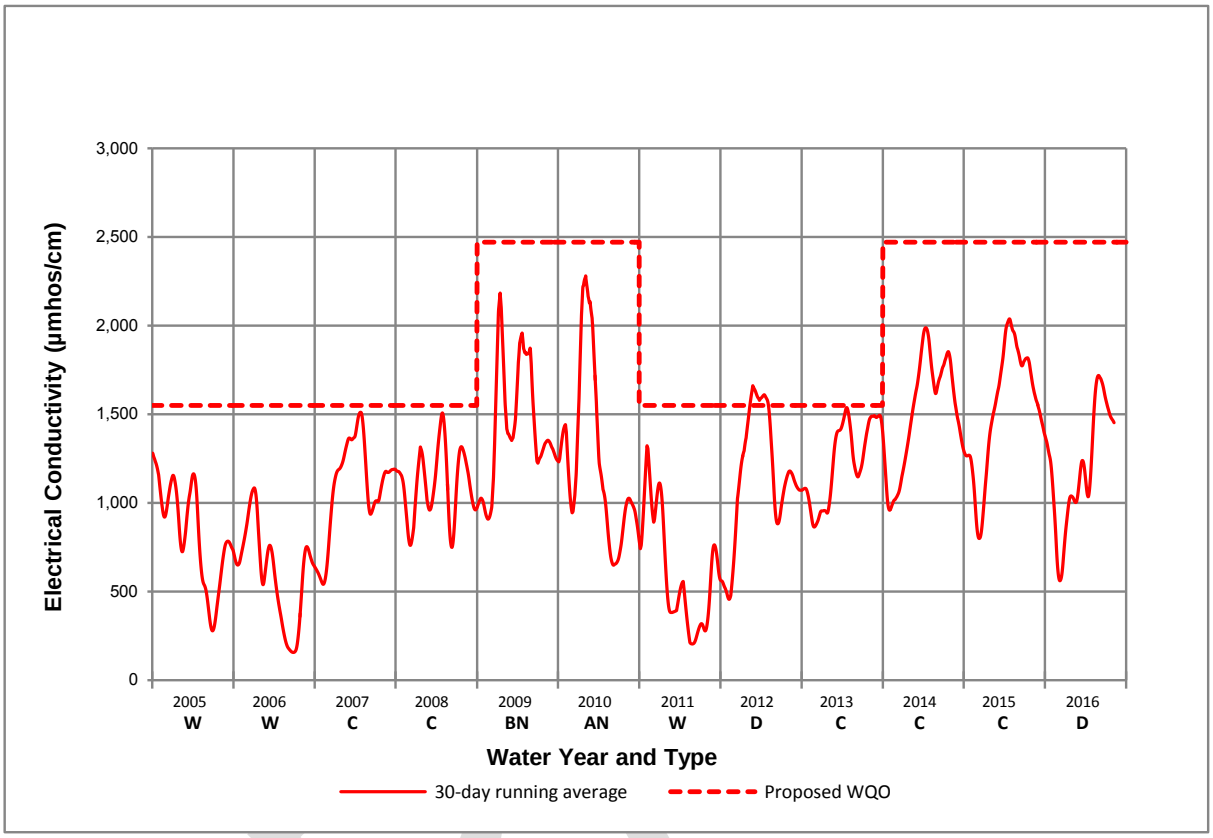
Figure 6-2 Electrical Conductivity 30-day running average at Crows Landing: WY2005 – 2016.



6.2.4 Implementation of Performance Goal

The Preferred Alternative also includes the implementation of an EC Performance Goal of 1,350 µS/cm for specific seasonal and water-year types (See Table 6-1). A Performance Goal used in implementation differs from a WQO in that its exceedance can trigger a management action, but not liability for regulatory non-compliance. The 1,350 µS/cm EC value is being proposed as a Performance Goal because:

- The WARMF model of planned actions in the watershed showed EC levels remaining at or below 1,350 µS/cm in Reach 83, particularly in years with more rainfall. While these results suggest that the river may achieve an EC level in the future that is lower than the proposed EC WQO of 1,550 µS/cm, the level of uncertainty inherent in the WARMF model at Crows Landing is too large to support pursuing a WQO lower than 1,550 µS/cm.

- Agricultural supply water at 1,350 µS/cm or lower would provide a higher level of protection during the irrigation season while allowing salt load to be moved out of the basin during the non-irrigation season.
- Water quality at 1,350 µS/cm or better would also help to maintain the soil salinity balance by flushing salt accumulated below the root zone during Extended Dry Periods.

Table 6-1 LSJR Reach 83 WQOs and Performance Goal (PG) for Seasonal and Water Year Considerations (µS/cm) during Non-Extended Dry Periods.

Water-Year Type	Irrigation Season		Non-irrigation Season
	March – June	July - September	October - February
Wet	**1,350 (PG)** & 1,550 (WQO)		1,550 (WQO)
Above Normal	**1,350 (PG)** & 1,550 (WQO)		1,550 (WQO)
Below Normal	**1,350 (PG)** & 1,550 (WQO)	1,550 (WQO)	
Dry	**1,350 (PG**) & 1,550 (WQO)	1,550 (WQO)	
Critical	1,550 (WQO)		

As part of the evaluation, the EC data should be analyzed to determine if the planned actions assumed for the Planned Bundle modeling have resulted in ambient river EC water quality less than 1,550 µS/cm. To ensure that planned improvements are not offset by significant new sources of salinity, the Central Valley Water Board should consider limiting and, if needed, prohibiting new sources of salt that would significantly increase salinity concentrations in Reach 83 of the San Joaquin River.

If the planned salinity management actions do not result in the attainment of the EC Performance Goal as expected, Regional Water Board staff will evaluate why the EC Performance Goal was not achieved. Such evaluation may include requesting reports from dischargers in Reach 83, soliciting input from interested parties, or other appropriate actions such as, requesting information from the Real-Time Management Group formed under the 2006 Salt and Boron TMDL for the San Joaquin River.

6.2.5 Time Schedule

It is projected, based on the modeling results for the Planned Alternative (Section 4.1.1), that the Preferred Alternative EC WQO can be consistently achieved after implementation of the Grassland Bypass project. The Grassland Bypass project is currently scheduled to be completed by the end of 2019. As such, the effective date of the Preferred Alternative EC WQO should be established to occur starting in 2020.

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6.2.6 **Basin Plan Re-opener**

A re-opener should be established in the Basin Plan ten (10) years after adoption of the amendment to evaluate if an EC value of less than 1,550 µS/cm as the numeric WQO in Reach 83 can consistently be achieved. Based on findings from the evaluation, the Central Valley Water Board may consider the following actions:

- Initiating a Basin Plan amendment effort to establish a new EC WQO.
- Maintaining the current EC WQO with no further planned evaluation.
- Scheduling a future evaluation to allow for additional data collection and analysis.
- Reconvene the LSJR Committee to assist in developing appropriate actions

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7 MONITORING AND SURVEILLANCE PROGRAM

The Water Code requires Basin Plan amendments to describe the surveillance and monitoring that will be necessary to evaluate attainment of applicable water quality objectives (WQOs). Specific monitoring and reporting requirements can be required through monitoring and reporting programs established for NPDES permits, WDRs, and conditional waivers of WDRs to ensure that the necessary information is collected and available to the Central Valley Water Board to determine progress in implementing the Basin Plan requirements and in attaining water quality standards.

Water Code section 13242 requires that implementation programs designed to achieve WQOs include a description of the surveillance to be carried out in order to determine compliance with the objectives. The Lower San Joaquin River Committee (LSJR Committee) used information presented in previous chapters of this staff report to identify monitoring components needed to evaluate attainment of the proposed salinity WQOs. The necessary components (hereafter referred to as the LSJR Monitoring Program) will be incorporated into Chapter V of the Basin Plan, which is the Basin Plan's Surveillance and Monitoring section. The process utilized to determine needed monitoring as well as the recommended components is outlined in this chapter.

7.1 Monitoring Program Goals

The purpose of the LSJR Monitoring Program is to evaluate compliance with the salinity and boron WQOs, compare water quality to Performance Goals in Reach 83 of the LSJR, and to assess the effectiveness of the implementation program. The goals of the LSJR Monitoring Program are as follows:

- Assess compliance with the proposed EC and existing boron WQOs (Table 7-1) in Reach 83 of the LSJR;
- Characterize long-term changes/trends in the ambient EC and boron concentrations within Reach 83 of the LSJR;
- Compare trends and changes in water quality to proposed Performance Goals;
- Assess whether the program supports compliance with salinity objectives at Vernalis;
- Assess the effectiveness of implemented management actions in controlling salt and boron in Reach 83; and,
- Use the resulting water quality information to identify potential revisions to the WQOs, Performance Goal, and/or implementation program.

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Table 7-1 Lower San Joaquin River Boron Water Quality Objectives.

Period of Applicability	Maximum (mg/L)	Monthly Mean (mg/L)	Critical[1] WY Monthly Mean (mg/L)
March 15th through September 15th	2.0	0.8	1.3
September 16th through March 14th	2.6	1.0	1.3

[1] Table IV-3, Basin Plan

These assessment goals may be modified in the future based on additional information and/or the adaptive management of the implementation program.

7.2 Water Quality Information Needed to Meet Goals

The ability to answer the assessment goals described above comprised the criteria considered by the LSJR Committee for identifying necessary water quality information.

7.2.1 Assess Compliance with the EC and Boron Water Quality Objectives

Compliance with a 30-day running average salinity objective is best measured through either the use of continuous sensors or daily sample collection. WARMF model results were calibrated with water quality information in the river at Crows Landing and Maze Road, which represent river segments between major eastside tributary inputs. To measure compliance with the Southern Delta salinity objectives, continuous or daily EC sample collection is recommended in the River at Vernalis.

Sample collection on a weekly basis is recommended for boron. The weekly collection would both determine if existing water quality frequently nears or exceeds the monthly average and monthly maximum WQOs as well as provide information to verify if a correlation still exists between EC and boron concentrations. A confirmed correlation may be used to estimate boron concentrations during other periods as outlined in Appendix C. Highest boron concentrations have consistently been found in the river at Crows Landing; therefore, weekly boron at that site should provide worse case compliance information. Exceedances of boron at Crows Landing would require additional boron analyses in the river at the Maze Road Bridge and the Airport Way Bridge near Vernalis to ensure compliance is being achieved.

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7.2.2 Characterize Long-term Changes/Trends in the Ambient EC and Boron Concentrations within Reach 83 of the LSJR

Trends are best assessed with higher frequency data collection, especially if the system experiences changing flow conditions and has a large number of factors that could contribute to the concentration and loading of salinity and boron. For the LSJR, these factors include the seasonal changes in discharge from agricultural and wetland inflows in addition to variable water-year types impacting available assimilative capacity. Continuous or daily sample collection for EC and weekly for boron at key locations in the river system would adequately characterize the effects of management actions, dam releases, or climate change over time relative to the rate of change and overall variability of flow, weather conditions, and water resource management. The frequency improves statistical power to identify changes in complex systems, the assessment duration, data variability, and the magnitude of the change in conditions. Trends in the data collected can be assessed through statistical comparisons that determine if differences over time are random in nature or systematic. Recommended locations and frequency identified to meet Goal 1 should provide adequate information to evaluate long-term changes and trends in ambient EC and boron concentrations.

7.2.3 Compare trends and changes in water quality to proposed Performance Goals

Since the Salinity Performance Goal is also a 30-day running average, the daily EC sampling design noted in the previous goals will provide a defensible data set for comparisons.

7.2.4 Assess Whether the Program Supports Compliance with Salinity Objectives at Vernalis

Since the salinity objectives at Vernalis are 30-day running averages, continuous or daily EC would be needed at the site to adequately determine compliance. Weekly boron analyses would also be needed during periods when the boron concentrations are exceeded at Crows Landing.

7.2.5 Assess the Effectiveness of Implemented Management Actions in Controlling Salt and Boron

WARMF modeling estimated that if currently planned management activities such as completion of the GBP were implemented, the proposed Performance Goals for salinity may be met. The monitoring design discussed in previous goals would be adequate to evaluate ability to meet Performance Goals. Should the Performance Goals not be met, management practices implemented since the adoption of the Basin Plan Amendment should be compared to those identified during modeling, to determine whether controllable factors are impacting water quality or whether results are consistent with

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variability inherent in the initial modeling results. Load information will be needed to determine whether anticipated salt load reductions are occurring as anticipated or whether changes in concentration are more closely related to changing assimilative capacity. Continuous flow measures at three critical sites within the LSJR (at Crows Landing, Maze Road, and Vernalis) would be needed in combination with the specific constituent information outlined in previous goals to allow for an adequate assessment.

7.2.6 Use the Resulting Water Quality information to Identify Potential Revisions to the WQOs and/or implementation Program

Daily salinity data at Crows Landing, Maze and Vernalis will adequately characterize WQO and Performance Goal attainment, including the duration and magnitude of WQO and Performance Goal exceedances. Weekly boron data at Crows with an expansion to Maze Road and Vernalis should the boron objectives be exceeded at Crows will also provide a solid data set for evaluating compliance. In addition, data collected at monitoring stations located on the San Joaquin River and its tributaries upstream of Crows Landing should be evaluated if objectives are exceeded. Upstream monitoring stations are identified in the Central Valley Comprehensive Water Quality Monitoring Guides (Central Valley Water Board, 2017). Continuous flow information at Crows, Maze and Vernalis can be combined with water quality data to determine changing loading patterns and available assimilative capacity. This data collection will support existing and expected modeling efforts under the Real Time Management Program for salinity that are used to characterize water flow and quality conditions and evaluate implemented, planned, and proposed management actions.

7.3 Proposed Monitoring Requirements

Based on the monitoring needs identified to meet the project goals, the following parameters, locations, frequencies and special considerations are proposed.

7.3.1 Electrical Conductivity

Table 7-2 Recommended Electrical Conductivity Monitoring.

SJR Location	Sampling Agency	Sampling Frequency and Method	Data Processing Method
Maze Road	DWR	daily average of 15-minute sensor data	30-day running average
Crows Landing Bridge	USGS	daily average of 15-minute sensor data	30-day running average

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7.3.1.1 Location Rationale

The LSJR at Crows Landing and at Maze Road sufficiently characterizes Reach 83 upstream of the Airport Way Bridge near Vernalis with respect to the location of major tributaries and point sources (Figure 7-1). The Maze Road station will be utilized to characterize water quality between the Tuolumne and Stanislaus Rivers; the Crows Landing Bridge station will be utilized to characterize water quality between the Merced and Tuolumne Rivers.

7.3.1.2 Frequency

The proposed EC WQO and Performance Goal will, at a minimum, require daily EC sample collection on the LSJR. While daily sample collection would be sufficient to calculate a 30-day running average, daily average values would also capture time-of-day bias and changes that may occur during a 24-hour period.

7.3.2 Boron

Table 7-3 Recommended Boron Monitoring.

SJR Location	Program	Sampling Frequency and Method	Data Processing Method
Crows Landing Bridge	Grassland Drainage	weekly grab sampling	Monthly maximum and mean

7.3.2.1 Location Rationale

Sample collection at the Crows Landing Bridge can be used to assess boron compliance, as the site has historically had the highest boron concentration within Reach 83 of the LSJR. Attainment of the boron objective at this location suggests downstream attainment, where the influence of the Tuolumne and Stanislaus Rivers would improve water quality. Upstream management actions include those upstream of Reach 83, and resultant changes would be adequately characterized by Crows Landing Bridge monitoring. Should the boron objectives be exceeded at Crows Landing, boron analyses should be expanded to weekly sampling at Maze Road and Vernalis.

7.3.2.2 Frequency

Reliable boron continuous sensors are not currently available therefore, weekly sample collection is recommended to both calculate a monthly average and to determine if previous or revised EC to boron correlations exist. Should the correlation exist, EC measurements may be used as a surrogate for boron. Appendix C discusses the potential correlation in more detail. Surrogate relationships between parameters such as

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EC and boron may be further evaluated to better understand trends and the effect of implementation programs.

7.3.3 Flow

Concentrations are known to fluctuate in relation to flow. To evaluate changing loads into the system that may result from changing management activities and/or changes in hydrology, continuous flow monitoring is recommended in the river at Crows Landing, Maze Road and Vernalis.

7.3.4 Adaption

Changes to the LSJR Monitoring Program could be made as part of the WQO assessment process and could be targeted to address specific trend changes, characterize specific segments, or better evaluate specific sources or management actions. Design of this additional monitoring would be based on existing data, modeling information, and best professional judgment to meet the monitoring objectives. For example, if an episodic exceedance of boron occurred for unknown reasons at Crows Landing Bridge during the same month in multiple years, additional sample collection of upstream tributaries could be scheduled for that month in the following year(s). Also, additional sample collection in that month at Maze Road and Vernalis would further characterize Reach 83 WQO objective compliance. In many cases data collected by others would be sufficient and additional sample collection might not be necessary. Data collected at monitoring stations located on the San Joaquin River and its tributaries upstream of Crows Landing should be evaluated if objectives are exceeded. Upstream monitoring stations are identified in the Central Valley Comprehensive Water Quality Monitoring Guides (Central Valley Water Board, 2017).

Finally, the proposed monitoring activities described above will provide a robust data set that can be used to measure the cumulative effect of all salinity management actions.

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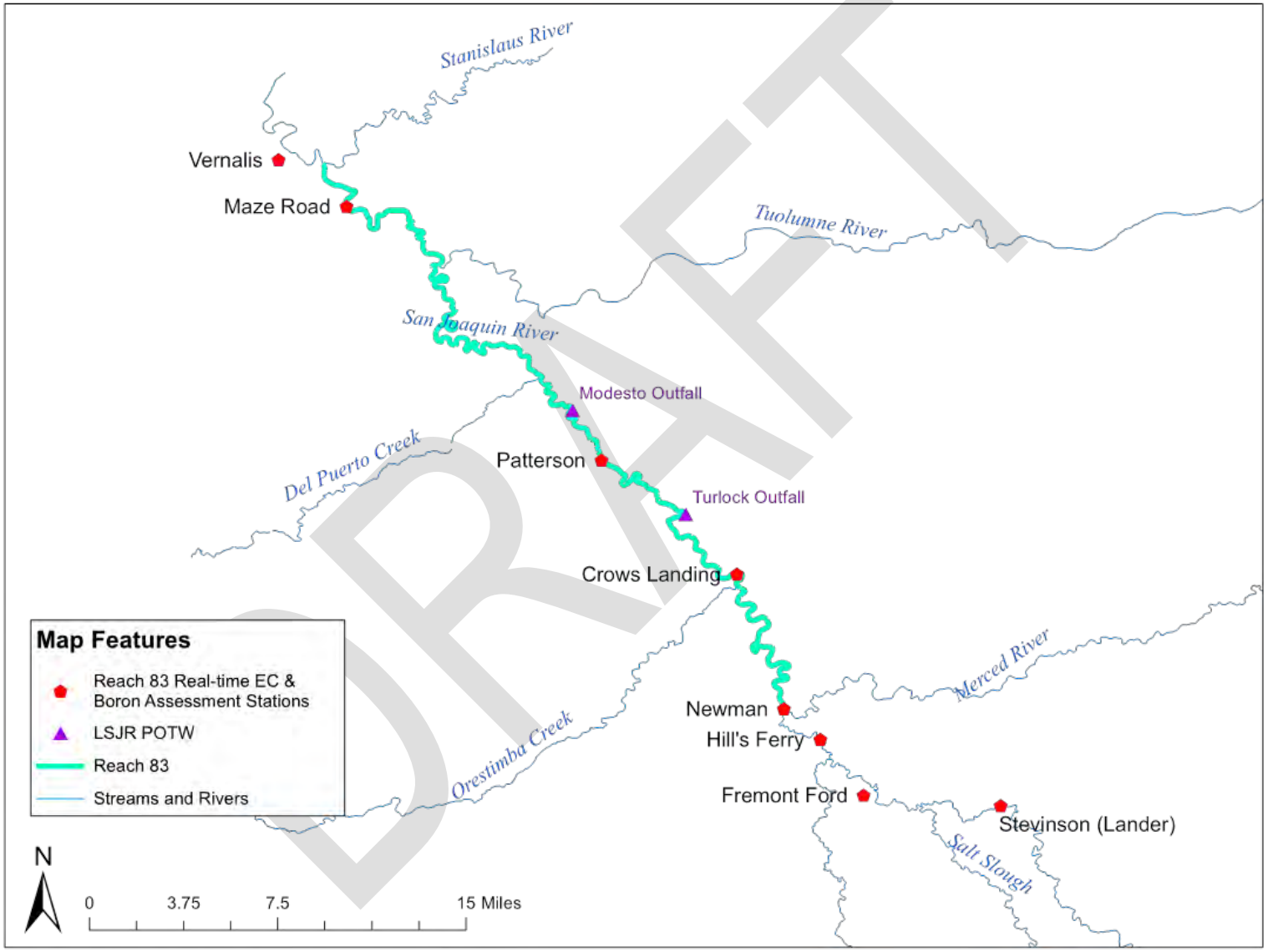
Figure 7-1 Project Location, and Sampling Locations.



7.4 Existing Monitoring Programs on the Lower San Joaquin River

7.4.1 Availability of Existing Monitoring Data

Existing monitoring efforts in the LSJR are significant and include continuous (typically 15-minute interval) sensors and sample collection for flow, EC, temperature, pH and dissolved oxygen at numerous locations within Reach 83 and immediately upstream in the San Joaquin River, Stanislaus River, Tuolumne River, Merced River, Orestimba Creek, Mud Slough, and Salt Slough. The Central Valley Water Board, the United States Geological Survey (USGS), the California Department of Water Resources (DWR), and the United States Bureau of Reclamation (USBR) all conduct routine flow and EC monitoring that can be used to meet and augment the recommended monitoring identified above. In addition, the USBR and San Luis & Delta-Mendota Water Authority collect weekly boron data at Crows Landing for the Grassland Drainage Project.

The following monitoring programs are or have collected samples that may be used to address the LSJR Monitoring Program assessment questions:

- The Central Valley Water Board previously collected weekly as well as daily average boron and EC samples through the Selenium Control Program and Surface Water Ambient Monitoring Program (SWAMP). Although this monitoring work was completed in 2011, information collected provides a historic database.
- The San Joaquin River Real-time Water Quality Management Program (RTMP) uses telemetered stream stage and salinity data and computer models to simulate and forecast water quality conditions along the LSJR. Its goal is to maximize export of salt from the San Joaquin River Basin while minimizing high quality releases made specifically for meeting San Joaquin River salinity objectives at Vernalis (the boundary of the Sacramento-San Joaquin Delta). DWR and USBR are cooperating agencies in this program, which has accessed an extensive network of flow and salinity (EC) continuous (15-minute interval) sensors in the San Joaquin River and major tributaries. These continuously measured data are reported through the California Data Exchange Center (CDEC), maintained by DWR.
- Monitoring by the United States Bureau of Reclamation and the San Luis & Delta-Mendota Water Authority for the Grassland Drainage discharge to the San Luis Drain is part of the 2010 use agreement (Agreement No. 10-WC-20-2975) that refers to the 2001 Waste Discharge Requirements (Grassland WDR, Order No. 5-01-234) monitoring program. The 2001 WDR was rescinded and replaced by Order R5-2015-0094, which requires weekly EC and boron sampling on the San Joaquin River and other upstream tributaries. This WDR monitoring characterizes the effects of the

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Grassland Bypass Project to reduce selenium and boron loading to surrounding wetlands and refuges, as well as the LSJR.

- The Central Valley Water Board's Irrigated Lands Regulatory Program (ILRP) requires monitoring through WDRs for agricultural non-point source discharges. The Westside San Joaquin River Coalition 2014 WDR includes boron and EC monitoring on the San Joaquin River upstream of Reach 83. Other ILRP WDRs includes upstream tributary monitoring.
- The City of Turlock and City of Modesto publically owned treatment works (POTWs) monitor EC at locations above and below their points of discharge to the LSJR. Both POTWs points of discharge are located in the segment of river between Crows Landing and Maze Road. The data are reported annually to the Central Valley Water Board.

Table 7-4 and Table 7-5 summarize the best available information on monitoring conducted in the main stem of Reach 83 and the immediate proximity. The data are of high quality and are readily available through the CDEC or the California Environmental Data Exchange Network (CEDEN). Figure 7-1 identifies the locations of each of these San Joaquin River main stem sites.

Based on review of the existing programs, continuous flow and EC data are available at Crows Landing, Maze Road, and Vernalis. The RTMP stakeholders are using the 30-day running average data from these stations for prediction of salinity at Vernalis. The sensor values are field calibrated by the operators and supplemented with calibration measurements done as part of the RTMP. Thus, no additional sample collection stations will be necessary for LSJR EC WQO compliance monitoring.

Boron is currently being collected weekly at Crows Landing. The remaining monitoring needs of boron at Maze and Vernalis would only occur if the boron WQOs are exceeded at Crows Landing. Evaluation of implemented management practices would only be triggered if salinity performance goals are exceeded.

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Table 7-4 Electrical Conductivity and Boron Monitoring in the Lower San Joaquin River.

	Source	CEDEN	CEDEN	CDEC	CDEC	CDEC	CEDEN
	Program	SWAMP	Grasslands	Real-Time Program			ILRP
	Agency	CVRWQCB	USBR	DWR	USBR	USGS	WSJRC
	Frequency	Weekly	Weekly	Continuous	Continuous	Continuous	Monthly
	EC	Yes	Yes	Yes	Yes	Yes	Yes
Location	**Boron**	Yes	Yes	No	No	No	Yes
Vernalis	Site ID	541SJC501		SJR	VER	VNS	
	Begin Date	1995		2005	1999	1999	
	End Date	2011		Present	Present	Present	
Maze Road	Site ID	541STC510		MRB			
	Begin Date	1995		2007			
	End Date	2011		Present			
Patterson	Site ID	541STC507		SJP			
	Begin Date	1995		2000			
	End Date	2011		Present			
Crows Landing Bridge	Site ID	535STC504	535STC504			SCL	
	Begin Date	1995	2011			2004	
	End Date	2011	Present			Present	
Newman [Flow Only]	Site ID					NEW [flow]	
	Begin Date					1995	
	End Date					Present	

Note: POTW river monitoring are weekly EC grab samples upstream and downstream of the effluent outfalls. Both effluent outfalls are between the Merced and Tuolumne Rivers

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Table 7-5. Electrical Conductivity and Boron Monitoring in the San Joaquin River Upstream of Reach 83.

	Source	CEDEN	CEDEN	CDEC	CDEC	CDEC	CEDEN
	Program	SWAMP	Grasslands	Real-Time Program			ILRP
	Agency	CVRWQCB	USBR	DWR	USBR	USGS	WSJRC
	Frequency	Weekly	Weekly	Continuous	Continuous	Continuous	Monthly
	EC	Yes	Yes	Yes	Yes	Yes	Yes
Location	**Boron**	Yes	Yes	No	No	No	Yes
Hills Ferry	Site ID	541STC512					
	Begin Date	1985					
	End Date	2007					
	Site ID	541MER538	541MER538			FFB	
Fremont Ford	Begin Date	1995	2011			2004	
	End Date	2011	Present			Present	
Stevenson/Lander Ave.	Site ID	541MER522		SJS			541MER522
	Begin Date	1995		2000			2011
	End Date	2011		Present			Present

Note: POTW river monitoring are weekly EC grab samples upstream and downstream of the effluent outfalls. Both effluent outfalls are between the Merced and Tuolumne Rivers.

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7.5 Remaining Monitoring Needs

7.5.1 Reporting

Data for the RTMP sensors (USBR, USGS and DWR) are reported and archived through CDEC. There is currently no specific SWAMP guidance for continuous sensors; however, the continuous sensor programs used by these agencies follow the intent of the SWAMP Quality Assurance Project Plan (QAPP) approach. Without implementation of continuous data QA computer software, continuous sensor data should be reviewed to identify out-of-range results in the 15-minute interval dataset and the performance of calibration samples should be considered. Boron and EC grab samples reported through CEDEN by the Grassland Bypass Project are collected according to their QAPP requirements and are consistent with SWAMP guidance as approved by the Central Valley Water Board in support of the Grassland Project Revised Monitoring Program document.

Adaptive management of the monitoring and assessment program may be necessary based on the Central Valley Water Board's review of WQO attainment. Recommended monitoring or assessment actions from this review may be performed by other stakeholders or regulated parties. Actions initiated by other regulatory programs (e.g., Grassland Bypass Project, NPDES permits, etc.) should be evaluated in light of the goals and proposed components of this program.

7.6 Final Proposal

Based on the extensive monitoring network currently in place on the LSJR, no additional monitoring requirements are proposed at this time. However, because the monitoring program relies on other external programs, it is important that those efforts are supported and tracked, especially where improvements or changes are proposed.

Should boron WQOs be exceeded at Crows Landing, weekly boron analyses should commence at Maze Road and Vernalis. Should salinity Performance Goals be exceeded at Crows Landing or Maze Blvd., Central Valley Water Board staff should work with dischargers and other agencies and stakeholders to determine if planned management practices have been implemented and/or there is reason to adjust the program during a reopener period (10-years after amendment adoption). Also, the Central Valley Water Board will evaluate data collected at monitoring stations located on the San Joaquin River and its tributaries upstream of Crows Landing when determining if a reopener period is necessary. Upstream monitoring stations are identified in the Central Valley Comprehensive Water Quality Monitoring Guides (Central Valley Water Board, 2017).

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8 ECONOMIC ANALYSIS

Existing law (Wat. Code, sections 13141 and 13241, Pub. Resources Code, § 21159, Cal. Code Regs., tit. 23, § 3777, subd. (b).) detailed in Section 3.5 requires that the Central Valley Water Board consider economics when conducting basin planning activities. The Board is required to evaluate economics when establishing water quality objectives (WQOs), implementing an agricultural water quality control program, or requiring the installation of new pollution control equipment as part of a basin planning action. This chapter summarizes the economic analysis presented in a report prepared for the Lower San Joaquin River (LSJR) Committee titled *Development of a Basin Plan Amendment for Salt and Boron in the Lower San Joaquin River (LSJR): Task 5 – Economic Analysis* (Larry Walker Associates (LWA), 2015c), intended to show estimated costs to various discharge sectors associated with implementation of major salinity management actions, including those in the selected Project Alternative (Alternative 4) as described in the WQOs and Implementation chapters of this staff report. In addition, the analysis includes the costs of alternative salinity WQOs that may provide a higher level of protection (Alternatives 2 and 6).

8.1 Economic Considerations for Alternative 1 (No Action)

Since this alternative is contrary to the directive of the Control Program for Salt and Boron Discharges to the LSJR that requires establishment of WQOs for salinity in Reach 83, as established in the Basin Plan, the economic considerations were not evaluated.

8.2 Economic Considerations for Alternative 2

Based on WARMF modeling results, the 1,550 µS/cm EC WQO associated with Project Alternative (Preferred Alternative #4) is expected to reliably be met at Crows Landing with implementation of currently planned implementation actions that were modeled for the Planned Bundle of Management Actions. The management actions included in the Preferred Alternative are discussed in Chapter 5 (Section 5.3).

In the interest of documenting the costs associated with implementation of the various salinity control actions included as part of the Preferred Alternative (Planned Bundle of management actions) and planned to occur in the project area during the next 5 – 10 years, project stakeholders were contacted and asked to provide planning level cost estimates for those implementation actions amenable to cost estimate development. The management action expected to provide the most significant salinity load reductions to Reach 83 of the LSJR based on WARMF modeling is the completion of the Grassland Bypass Project (GBP). The GBP was initiated in 1995 and is scheduled

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to be completed at the end of 2019. The cost of Implementation Action 8b (Water Conservation – Optimize Existing Irrigation Efficiency) was not estimated because these costs have already been incorporated into the overall costs of the Irrigated Regulatory Lands Program (ICF International, 2010). The cost of Implementation Action 12b (Drainage Water Recirculation – Tilewater Recovery) was not estimated because no tilewater recovery projects were identified in the project area for consideration in the WARMF modeling effort. The estimated planning level costs of the implementation actions included in the Planned Bundle are provided in Table 8-1 and described in detail in Appendix D (originally presented as Attachment A in the LWA 2015 Task 5 Report).

At this time, the evaluation of compliance with a potential 1,550 µS/cm EC objective in Reach 83 is proposed to be accomplished by using water quality data collected at Crows Landing and Maze Road Bridge under existing monitoring programs (See Chapter 7). Evaluation of boron compliance is proposed to be accomplished using data collected by the GBP at Crows Landing. Thus, no additional costs are currently anticipated for an additional monitoring and surveillance program needed to track compliance with EC or boron WQO in Reach 83. However, because the long-term funding of existing LSJR water quality monitoring programs is unknown, a need could arise in the future to fund water quality monitoring at Crows Landing and Maze Road Bridge specifically to evaluate compliance with Reach 83 WQOs. Furthermore, future monitoring efforts could reveal that additional monitoring, either in location or frequency, is needed to adequately evaluate compliance with Reach 83 WQOs. These future, potential monitoring activities are estimated to require an annual budget of approximately $111,000 to accomplish all data collection, instrument maintenance, quality assurance and quality control (QA/QC), data analysis, and report preparation collectively performed by the existing monitoring programs operating in the LSJR. Monitoring and reporting costs were developed in consideration of EC and boron monitoring at Crows Landing Bridge and EC monitoring at Maze Road.

While the Preferred Alternative included controlled timing of salinity discharges as one of its implementation actions, apart from the consideration of tailwater recovery projects in the project area, controlled timing of salinity discharges was not modeled in WARMF. To this end, the $111,000 cost estimate for a monitoring and surveillance program noted above does not consider the ongoing costs of implementing the San Joaquin Real Time Management Program (RTMP) to manage salt loads and resulting concentrations at Vernalis, including costs of a cyberinfrastructure, coordination among participating stakeholders, or the forecasting of water quality conditions that will dictate when timed salinity discharges can or cannot occur under the RTMP.

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Table 8-1: Cost Estimates of Specific Implementation Actions included in the Preferred Alternative.

Implementation Action	Cost Basis	Cost Estimate	
		Annual Cost	Capital Cost
1. Controlled Timing of Salinity Discharges	Addressed under Implementation Action 12a as cost of tailwater recovery projects	See 12a	
2c. Reduce Point Sources	City of Modesto – Pretreatment Program costs	$964,989[1]	-----
	City of Modesto – Surface Water Expansion Projects: Phase 1 (top est.) and Phase 2 (bottom est.)		$105,000,000[2] $113,000,000[2]
	City of Turlock – Pretreatment Program costs	$20,000[3]	-----
	City of Turlock – Surface Water Supply Diversification Project	$1,350,000[3]	$89,000,000[3]
3a. Reduce Nonpoint Sources	As a sensitivity analysis, 10% reduction in the application of nitrogen-based fertilizers in the Northwest, East Valley Floor, and Grassland Drainage Area subareas. (Implementation action would result in a cost savings)	-$14,200,000[4]	-----
9a. Installation of New High Efficiency Irrigation and Delivery Systems	Retrofitting of existing irrigation systems with high efficiency systems (drip or microspray) in the Northwest, East Valley Floor, and Grassland Drainage Area subareas (includes cotton^)	$9,600,000[4] $21,500,000^[4]	$26,800,000[4] $59,700,000^[4]
8b. Water Conservation – Optimize Existing Irrigation Efficiency	The costs for water conservation measures to optimize existing irrigation efficiency were included in the overall costs of the Irrigated Lands Regulatory Program and not calculated specifically for the Lower San Joaquin River Irrigation Area (ICF International, 2010)	-----	-----
10b. Sequential Reuse and Volume Reduction – Salt Accumulation Area	Total cost of Grassland Bypass Project (completion by December 2019; see Attachment A for cost itemization)	-----	$136,388,129[5]
12a. Drainage Water Recirculation – Tailwater Recovery	Patterson Irrigation District – Two Drains Project (cost range provided)	-----	$4,200,000 – $4,300,000[6]
	Grassland Water District – North Grasslands Water Conservation and Water Quality Control Project	-----	$12,000,000[7]
Monitoring and Surveillance Program	Compliance Monitoring and Surveillance Program costs	$111,000[8]	-----
	Total	**$19.3 Million**	**$541 Million**

Notes – Cost estimate provided by:

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1. City of Modesto Annual Compliance Report for Conductivity, August 5, 2015.
2. Thomas Sinclair, Environmental Regulatory Compliance Manager, City of Modesto, Utilities Department Wastewater Division, August 26, 2015.
3. Dan Madden, City of Turlock, Municipal Services Water Quality Control Division, August 18, 2015.
4. Mark J. Roberson, PhD, CPSS, Senior Soil & Water Scientist, Formation Environmental, August 26, 2015 (Appendix D for additional information).
5. David Cory, San Joaquin Valley Drainage Authority, July 24, 2015 (see Appendix D for additional information).
6. Peter Rietkerk, P.E., General Manager, Patterson Irrigation District, August 18, 2015.
7. Ken Swanson, P.E., District Engineer, Grassland Water District, August 4, 2015 (see Appendix D for additional information).
8. Brian Laurenson, P.E., Vice President, Larry Walker Associates, July 13, 2015. (See Appendix D for additional information).

8.3 Economic Considerations for Alternative 4 (Preferred)

The only difference between Project Alternatives #2 and #4 is the inclusion of a 1,350 µS/cm EC Performance Goal in the latter alternative. As such, the economic considerations for the implementation of Alternative #4 are the same as those described below for the Preferred Alternative (#2). Since the Performance Goals are based on expected water quality once currently scheduled activities are implemented, no additional costs are anticipated. Should the performance goals be exceeded, documents already developed under the Board approved RTMP will be evaluated to determine whether implementation activities have occurred on schedule and the relative sources of salt loading, in order to determine whether adjustments to the Control Program is needed in the future.

8.4 Economic Considerations for Alternative 6

Among the four potential project alternatives selected by the LSJRC for consideration in the Basin Planning process, Project Alternative #6 (1,000 µS/cm) was the only alternative considered that would require new salinity control measures to attain the WQO.

Project Alternative #6 would require the construction and operation of a desalination facility in the Grassland Drainage Area in order to meet a 1,010 µS/cm EC objective at Crows Landing. This would result in significant, additional costs to the discharge sectors. The planning level cost analysis of Alternative #6 estimates the conceptual desalination facility total project cost at $900 million, the annual operation and maintenance cost at $16.1 million, and the 30-year life-cycle cost at $1.15 billion (see Appendix E, originally presented as Attachment B in the LWA 2015 Task 5 Report). The economic analysis provided for Alternative #6 acts as an evaluation of the costs of an alternative salinity WQO. While the LSJRC has not discussed how such a desalination project would be funded if it were ever to be built, some level of cost-

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sharing between those entities that discharge to the LSJR, including POTWs, would likely be necessary.

Reverse osmosis (RO) at individual POTW facilities was not considered as part of the Planned Plus Maximum Treatment Focus Alternative as a means for POTWs to meet the 1,000 µS/cm EC objective as end-of-pipe effluent limits. Under Alternative #6, POTWs would either require a means to establish attainable effluent limits in implementing a 1,000 µS/cm EC objective, similar to the POTW permitting considerations discussed above in the Preferred Alternative section or would be required to implement other compliance strategies including RO treatment, improvements to remove discharges from the LSJR on a year-round basis, or development of a specific pollutant trading program.

Similar to the discussion provided for the Preferred Alternative, evaluation of compliance with a potential 1,010 µS/cm EC objective in Reach 83 is proposed to be accomplished by using water quality data collected at Crows Landing and Maze Road Bridge by existing monitoring programs. The cost of any future monitoring that may be required to augment those water quality data collected by existing programs is unknown and thus, not included as part of this analysis. However, it is estimated that a single monitoring and surveillance program would require an annual budget of approximately $111,000 to accomplish all data collection, instrument maintenance, QA/QC, data analysis, and report preparation collectively performed by the existing monitoring programs operating in the LSJR.

Appendix E, prepared by Carollo Engineers (LWA subcontractor), provides information regarding the overall cost of implementing an alternative EC objective of 1,010 µS/cm in Reach 83. A portion of these significant overall costs would be the responsibility of the agricultural community, if the alternative objective is adopted.

8.5 Extended Dry Period

A WQO adjustment for an Extended Dry Period was considered for all the alternatives evaluated. Based on modeled values, the adjust WQO of 2,200 uS/cm, would be achieved with implementation of scheduled activities. Therefore, no additional costs above those documented in Alternative 4 are anticipated.

8.6 Summary

This staff report predicts that there are no additional implementation costs currently associated with the Preferred Alternative. Potential future costs are relatively minor and

are primarily related to monitoring and reporting requirements. A portion of the overall monitoring and reporting costs may be the responsibility of the discharger community in the future if existing monitoring ceases to fulfill the requirements set for the in the Monitoring and Surveillance Program. Appendix D provides supplemental information related to costs for specific implementation actions included in the Preferred Alternative. This staff report predicts that a new agricultural program will not be required to achieve the preferred EC WQOs alternative, nor will any additional pollution control equipment such as RO systems or desalting facilities.

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9 ENVIRONMENTAL ANALYSIS

9.1 Environmental Review

As detailed in Chapter 3 (Section 3.6), the Central Valley Water Board as a Lead Agency under the California Environmental Quality Act (CEQA), is responsible for evaluating the potential environmental impacts that may occur because of changes made to the Basin Plan as a result of the proposed Basin Plan Amendment. The full staff report and the Environmental Checklist presented in Appendix F satisfy the requirements of State Water Board's Regulations for Implementation of CEQA for Exempt Regulatory Programs.

This chapter specifically evaluates the potential environmental impacts, including cumulative impacts, of the proposed amendments to the Basin Plan as compared to baseline conditions.

9.1.1 Setting/Baseline

The baseline against which the proposed Basin Plan amendment is assessed includes the following characteristics:

- Existing water body characteristics, hydrology and operation (see Chapters 2 & 5)
- Existing discharges to the LSJR (including discharges from irrigated agriculture, Publically Owned Treatment Works (POTW) wastewater effluent and storm water) and receiving water quality
- Existing regulatory programs and policies

Existing regulatory programs and policies include, but are not limited to, the following.

- Irrigated Lands Regulatory Program (ILRP) to ensure that agricultural discharges do not negatively impact beneficial uses.
- The NPDES program to regulate point source discharges to surface water, including municipal wastewater treatment plants and medium to large municipal separate storm sewer systems (MS4s) serving populations greater than 10,000.
- Storm Water General Permit programs for construction and industrial activities.
- Water Quality Certification program for dredge and fill activities.
- The *Sources of Drinking Water Policy* which assumes that all surface and ground water has the potential to provide municipal and domestic supply unless specific exceptions are met.

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- The State Water Board Statement of Policy with Respect to Maintaining High Quality of Waters in California (Resolution 68-16 or Antidegradation Policy).
- South Delta Salinity Objectives (State Water Resources Control Board, 2006)
- Control Program for Salt and Boron Discharges to the LSJR (Central Valley Water Board, 2004)
- Selenium Control Program (Central Valley Water Board, 2010c)
    - Grassland Bypass Project (Order Number R5-2015-0094)

The most recent major hydrologic change to the LSJR was the adoption of the Selenium Control Program, which includes implementation of the GBP. The GBP systematically reduces selenium, salt and boron loading to the LSJR from a 90,000-acre area of irrigated agriculture. The GBP began operation in 1995 and is scheduled to go to zero discharge by 2019. In addition, a Control Program for Salt and Boron Dischargers to the LSJR was adopted by the Central Valley Water Board in 2004 to meet salinity WQOs at Vernalis. As part of the program, a Real-Time Salinity Management Program was approved by the Central Valley Water Board in 2014.

For baseline conditions, 30-day running average EC concentrations were evaluated at Crows Landing (location with the poorest water quality in Reach 83) from the beginning of the GBP (1996) through 2014. The information was evaluated against irrigation season and water-year type as defined by San Joaquin Valley Water Year Index (from wet to critically dry). A summary is depicted in Figure 6-1.

9.1.2 Analysis of the Preferred Alternative

If adopted, the proposed Basin Plan amendment will establish salinity WQOs for the LSJR, between the mouth of the Merced River and the Airport Way Bridge near Vernalis. The new electrical conductivity (EC) WQOs were developed in consideration of state and federal laws, regulations, and policies, including the state's *Sources of Drinking Water Policy*, the Basin Plan, state and federal regulations, and other state and federal requirements relevant to drinking water, stock drinking water, agricultural irrigation uses, and aquatic-life protection.

Based on WARMF modeling results, the proposed 1,550 µmhos/cm EC WQO associated with the Preferred Alternative is expected to reliably be met in the San Joaquin River at Crows Landing with the implementation of currently planned actions to manage/reduce salts that were modeled for the Preferred Alternative. The planned actions included in the Preferred Alternative are listed in Table F-2 of Appendix F. The planned action expected to provide the most significant salinity load reductions to Reach 83 of the LSJR based on WARMF modeling is the completion of the Grassland Bypass Project (GBP). The GBP was initiated in 1995 and is scheduled to be completed

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at the end of 2019. The EC WQOs will be achieved primarily through the completion of the Grassland Bypass Project. The proposed objectives are lower than EC concentrations observed during 1996 through 2014 (baseline conditions).

When the planned actions were modeled through 2019, water quality was noted to remain below 1,350 μS/cm during all but extended dry periods. Therefore, the proposed action also includes the establishment of an implementation EC Performance Goal and alternative Extended Dry Period WQOs in Reach 83. The Performance Goal will be used to measure progress toward achievement of EC levels during the irrigation season of non-Extended Dry Periods when EC levels lower than the EC WQO would be beneficial to agriculture and are considered potentially achievable. The Extended Dry Period exception exists to allow discharges to the LSJR to occur under hydrologic conditions (e.g., low flows and elevated EC levels) when it is anticipated that agriculture will value water availability over water quality (water with EC concentrations greater than the proposed WQO of 1,550 μS/cm). The process for determining extended dry periods is outlined in Chapter 6 (Section 6.2.3) and is summarized in Appendix F.

The proposed WQO, Performance Goals and adjusted WQO for extended dry periods were overlain onto the historic baseline water quality conditions in the LSJR at Crows Landing (Figure 6-2). The resulting overlay indicates that meeting the proposed WQOs caps salinity concentrations in all cases and improves water quality during some periods. Meeting the proposed Performance Goals consistently means improved water quality over historic conditions.

The proposed amendment requires routine EC and boron monitoring in the LSJR at Crows Landing and Maze Road Bridge to track compliance with the EC and boron WQOs and the achievement of the Performance Goal. The needed monitoring is currently incorporated as part of the RTMP to manage salt loads and resulting concentrations at Vernalis, therefore, water quality monitoring of EC and boron will not result in adverse physical effects to baseline conditions.

The proposed action will not result in any direct or indirect environmental effects that have not already been evaluated. The proposed Basin Plan amendment will not cause any potentially significant environmental impacts over baseline conditions and, therefore, there are no mitigation measures or alternatives necessary to reduce or avoid significant impacts. This conclusion is reflected in the Environmental Checklist provided in Appendix F.

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9.1.3 **Cumulative Impact Analysis**

Cumulative impacts refer to one or more individual effects which, when taken together, are considerable or which compound or increase other environmental impacts. Cumulative impacts are the result of the incremental impact of a project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time. Reasonably foreseeable future projects include the Board's revision of permit requirements for regulated entities that discharge into the LSJR. Board staff anticipate that the regulated entities whose permits may be revised by the Board subsequent to the adoption of the proposed Amendment may include agricultural operations that utilize the LSJR for agricultural water supply and discharge return flows into the LSJR, and the two POTWs that discharge wastes into the LSJR.

The Board has issued ILRP General Orders to third-party coalitions (representatives of agricultural growers), including the Eastern San Joaquin Watershed, the Western San Joaquin River and the Grassland Drainage Area, that require the coalitions to develop regional water quality management plans for areas where irrigated agriculture may be contributing to water quality problems. The ILRP General Orders require growers to conduct evaluations of their management practices to ensure they are protecting groundwater and surface water, and require coordinated monitoring at specified monitoring points that have been determined to be representative of water quality within the watershed. The ILRP, which is a relatively new regulatory program, is requiring coalitions throughout the state to engage in a process of evaluating and addressing water quality impairments, and this program is generally resulting in increased water quality. Unless water quality conditions are expected to degrade due to either significant changes in agricultural diversion and return-flow discharge operations, which dominate the flow conditions in the LSJR, or due to an expansion of irrigated acreage, water quality is generally expected to improve due to implementation of the ILRP General Orders. Because the ILRP General Orders are resulting in greater water quality improvements as the program matures, no significant degradation is expected due to changes in operations or increases in irrigated acreage in the LSJR Irrigation area. On the contrary, water quality within the LSJR is expected to improve relative to existing conditions, largely in part to the completion of the Grasslands Bypass Project and other planned salinity reduction management actions.

Continued implementation of the San Joaquin Real Time Management Program (RTMP) will ensure that WQOs at Vernalis are met and develop the water quality information needed to both evaluate water quality at Crows Landing and Maze Blvd. and document salt management activities in the basin. The RTMP seeks to optimize/maximize the export of salt from groundwater, perched zones, and agricultural

drain water from the LSJR Basin while ensuring that salinity objectives are met at Vernalis. The Central Valley Water Board has approved the RTMP in the Basin Plan as an alternative salt management strategy in lieu of monthly salt load allocations enforced by the Central Valley Water Board. The RTMP facilitates the control and timing of wetland, agricultural drainage, and/or other discharges to the LSJR to coincide with periods when the river has capacity to assimilate additional salts up to a WQO. The Eastern San Joaquin Watershed, the Western San Joaquin River and the Grassland Drainage Area Coalitions are members of the RTMP program.

The other regulated entities that are likely to be affected by the proposed EC WQOs are the POTWs from the cities of Modesto and Turlock. While the establishment of future effluent limitations for salinity in the NPDES permits issued to the Cities of Modesto and Turlock for operation of their wastewater treatment facilities are not a component of the proposed action, future salinity-related effluent limitations for these facilities will need to consider the proposed EC WQO of 1,550 µmhos/cm, if adopted. The Central Valley Water Board, the entity responsible for developing effluent limitations and issuing NPDES permits, will need to account for the continued effects of water conservation, water supply constraints, and Extended Dry Periods. The consideration given to implementing the WQOs for NPDES dischargers is described in Chapter 6 (Section 6.2.2) and the proposed requirements are not expected to result in the need to construct supplementary facilities or additions to the existing wastewater treatment facilities in the cities of Modesto and Turlock. Further, any expanded discharge from the POTWs, any new point sources that propose to discharge into the LSJR, and the continued agricultural activities that discharge into the LSJR addressed by the proposed Basin Plan amendment will all be required to comply with regulatory limits developed to protect applicable beneficial uses. When a permittee proposes a new or expanded discharge, they must submit a new report of waste discharge to the Board, and the Board will be required to conduct a new antidegradation analysis and potentially a new reasonable potential analysis before the Board can issue a new permit. In this manner, the Board would ensure that beneficial uses in the LSJR will continue to be protected.

Other programs that do not currently regulate any discharges into the LSJR, but that could in the future, include the Board's stormwater and water quality certification program. However, potential changes in storm water volume due to increased urban development are not expected to have a significant impact to the water quality to the LSJR in the foreseeable future. Small MS4s serving less than 10,000 people and construction sites disturbing between one and five acres of land are required through a general permit administered by the State Water Board to implement Best Management Practices (BMPs) to control 303(d) listed pollutants and other pollutants of concern. In addition, the general permit recently approved incorporates Low Impact Development

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requirements to reduce urban runoff in areas of new development and redevelopment (Order No. R5-2016-0040). Storm Water General Permit programs will regulate storm water discharges and future construction and industrial activities. However, stormwater has virtually no salt or boron.

Chapter 6's implementation provision to have a re-opener to the Basin Plan ten years after adoption of the Basin Plan Amendment and Chapter 7's water quality monitoring program provide assurance that there will be an ongoing evaluation and assessment of water quality in the river to ensure that potential cumulative effects are not significant.

9.1.4 Climate Change

Potential impacts of climate change were evaluated and noted to cause more frequent extended dry periods, additional recycling, conservation and reuse, and reduction in availability of assimilative capacity. To address the potential impacts, WQOs are adjusted during extended dry periods to allow dischargers more flexibility to reuse and conserve limited water resources, which typically increases salinity concentrations. In addition, an option to re-evaluate the objectives and performance goals is identified to allow a review of overall trends in water quality, implementation of management activities and changes in hydrology that may impact assimilative capacity.

9.1.5 Overall Analysis

A CEQA analysis and checklist was completed and is provided in Appendix F. The evaluation indicates that the Proposed Project will not cause any potentially significant environmental impacts. Since there was a finding of no impact, no analysis of alternatives to determine whether an alternative could lessen or eliminate significant impacts of the proposed project is required, however, this report includes a discussion of a No Action Alternative and alternatives identifying lower WQOs to provide additional context for decision-making parties. The additional reviews are included in Appendix F.

9.2 Antidegradation Consideration

Based on the analysis summarized above and depicted in Figure 6-2, the preferred alternative provides a cap on water quality that prevents conditions worse than baseline and with the inclusion of performance goals, promotes obtaining the best water quality reasonably attainable given ongoing and planned management activities within the basin. Further discussion of antidegradation considerations is provided in Chapter 10, Consistency with Laws, Plans and Policies, Section 10.1.

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10 CONSISTENCY WITH LAWS, PLANS, AND POLICIES

10.1 Antidegradation Policies

The State and Federal Antidegradation Policies are detailed in Chapter 3 (Section 3.7). The following section evaluates whether the proposed Basin Plan Amendments are consistent with the *Federal Antidegradation Policy* and the *State Antidegradation Policy*.

10.1.1 Consistency with the *State Antidegradation Policy*

The *State Antidegradation Policy*, adopted by the State Water Board in October 1968, limits the Central Valley Water Board's discretion to authorize the degradation of high-quality waters. This policy has been incorporated into the Basin Plan. High-quality waters are those waters where water quality is more than sufficient to support the designated beneficial uses.

The proposed Basin Plan Amendments do not themselves authorize the degradation of any high-quality waters. They instead establish salinity water quality objectives (WQOs) in Reach 83 of the Lower San Joaquin River and a program of implementation designed to achieve those WQOs. Any degradation that would occur as an indirect result of the Central Valley Water Board's adoption of the proposed Basin Plan Amendments would occur when the Board prescribes or modifies waste discharge requirements (including NPDES Permits), issues conditional waivers, or issues water quality certifications that authorize waste discharges to the LSJR.

Following the establishment of the salinity objectives proposed by the Basin Plan Amendments, the Central Valley Water Board will still be required to implement the *State Antidegradation Policy* when prescribing or modifying waste discharge requirements, issuing conditional waivers, and issuing water quality certifications that authorize degradation in the LSJR. In the area affected by the proposed Basin Plan Amendments, agricultural discharges are the primary nonpoint source discharges that threaten to degrade water quality with respect to salinity. These discharges will continue to be regulated under waste discharge requirements issued by the Central Valley Water Board through the Irrigated Lands Regulatory Program (ILRP). Consistent with the *State Antidegradation Policy*, the ILRP currently requires that agricultural discharges implement a suite of management practies that the Central Valley Water Board considers to be the best practicable treatment or control (BPTC) of the wastes in their discharges. The set of management practices imposed by the ILRP require growers to conduct a continuous evaluation of their management practices to ensure they are adequality protective of both groundwater and surface water, require the submittal of regional water quality management plans for areas where irrigated agriculture may be contributing to water quality problems, and require all growers to conduct farm evaluations to ascertain the effectiveness of the management practices

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that are being implemented on individual farms. Should the monitoring conducted pursuant to the ILRP's waste discharge requirements reveal water quality problems, growers are required to implement practices consistent with specified management plans developed to address the water quality problems.

The Central Valley Water Board is also required to make findings demonstrating that any authorized degradation inheres to the maximum benefit of the people of the state whenever the Central Valley Water Board issues or modifies any order that would authorize the degradation of high-quality waters (including any changes to the ILRP orders). Though the economic discussion in Chapter 8 does not obviate this requirement, this discussion strongly suggests that degradation authorized pursuant to the implementation plan in the proposed Basin Plan Amendments (i.e., degradation that does not result in an exceedance of the WQOs that would be established by the proposed Basin Plan Amendment) would be consistent with the *State Antidegradation Policy.*

10.1.2 Consistency with the *Federal Antidegradation Policy*

The *Federal Antidegradation Policy* requires the protection of existing instream water uses and the level of water quality necessary to protect those uses, requires that where water quality exceeds levels necessary to support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water, such water quality shall be maintained with limited exceptions, and requires that, where high quality waters constitute an outstanding National resource, water quality shall be maintained and protected. (40 C.F.R. 131.12.)

The LSJR is not considered an outstanding National resource. Furthermore, the Basin Plan amendments will not result in an impairment of any existing instream water uses. To the extent that any permits issued under the federal NPDES program are changed due to the adoption of the proposed Basin Plan Amendments, such permit changes would remain subject to stringent antidegradation requirements.

NPDES Permits for the two POTWs are reviewed approximately every five years. At least once during these permit terms (and often more frequently), the Board requires the Dischargers to monitor effluent and upstream receiving water sites for priority pollutants and other constituents of concern. If an NPDES permittee predicts that there will be a substantial change in or expansion of its wastewater discharge, the permittee must submit a new report of waste discharge to the Board and the Board must conduct a new antidegradation analysis and potentially a new Reasonable Potential Analysis before the Board can issue a new permit. Any new point-source discharges to Reach 83 of the LSJR, must also go through the same antidegradation and Resonable Potential Analysis (RPA) analyses as those required of the two existing POTWs.

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As described above, discharges from irrigated agriculture are currently regulated under the Board's ILRP. Such discharges fall outside the purview of federal permitting requirements. However, the state's establishment and modification of water quality standards in jurisdictional waterways is subject to federal oversight. As described herein, the proposed Basin Plan Amendments are fully consistent with all applicable federal statutes and regulations that limit the Board's authority to prohibit unreasonable degradation of water quality.

10.2 Consistency with Federal and State Laws

Federal agencies have adopted regulations implementing federal laws to which Central Valley Water Board actions must conform. The following Federal laws were evaluated for this proposed Basin Plan Amendment:

- Clean Water Act
- Federal & State Endangered Species Acts (16 U.S.C. § 1531 et seq., Fish and G. Code §2050-2116 *et seq*.)

These laws and their relevance to the proposed Basin Plan Amendment are described in the following sections in addition to state law.

10.2.1 **Clean Water Act**

Federal Requirements for Review of Water Quality Standards

Under Section 303(c) of the Clean Water Act, water quality standards adopted by a State that affect waters of the United States are subject to USEPA approval. Water quality standards consist of the designated uses and the water quality criteria to protect these uses. (33 USC §1313 (c)(2)(A) and 40 CFR §131.3(i).) When designating uses, the State must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation. (40 CFR §131.10(a).) When designating uses of a water body and the appropriate criteria for those uses, the State shall ensure that the water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters. (40 CFR §131.10(b).)

By adopting this amendment, the Central Valley Water Board finds that meeting the proposed WQOs in Reach 83 will not impact attainment of salinity objectives downstream in the LSJR at Vernalis (boundary of the Sacramento-San Joaquin Delta. The finding will be verified with water quality information collected under the Real-Time Salinity Management Program (RTMP) that is part of the Control Program for Salt and Boron Discharges to the LSJR adopted in 2004 (Central Valley Water Board, 2004).

Federal Regulations Pertaining to NPDES Permits

Section 402 of the Clean Water Act requires a permitting system which USEPA addressed by promulgating Title 40 Code of Federal Regulations Part 122, which are the regulations pertaining to the NPDES (National Pollutant Discharge Elimination System) program. The State's regulations pertaining to NPDES permits must be consistent with the federal regulations. Title 40 Code of Federal Regulation section 122.44(d)(1)(ii) sets forth the regulations for determining whether a discharge has a reasonable potential to cause or contribute to a violation of water quality standards. It states, "When determining whether a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative or numeric criteria within a State water quality standard, the permitting authority shall use procedures which account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant or pollutant parameter in the effluent, the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity), and where appropriate, the dilution of the effluent in the receiving water."

The proposed Basin Plan Amendment does not recommend any new or modification to federal or state NPDES permitting procedures. This Basin Plan Amendment is consistent with federal and state NPDES procedures and depends on the continued implementation of these procedures to provide appropriate protection of the LSJR.

Requirements for Avoiding Wetland Loss

Under Clean Water Act section 404 and the Rivers and Harbors Act of 1899 Section 10, alteration of waterways, including wetlands that affect navigable waters requires a permit from the Federal government and assurance that impacts will be avoided or mitigated. The U.S. Army Corps of Engineers operates the 404 permit program with a goal of achieving "no net loss" of wetlands. For projects proposing unavoidable impacts on wetlands, compensatory mitigation in the form of replacing the lost aquatic functions is generally required. Under authority of Clean Water Act section 401, the State also reviews federally-authorized projects, including permits issued by the US Army Corps of Engineers for dredge and fill activities under CWA section 404 and construction permits issued under Section 10 of the Rivers and Harbors Act, that could have water quality impacts on jurisdictional water bodies.

The proposed Basin Plan Amendment will not authorize any activities that will adversely affect or have net loss to current wetlands.

10.2.2 **Federal and State Endangered Species Act**

The Federal Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq.) was established to identify, protect and recover imperiled species and the ecosystems upon

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which they depend. It is administered by the Interior Department's U.S. Fish and Wildlife Service (USFWS) and the Department of Commerce's National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS). The USFWS has primary responsibility for terrestrial and freshwater organisms, while the NMFS has primary responsibility for marine species such as salmon and whales. In addition, the State of California enacted the California Endangered Species Act (Fish & G. Code, sections 2050-2116 *et seq*.), which is administered by the California Department of Fish and Wildlife and similarly maintains State lists of rare, threatened and endangered species.

The proposed Basin Plan Amendment addresses the two salt-sensitive beneficial uses (MUN and AGR irrigation supply) and is not expected to affect threatened or endangered fish and wildlife (Kennedy/Jenks Consultants, 2010). Therefore, the proposed Basin Plan Amendments are consistent with the Federal and State Endangered Species Acts.

10.2.3 **Consistency with California Water Code 106.3**

In compliance with Water Code section 106.3, it is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. Water Code section 106.3 states that:

a. It is hereby declared to be the established policy of the state that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.
b. All relevant state agencies, including the department, the state board, and the State Department of Public Health, shall consider this state policy when revising, adopting, or establishing policies, regulations, and grant criteria when those policies, regulations, and criteria are pertinent to the uses of water described in this section.
c. This section does not expand any obligation of the state to provide water or to require the expenditure of additional resources to develop water infrastructure beyond the obligations that may exist pursuant to subdivision (b).
d. This section shall not apply to water supplies for new development.
e. The implementation of this section shall not infringe on the rights or responsibilities of any public water system.

Related resolutions supporting this policy were adopted by the State Water Board (Resolution No. 2016-0010) and Central Valley Water Board (Resolution No. R5-2016-0018).

The proposed WQOs are protective of the potential MUN beneficial use in the LSJR and therefore this amendment is consistent with Water Code section 106.3 and the resolutions listed above.

10.2.4 **Assembly Bill 32 – California Global Warming Solutions Act**

Assembly Bill (AB) 32, is a California State Law that fights global warming by establishing a comprehensive program to reduce greenhouse gas emissions from all sources throughout the state. AB 32 is largely implemented by the California Air Resources Board, which has been directed by AB 32 to adopt regulations to achieve cost-effective GHG emission reductions, thereby mitigating the risks associated with climate change, while improving energy efficiency and expanding the use of renewable energy resources.

The Water Boards are committed to the adoption and implementation of effective actions to mitigate greenhouse gas emissions and to adaptation of our policies and programs to the environmental conditions resulting from climate change. In establishing the proposed salinity WQOs for the LSJR, potential impacts of climate change were evaluated and noted to cause more frequent extended dry periods, additional recycling, conservation and reuse, and reduction in availability of assimilative capacity. To address the potential impacts, proposed WQOs are adjusted during extended dry periods to allow dischargers more flexibility to reuse and conserve limited water resources which typically increases salinity concentrations. In addition, an option to re-evaluate the objectives and performance goals is identified to allow a review of overall trends in water quality, implementation of management activities and changes in hydrology that may impact assimilative capacity.

10.3 **Consistency with State Water Board Policies**

The State Water Board is authorized to adopt state policy for water quality control. (Wat. Code §13140.) State Water Board water quality control plans supersede any regional water quality control plans for the same waters to the extent of any conflict. (Wat. Code §13170.) The following are thirteen State Water Board policies:

1. State Water Board Resolution 68-16, the Statement of Policy with Respect to Maintaining High Quality of Waters in California (*State Antidegradation Policy*)
2. Water Quality Control Policy for the Enclosed Bays and Estuaries of California (Resolution No. 74-43)

3. Sources of Drinking Water Policy (Resolution No. 88-63)
4. Pollutant Policy Document (Resolution No. 90-67)
5. Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304 (Resolution No. 92-49)
6. Consolidated Toxic Hot Spots Cleanup Plan (Resolution No. 99-065 and 2004-0002)
7. Nonpoint Source Management Plan & the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (Resolution No. 99-114 and 2004-0030)
8. Water Quality Enforcement Policy (Resolution No. 2002-0040)
9. Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Resolution No. 2005-0019)
10. Policy for Developing California's Clean Water Act Section 303(d) list (Resolution No. 2004-0063)
11. Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options (Resolution No. 2005-0050)
12. Policy for Compliance Schedules in Nation Pollutant Discharge Elimination System Permits (Resolution No. 2008-0025)
13. Policy for Water Quality Control for Recycled Water (Resolution No. 2009-0011)

The thirteen policies are evaluated in the following sections..

10.3.1 State Water Board Resolution 68-16, the Statement of Policy with Respect to Maintaining High Quality of Waters in California (*State Antidegradation Policy*)

This policy is discussed above in Section 8.1 of this staff report.

10.3.2 Resolution No. 74-43: Water Quality Control Policy for the Enclosed Bays and Estuaries of California

This policy was adopted by the State Water Board in 1974 and updated in 1995. This policy provides water quality principles and guidelines for the prevention of water quality degradation in enclosed bays and estuaries to protect the beneficial uses of such waters. The Regional Water Boards must enforce the policy and take actions consistent with its provisions. For the San Francisco Bay-Delta system, the policy requires implementation of a program which controls toxic effects through a combination of source control for toxic materials, upgraded waste treatment, and improved dilution of wastewaters to provide full protection to the biota and the beneficial uses of San Francisco Bay-Delta waters.

The proposed Basin Plan Amendment does not eliminate or contradict the core requirement of the Water Quality Control Policy for the Enclosed Bays and Estuaries of

California that the Central Valley Water Board ensure that persistent or cumulative toxic substances be removed from waste discharges to the maximum extent practicable through source control or adequate treatment. Furthermore, the proposed Basin Plan Amendment does not change the Bay-Delta electrical conductivity WQOs set for the San Joaquin River at Vernalis. Therefore, the proposed Basin Plan Amendments are consistent with this policy.

10.3.3 **Resolution No. 88-63: Sources of Drinking Water Policy**

This policy states that all waters of the state are to be considered suitable or potentially suitable for municipal and domestic supply unless certain exceptions are met.

The proposed Basin Plan Amendment will not change the potential MUN beneficial use designated for the LSJR and is therefore consistent with this policy.

10.3.4 **Resolution No. 90-67: Pollutant Policy Document**

This policy requires, in part, that the Central Valley and San Francisco Bay Water Boards use the Pollutant Policy Document (PPD) as a guide to update portions of their Basin Plans. The PPD requires that the Central Valley Water Board develop a Mass Emissions Strategy (MES) for limiting loads of pollutants that enter the Sacramento-San Joaquin Delta. The purpose of the MES is to control the accumulation in sediments and the bioaccumulation of pollutant substances in the tissues of aquatic organisms in accordance with the statutory requirements of the state Porter-Cologne Water Quality Act and the Federal Clean Water Act.

The proposed Basin Plan amendment addresses salt and boron which do not increase the accumulation of pollutants in sediment or bioaccumulation of pollutant substances in tissues of aquatic organisms; therefore, this Policy is not applicable.

10.3.5 **Resolution No. 92-49: Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304**

The State Water Board adopted this policy in 1992 and updated this policy in 1994 and 1996. This policy contains procedures for the Central Valley Water Board to follow when issuing orders pursuant to Water Code section 13304 that require the cleanup of discharges of wastes that have impacted, or that threaten to impact, waters of the state. The proposed Basin Plan Amendment does not include any change to the procedures pertaining to cleanup and abatement activities. Therefore, this policy is not applicable to the proposed Basin Plan Amendment.

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10.3.6 Resolution No. 99-065 & Resolution No. 2004-0002: Consolidated Toxic Hot Spots Cleanup Plan

In June 1999, the State Water Board adopted the Consolidated Toxic Hot Spots Cleanup Plan (Cleanup Plan), as required by California Water Code Section 13394.

The proposed Basin Plan Amendment does not address any of the constituents needing cleanup plans; therefore, the Cleanup Plan is not applicable.

10.3.7 Resolution No. 99-114 & Resolution No. 2004-0030: Nonpoint Source Management Plan & the Policy for Implementation and Enforcement of Nonpoint Source Pollution Control Program

In December 1999, the State Water Board adopted the Plan for California's Nonpoint Source (NPS) Pollution Control Program (NPS Program Plan) and in May 2004, the State Water Board adopted the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy). The NPS Policy explains how State and Regional Water Boards will use their administrative permitting authority under the Porter-Cologne Act to implement and enforce the NPS Program Plan. The NPS Policy requires all nonpoint source discharges to be regulated under waste discharge requirements, waivers of waste discharge requirements, a Basin Plan prohibition, or some combination of these administrative tools. The NPS Policy also describes the key elements that must be included in a nonpoint source implementation program.

The proposed Basin Plan Amendment will not change how the management, implementation or enforcement activities of nonpoint source pollution control programs are regulated.

10.3.8 Resolution No. 2002-0040: Water Quality Enforcement Policy

The State Water Board adopted this policy to ensure enforcement actions are consistent, predictable, and fair. The policy describes tools that the State and Regional Water Boards may use to determine the following: type of enforcement order applicable, compliance with enforcement orders by applying methods consistently, and type of enforcement actions appropriate for each type of violation. The State and Regional Water Boards have authority to take a variety of enforcement actions under the Porter-Cologne Water Quality Control Act. These include administrative permitting authority such waste discharge requirements (WDRs), waivers of WDRs, and Basin Plan prohibitions.

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The proposed Basin Plan Amendment does not change how the water quality enforcement actions are taken nor propose any Basin Plan Prohibitions.

10.3.9 Resolution No. 2004-0063: Policy for Developing California's Clean Water Act Section 303(d) List

Pursuant to the Water Code section 13191.3(a), this State policy for water quality control describes the process by which the State Water Board and the Regional Water Boards will comply with the listing requirements of Clean Water Act section 303(d). The Listing Policy establishes a standardized approach for developing California's section 303(d) list to achieve water quality standards and maintain beneficial uses in all of California's surface waters. The Listing Policy applies only to the listing process methodology used to comply with Clean Water Act section 303(d).

Clean Water Act section 303(d) requires states to identify waters that do not meet, or are not expected to meet by the next listing cycle, applicable water quality standards after the application of certain technology-based controls and schedule such waters for development of Total Maximum Daily Loads. (40 CFR §130.7(c) and (d).)

The proposed amendment establishes WQOs to protect beneficial uses in Reach 83 of the LSJR. These objectives will be utilized in the future to determine whether water quality standards are being met in this water body segment.

10.3.10 Resolution No. 2005-0019: Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California

The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (a.k.a. State Implementation Plan or SIP) applies to discharges of toxic pollutants into the inland surface waters, enclosed bays, and estuaries of California subject to regulation under the Porter-Cologne Water Quality Control Act and the Federal Clean Water Act. Regulation of priority toxic pollutants may occur through the issuance of NPDES permits. The goal of the SIP is to establish a statewide, standardized approach for permitting discharges of toxic pollutants to non-ocean surface waters.

The proposed Basin Plan Amendment addresses salt and boron, which are not priority pollutants.

10.3.11 Resolution No. 2005-0050: Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options

The State Water Board's Impaired Waters Policy incorporates the following:

- Clean Water Act section 303(d) identification of waters that do not meet applicable water quality standards and prioritization for TMDL development;
- Water Code section 13191.3(a) requirements to prepare guidelines to be used by the Regional Water Boards in listing, delisting, developing, and implementing TMDLs pursuant to Clean Water Act Section 303(d) of 33 USC Section 1313(d); and
- Water Code Section 13191.3(b) requirements that State Water Board considers consensus recommendations adopted by the 2000 Public Advisory Group when preparing guidelines.

The Impaired Waters Policy includes the following statements:

A. If the water body is neither impaired nor threatened, the appropriate regulatory response is to delist the water body.

B. If the failure to attain standards is due to the fact that the applicable standards are not appropriate due to natural conditions, an appropriate regulatory response is to correct the standards.

C. The State Water Board and Regional Water Boards are responsible for the quality of all waters of the state, irrespective of the cause of the impairment. In addition, a TMDL must be calculated for impairments caused by certain EPA designated pollutants.

D. Whether or not a TMDL calculation is required as described above, impaired waters will be corrected (and implementation plans crafted) using existing regulatory tools.

D1. If the solution to an impairment will require multiple actions of the Regional Water Board that affect multiple persons, the solution must be implemented through a Basin Plan amendment or other regulation.

D2. If the solution to an impairment can be implemented with a single vote of the Regional Water Board, it may be implemented by that vote.

D3. If a solution to an impairment is being implemented by a regulatory action of another state, regional, local, or federal agency, and the Regional Water Board finds that the solution will actually correct the impairment, the Regional Water Board may certify that the regulatory action will correct the impairment and if applicable, implement the assumptions of the TMDL, in lieu of adopting a redundant program.

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D4. If a solution to an impairment is being implemented by a non-regulatory action of another entity, and the Regional Water Board finds that the solution will actually correct the impairment, the Regional Water Board may certify that the non-regulatory action will correct the impairment and if applicable, implement the assumptions of the TMDL, in lieu of adopting a redundant program."

The California 2010 303(d) Integrated report lists portions of the Lower San Joaquin River for boron, chlorpyrifos, DDE, DDT, diazinon, diuron, EC, group A pesticides, mercury, selenium, temperature, toxaphene, unknown toxicity, and alpha-BHC/alpha-HCH. Many of these constituents are already being addressed with a TMDL control program. Because these amendments anticipate a reduction of agricultural discharges, they are not expected to aggravate any impairment caused by agricultural activities.The proposed Basin Plan Amendment also does not affect the process to address impaired water bodies and develop TMDLs.

10.3.12 Resolution No. 2008-0025: Policy for Compliance Schedules in National Pollutant Discharge Elimination System Permits

The Policy authorizes the Regional Water Board to include a compliance schedule in a permit for an existing discharger to implement a new, revised, or newly interpreted water quality objective (WQO) or criterion in a water quality standard that results in a permit limitation more stringent than the limitation previously imposed.

The proposed Basin Plan Amendment does not propose EC WQOs more stringent than the effluent limits in the current NPDES permits, so no compliance schedules are expected to be required following the adotion of the proposed Basin Plan Amendment.

10.3.13 Resolution No. 2009-0011: Policy for Water Quality Control for Recycled Water

This Policy is intended to establish consistent and predictable requirements in order to increase the use of recycled water in California. This policy:

- Establishes mandates for the use of recycled water;
- Requires the development by stakeholders and the adoption by Regional Water Quality Control Boards of regional salt/nutrient management plans;
- Establishes requirements for regulating incidental runoff from landscape irrigation with recycled water;
- Establishes criteria and procedures for recycled water landscape irrigation projects eligible for streamlined permitting;

- Establishes procedures for permitting groundwater recharge projects;
- Establishes procedures for implementing the *State Antidegradation Policy* for recycled water projects;
- Requires the establishment of a scientific advisory panel to advise the State Water Board on regulation of constituents of emerging concern; and
- Establishes actions and incentives to promote the use of recycled water.

The proposed Basin Plan Amendment will not restrict the development or use of recycled water. The goal of the CV-SALTS initiative is to address salinity and nitrate concerns in a consistent and sustainable manner and portions of the comprehensive, Central Valley-wide salt and nitrate management plan developed by CV-SALTS will satisfy requirements of the Recycled Water Policy.

10.4 Consistency with Central Valley Water Board Policies

10.4.1 Urban Runoff Policy

On page IV-14.00 of the Basin Plan, the Central Valley Water Board's Urban Runoff Policy states:

> "a. Subregional municipal and industrial plans are required to assess the impact of urban runoff on receiving water quality and consider abatement measures if a problem exists.
>
> "b. Effluent limitations for storm water runoff are to be included in NPDES permits where it results in water quality problems."

Storm water dischargers to these water bodies are not required to consider abatement measures nor has there been a need to include effluent limitations for these dischargers for salinity.

10.4.2 Controllable Factors Policy

On page IV-15.00 of the Basin Plan, the Central Valley Water Board's Controllable Factors Policy states:

> "Controllable water quality factors are not allowed to cause further degradation of water quality in instances where other factors have already resulted in water quality objective being exceeded. Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State, that are subject to the authority of

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> the State Water Board or Central Valley Water Board, and that may be reasonably controlled."

There is an expected improvement of water quality due to the proposed Basin Plan Amendment, therefore the proposed Basin Plan Amendment is consistent with the Controllable Factors Policy.

10.4.3 **Water Quality Limited Segment Policy**

On page IV-15.00 of the Basin Plan, the Central Valley Water Board's Water Quality Limited Segment Policy states:

> "Additional treatment beyond minimum federal requirements will be imposed on dischargers to Water Quality Limited Segments. Dischargers will be assigned or allocated a maximum allowable load of critical pollutants so that water quality objectives can be met in the segment."

No additional treatment controls are anticipated to meet the proposed WQOs.

10.4.4 **Antidegradation Implementation Policy**

Consistency of the proposed Basin Plan Amendment with the federal and state Antidegradation policies is discussed earlier in Section 8.1.

10.4.5 **Application of Water Quality Objectives Policy**

Excerpts from Policy for Application of Water Quality Objectives are presented below. The full text can be found on page IV-16.00 of the Basin Plan.

> " Water quality objectives are defined as 'the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water, or the prevention of nuisance within a specific area.'… Water quality objectives may be stated in either numerical or narrative form. Water quality objectives apply to all waters within a surface or ground water resource for which beneficial uses have been designated…
>
> " The numerical and narrative water quality objectives define the least stringent standards that the Regional Water Boards will apply to regional waters in order to protect beneficial uses."

The proposed Basin Plan Amendment establishes numeric WQOs that provide reasonable protection of beneficial uses in the LSJR.

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10.4.6 **Watershed Policy**

On page IV-21.00 of the Basin Plan, the Central Valley Water Board's Watershed Policy states:

> "The Regional Water Board supports implementing a watershed based approach to addressing water quality problems. The State and Regional Water Boards are in the process of developing a proposal for integrating a watershed approach into the Board's programs. The benefits to implementing a watershed based program would include gaining participation of stakeholders and focusing efforts on the most important problems and those sources contributing most significantly to those problems.

The proposed Basin Plan Amendment was developed with the assistance of a stakeholder workgroup and is consistent with taking a watershed based approach to addressing water quality issues and concerns.

10.4.7 **Drinking Water Policy for Surface Waters of the Delta and its Upstream Tributaries**

This Policy includes a narrative WQO for *Cryptosporidium* and *Giardia*, along with implementation provisions to maintain existing conditions for public water systems. Applicable provisions from this Policy include the requirements to upstream dischargers when implementation actions are triggered by monitoring at a public water system. In addition, the Policy recommends that the Central Valley Water Board consider the necessity of including monitoring of organic carbon, salinity and nutrients when waste discharge requirements are renewed.

The proposed Basin Plan Amendment does not change the implementation of this Policy and includes salinity monitoring as part of the proposed Monitoring and Surveillance Program.

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APPENDIX A
COMPILATION OF WATER QUALITY DATA

The Lower San Joaquin River (LSJR) Committee contracted Larry Walker Associates[1] (LWA) to compile and develop into a database, the available water quality and salt loading data from the LSJR drainage basin. The database was needed to:

- Determine baseline salt loading to the LSJR;
- Evaluate current water quality conditions within the LSJR; and
- Estimate compliance with the water quality objectives (WQOs) being considered for the river.

In order to complete this task, the LWA Team assembled the available surface water quality data and information for the LSJR project area (Figure A-1). The Team updated the existing data compilations within the Watershed Analysis Risk Framework (WARMF) database[2] with data from 1968 to present [the primary focus being on the time period from 1995 to present (through September or December 2013, depending on the database)].

The data from the 2004 LSJR Salt and Boron TMDL report (CVRWQCB, 2004) were integrated and updated with more recent data (1995 to present) from the same sources drawn upon by the TMDL. The WARMF database was used for the integration. This effort was also supplemented with data from other relevant sources as described in more detail below.

Use of the WARMF database provides several advantages for the current BPA effort including:

- WARMF model inputs and outputs will meet the project's data needs,
- WARMF model inputs have already undergone an extensive Quality Assurance/Quality Control (QA/QC) review,
- Regular data updates to WARMF through its use in other projects associated with the San Joaquin River provides the LSJR Committee with a larger and more comprehensive dataset compared to the dataset used for the 2004 LSJR Salt and Boron TMDL.
- Tools already exist in WARMF that provide rapid and efficient updating of its database through the access of major online databases including:

[1] The LWA Team includes the following subcontracted firms: Luhdorff and Scalmanini Consulting Engineers, Kennedy/Jenks Consultants, PlanTierra, Systech Water Resources, Carollo Engineers, Ascent Environmental, and Dr. Richard Howitt.
[2] The LSJR Committee members decided that the WARMF database would serve as the overall database and would be updated with the data collected for this work effort.

- United States Geological Survey National Water Information System (USGS NWIS)
- California Department of Water Resources (DWR) Water Quality Library (DWR Library)
- California Environmental Data Exchange Network (CEDEN)
- California Department of Water Resources California Data Exchange Center (CDEC).

To the extent practicable, future tasks and data needs were considered during the database update. This appendix provides a summary of the data collected as well as the sources of the data.

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This appendix is organized as follows:

- Section I WARMF Background – This section provides a brief description of WARMF;
- Section II Prior WARMF Application to the San Joaquin River – This section provides a description of how WARMF was used in prior investigations of the San Joaquin River Watershed;
- Section III Data Gathering Overview – This section provides a brief description of the data gathering effort and the data obtained, along with other data sources;
- Section IV WARMF Database Updates – This section provides a description of the new data added to the WARMF database, the QA/QC process used to validate these data and the data already in the database; and
- Section V Conclusions.

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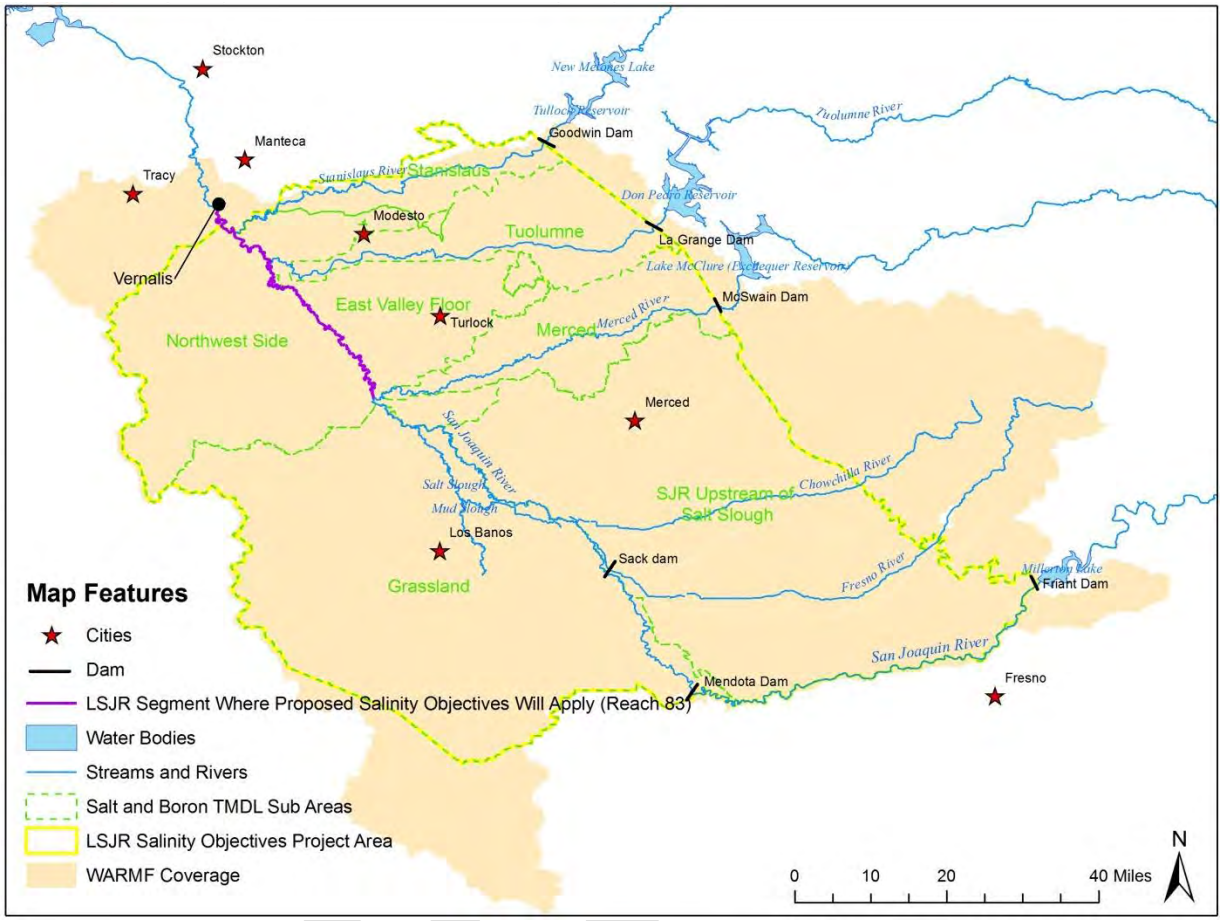

Figure A-1: Lower San Joaquin River Basin Salinity Objectives Project Area

I. WARMF BACKGROUND

As noted above, the LSJR Committee decided that the WARMF database would serve as the overall database for this work effort and that it would be updated with additional data. WARMF as a model will also be used in an update analysis of baseline salt loading to the LSJR. The WARMF model simulates flow and loading from shallow groundwater accretion which is measured indirectly by difference between monitoring stations in the San Joaquin River. To focus the data gathering efforts, the LWA Team needed to gather parameters and constituents currently built into WARMF. This section provides a brief description of WARMF, its inputs and outputs, and its capabilities.

WARMF is a physically-based watershed model capable of simulating watershed hydrology and water quality on a daily or shorter time step. In WARMF, a watershed is divided into land catchments, river segments, and layered reservoirs. Catchments are further divided into land uses on the surface and soil layers below the surface. The network of catchments, rivers, and reservoirs is linked together by a flow path into a seamless watershed model. WARMF simulates watershed processes while maintaining mass and heat balance to calculate flow and

water quality to the land, from the land to surface water, and recharging to the groundwater aquifer. WARMF only simulates the near-surface groundwater which interacts with surface water down to a depth of approximately 8 feet; recharge is considered to be lost from the model domain. The WARMF Technical Documentation describes the algorithms and methods used to simulate watershed processes (Chen et. al. 2001).

WARMF uses five types of time series data to drive simulations: meteorology, air and rain chemistry, point sources, boundary inflows, and diversions. Measured in-stream flow and water quality data are used to create boundary inflows where tributaries flow into the model domain from upstream, but the primary purpose of measured in-stream data is to evaluate how well the model can predict flow and water quality. Groundwater quality data are used to estimate the concentration of chemical constituents in pumped irrigation water, which enters the WARMF model domain as point sources. Because WARMF calculates near-surface groundwater flow and chemistry as a function of watershed characteristics and model inputs, groundwater data are not needed by WARMF and are not included in its database.

WARMF simulates flow using a water balance. Precipitation, irrigation, and flow are inputs to the land. The model calculates evapotranspiration from the land and canopy and lateral surface and subsurface flow to surface water. WARMF simulates over 30 water quality parameters including temperature, pH, major cations and anions (Ca, Mg, K, Na, SO_4, Cl), nutrient components (NH4, NO_3, PO_4), inorganic carbon, organic carbon, dissolved oxygen, phytoplankton, and suspended sediment. Total phosphorus, total kjeldahl nitrogen, and total nitrogen are calculated by adding up the respective dissolved, adsorbed, and organic forms of the applicable chemical species. Total dissolved solids (TDS) are calculated by adding the concentrations of all ionic species. Electrical conductivity (EC) is calculated from total dissolved solids using a multiplier of 1.67 developed using concurrent TDS and EC data measured at Vernalis. Boron is not included within the model, but can be calculated from EC using site specific ratios found in the 2004 LSJR Salt and Boron TMDL staff report.

II. PRIOR APPLICATION OF WARMF TO THE SAN JOAQUIN RIVER

The data from the 2004 LSJR Salt and Boron TMDL report was integrated into the database and updated with more recent data (1995 to present) from the same sources drawn upon by the TMDL. This section provides an overview of the data and data sources added to WARMF prior to the start of the current work effort.

In 2003, CALFED funded the directed action project for monitoring and investigations of the San Joaquin River and tributaries related to dissolved oxygen. As a part of this project, a comprehensive field program was established to measure flow and water quality in the San Joaquin River and its tributaries from Lander Avenue (near Stevinson) to the Old River. USGS and University of California Davis (UCD) collaborated to measure sources and transport of

nutrients and algae during summer and fall of 2000 and 2001 (Kratzer et al. 2004). Jones & Stokes (Jones and Stokes, 2005) created a Data Atlas by compiling all these data and publicly available databases into a compact disk (CD) to support data analysis and modeling. The data used for the 2004 LSJR Salt and Boron TMDL was contained within the created Data Atlas, which was then incorporated into WARMF.

The WARMF model was initially created for the San Joaquin River in parallel with field data collection efforts (Herr, Chen, and van Werkhoven 2008). The model was used to simulate pollutant loading sources which could not be measured, such as diffuse near-surface groundwater flow in agricultural areas, and transformations which occur in the land and surface water such as chemical reactions and phytoplankton growth.

The initial model domain extended from the San Joaquin River at Lander Avenue to the San Joaquin River at the Old River junction, but excluded gaged tributaries of the San Joaquin River. The data collected by the aforementioned CALFED-funded study was incorporated into the WARMF model database along with publicly available downloadable data. Downloadable data sources whose data were incorporated into the WARMF model database as part of this initial study are shown in Table A-1. Additional project specific and discontinued databases incorporated into WARMF are listed in Table A-2.

Table A-1 Online Databases for Initial Application of WARMF to the San Joaquin River.

Data Source	Online Link
USGS NWIS	http://maps.waterdata.usgs.gov/mapper/index.html
DWR Library	http://www.water.ca.gov/waterdatalibrary/
CDEC	http://cdec.water.ca.gov/queryCSV.html

Table A-2 Project and Discontinued Data Sources Incorporated into the WARMF Database.

Data Source	Online Link or Reference Document
SJR Data Atlas	http://sjrdotmdl.org/rsrcs-datasets.html
SJR DO TMDL Upstream Studies	Stringfellow et. al. 2008
SJR DO TMDL Downstream Studies	(1)
Bay Delta and Tributaries Project	http://www.water.ca.gov/iep/products/data/bdatnotice.cfm

1 Data for the SJR DO TMDL Downstream Studies have not been published as of the drafting of this technical memorandum. Contact Dr. Will Stringfellow of the University of the Pacific for more information.

In 2008, under sponsorship from the Bureau of Reclamation, the WARMF model was expanded to include the river and watershed upstream to Friant Dam (Herr & Chen 2008). Flow and water quality data from the sources listed in Table A-1 were added to the WARMF database for the

expanded model domain. Although the expansion area was not fully parameterized and calibrated, it provided a basis for future work.

Under a contract with the California Urban Water Agencies acting on behalf of the Central Valley Drinking Water Policy Work Group, the San Joaquin River WARMF model was used to evaluate the sources and transport of organic carbon and nutrients (Systech Water Resources 2011a). The databases in Table A-1 were searched to ensure that the WARMF database included all the available data for the water quality parameters of concern.

The Central Valley Salinity Coalition (CV-SALTS) sponsored a project to upgrade the WARMF model as part of a pilot study to account for and track salinity and nitrate movement between land, shallow groundwater, deeper groundwater, and surface water (Larry Walker Associates 2010). The project brought detailed land use representation to the watershed lands east of the San Joaquin River and linked WARMF to a MODFLOW groundwater model to calculate the transfer of salt and nitrate to the deeper groundwater aquifer. Some of the flow and water quality data were extended through 2009 for this project using the data sources listed in Table A-1.

The Bureau of Reclamation's Westside Salt and Nitrate Assessment Study brought an analysis similar to the CV-SALTS pilot study to the west side watersheds of the San Joaquin River (Bureau of Reclamation 2012a, Bureau of Reclamation 2012b). As part of this project, the WARMF model domain was expanded to include all tributary lands west of the San Joaquin River. Land use with similar detail to the east side tributary lands was applied to the west side. The project also added a linkage to the WestSim model to track salt and nitrate recharged into the deeper groundwater. Some additional data were collected from the sources in Table A-1 to expand the database forward to 2010 at certain key locations, particularly west side tributaries.

In 2011, the Metropolitan Water District of Southern California sponsored upgrades to the WARMF model so that it could track winter flows through the watershed lands and rivers in the region between Friant Dam and the San Joaquin River at Lander Avenue (Systech Water Resources 2011b). To accomplish this, the model was calibrated for winter storms and seepage losses were added to estimate the persistence of flow through the Eastside Bypass to the LSJR. Turbidity data collected by the sources listed in Table A-1 were added to the WARMF database, and additional measured flow data were collected for key gauging stations on the San Joaquin River. Turbidity data was updated at selected locations through the beginning of 2013 in subsequent studies conducted during the winters of 2011-2012 and 2012-2013.

Also in 2011, the California Department of Fish and Game sponsored a detailed study on the Orestimba Creek Watershed which is ongoing as of this time. This heavily monitored watershed was used to quantify agricultural practices and watershed characteristics such as applied water

rates, land application rates, the quality of groundwater used for irrigation, and groundwater interactions on a local scale to improve the modeling of the entire west side watershed lands. The model's flow and water quality databases were updated with data from the Orestimba Creek region.

The resulting WARMF model domain produced by the various San Joaquin River WARMF projects described above is shown in Figure A-2. The area shown in yellow has been fully parameterized (contains all of the parameter inputs for WARMF). The salmon colored area has been calibrated for winter conditions, but has not been fully parameterized with irrigation for summer conditions. However, this area has limited impact on the LSJR because water does not generally flow all the way through this area to the lower river. The light blue area shows the watersheds of the east side tributaries upstream of their most downstream gauges, which is not currently part of the WARMF model domain. The WARMF database includes data from all three colored areas shown on the map. Although as described above, the data coverage is not uniform throughout.

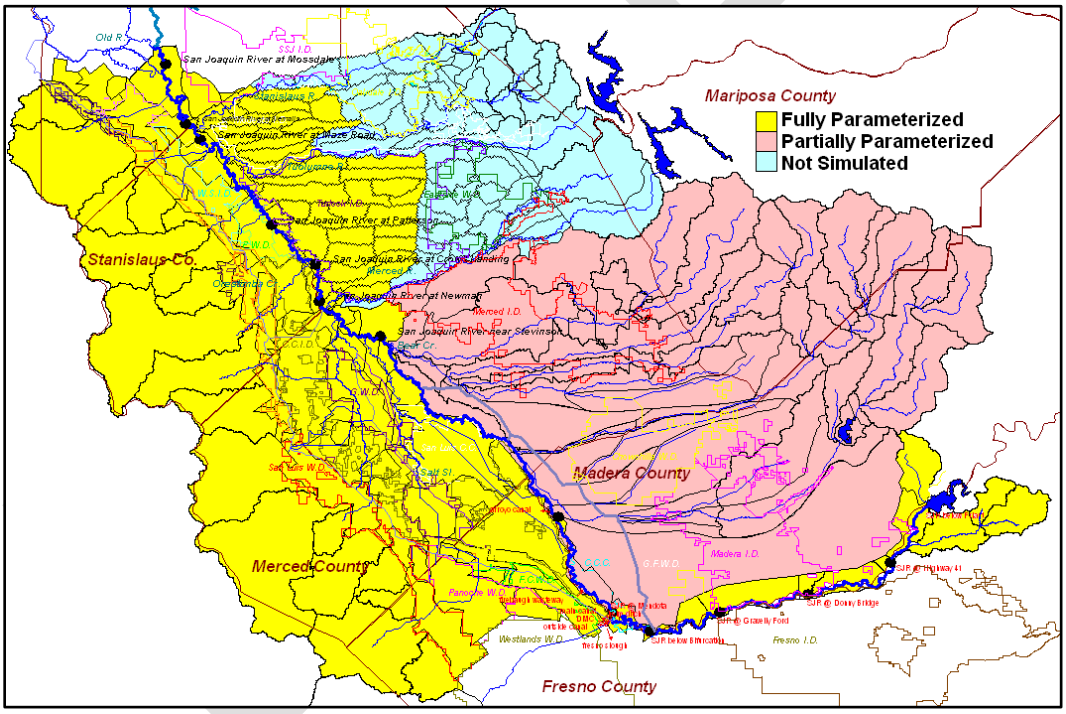

Figure A-2: San Joaquin River WARMF Status Map

Since the WARMF database was expanded each time the model was used, a very large flow and water quality database has been created that is well-suited to meet the modeling needs of the LSJR BPA effort. As a result, and to maximize the utility of limited resources, the existing WARMF database will be used as a basis for the LSJR work effort. For this project, the database will be used to determine baseline salt loading, water quality conditions, and the state

of compliance with proposed salinity WQOs. To upgrade the WARMF database for these new uses, it was expanded to incorporate additional data beyond those that were needed for the earlier modeling efforts. The new data added to WARMF extend back to October 1, 1976[3], and forward through 2013.

Data Gathering Effort

As was noted earlier, the WARMF database is fairly comprehensive and is routinely updated from major online resources (USGS NWIS, DWR Library, CEDEN, and CDEC). In order to supplement these ongoing updates and obtain additional data that may not already be within the WARMF database, a data request was distributed to the LSJR Committee on October 28, 2013. The data request provided an overview of data that were already accounted for within WARMF and identified additional data that were requested. The purpose of the data request was to identify new data sources that may not exist in the WARMF database and would not be available in the major online databases. As a result, five (5) resources were brought to the attention of the LWA Team and investigated to determine if these data were new to WARMF and should be incorporated or were already included in WARMF.

The following is a list of the 5 new data resources:

1. The Department of Water Resources (DWR) – data already included in WARMF;
2. The 2004 Salt and Boron TMDL – data already included in WARMF;
3. Turlock Irrigation District – included available data that could not be incorporated due to the timing of the data request to the stakeholder. A small amount of that data was already included in WARMF;
4. 1980 SDWA/USBR Report on the Effects of the Central Valley Project on the Southern Delta – contained data outside of the 1968 – present time range of this work effort and not included in WARMF; and
5. Grassland Water District Monitoring Sites – data that were identified as new to the WARMF database, but could not be incorporated into WARMF at this time due to the time that would be necessary to obtain and reformat the data.

The following sections document the data available from the 5 data sources identified in the previous paragraph.

Department of Water Resources (data resource 1)

The WARMF database with inclusion of the major online databases contained data from 1/1/1984 to present so there was a need for additional data from the period 10/1/1968 to 12/31/1983.

[3] Although the date range for this work effort was initially identified as 1968 – present, this is currently undergoing review by the LSJR Committee. It is anticipated that the date range may be modified to 1977 – present.

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At a number of locations, EC and flow data were available and were provided by Ernie Taylor of DWR[4]. Attributes of the data provided are listed in Table A-3. A comparison of these DWR data to the data in WARMF revealed that these data were already included in the San Joaquin River Data Atlas (Jones and Stokes, 2005), which had previously been incorporated into the WARMF database.

Table A-3 Summary of Data Received from DWR

CDEC Code	Stream and Station	Flow (cfs)		EC (uS/cm)	
		Earliest Date	Latest Date	Earliest Date	Latest Date
	San Joaquin River				
SJS	San Joaquin R. near Stevinson (or Lander Ave)	10/2/1961	Present	1/5/2002	Present
SJP	San Joaquin R. at Patterson Bridge	10/2/1969	Present	10/2/1964	Present
MRB	San Joaquin R. at Maze Road Bridge	10/2/1960	Present	1/2/1965	Present
	Salt Slough				
	Salt Slough near Stevinson	3/1/1968	1/3/2010	NA	NA
	San Joaquin River				
CRS	Merced R. at Cressey	10/20/1960	Present	1/8/2001	Present
	Merced R. at Millikin Bridge	NA	NA	7/25/1962	10/1/1991
MST	Merced R. near Stevinson	10/2/1995	Present	4/16/2002	Present
	Tuolumne River				
	Tuolumne R. at Tuolumne City	10/2/1960	10/1/1981	10/2/1985	9/12/1991
	Stanislaus River				
OBB	Stanislaus R. at Orange Blossom Bridge	1/1/1961	Present	8/1/2002	Present
KTZ	Stanislaus R at Koetitz Ranch	10/2/1962	Present	10/2/1964	10/1/1992

2004 Salt and Boron TMDL (data resource 2)

The WARMF database update started with a verification that the data used in the 2004 LSJR Salt and Boron TMDL (CVRWQCB, 2004) were included in WARMF and then updated with more recent data (1995 to present) from the same sources as those used in the TMDL. While projects mentioned in Section I led to the incorporation of these data into WARMF, the critical data from the 2004 TMDL were verified to be in the WARMF database. During this verification, it was noted that the data in the original 2004 report and its appendices were data that had already undergone processing such as averaging and summation (e.g., daily averages summed to monthly data), thus they were not processed data. Each WARMF run adds new data as it becomes available, and updates its own database as old data undergoes QA/QC in the online databases. This made a direct comparison of the WARMF database and the TMDL data in the report infeasible. Replicating the processing (summation or averaging) would not guarantee the same result as reported in the 2004 report because the processed data may have changed due to QA/QC or the addition of data added later. Therefore, the locations, station names, and time frames for the data in the TMDL report were compared to the data currently in WARMF. The following compares data in tables and figures from the TMDL Staff Report's Appendix 1 with the WARMF data:

[4] Personal Communication, 11/15/2013

- TMDL report Appendix 1, Table A-1: Flow Data Sources which are standard USGS gages. Comparison showed data location and date ranges were already in WARMF.
- TMDL report Appendix 1, Table A-2: More Flow Data Sources which are standard USGS gages. Comparison showed data location and date ranges were already in WARMF.
- TMDL report Appendix 1, Figure A-1: Locations of WQ stations. Three stations with unfamiliar names were identified (Stanislaus River at Koetitz Ranch, Tuolumne River at Tuolumne City, and Merced River at Milliken Bridge). The first two lined up with Stanislaus River at Caswell State Park and Tuolumne River at Shiloh Road, which are the monitoring points with the most data on each of the two rivers and comparison showed data location and date ranges were already in WARMF. The Milliken Bridge location doesn't line up with any modern sampling point, and the data were not able to be located.
- TMDL report Appendix 1, Table A-3: The table cites (Kratzer et. al, 1987) and (Grober et.al, 1998) as data sources for EC and TDS data. Kratzer et. al is a reference to the San Joaquin River Input Output Model, which is a DWR flow and salinity model, previously incorporated into WARMF. The data used by Grober et. al were located at the Water Board's website and comparison showed data location and date ranges were already in WARMF.

This evaluation confirmed that the data collected for the 2004 Salt and Boron TMDL report were not included in the major online databases. However, these data had already been incorporated into the WARMF database via the San Joaquin River Data Atlas (Jones and Stokes, 2005).

Turlock Irrigation District Data (data resource 3)

The LSJR Committee was contacted by Debbie Liebersbach[5] of the Turlock Irrigation District (TID) with clarifying questions regarding the Committee's initial data request. This included questions regarding how much data WARMF already includes from listed databases, what constituents were being requested, time-step information, and what types of QA/QC were needed. Some TID data has already been incorporated into the WARMF database, and additional data was identified as new to the database. However, further communications did not yield any additional data. Due to the timing of when the data was identified and time constraints retrieving the data from the TID, these data were not compared to, or included in, the updates to the WARMF database.

1980 SDWA/USBR Report on the Effects of the Central Valley Project on the Southern Delta (data resource 4)

[5] Personal Communication, 11/15/2013

The 1980 SDWA USBR report of the effects of the Central Valley Project on the Southern Delta (SDWA & USBR, 1980) was provided to the LSJR Committee[6]. The report contained useful data in .pdf format on flow and salinity at a number of key locations in the LSJR. However, the data record (1930 – 1969) was outside the date range of the evaluation, with the exception of 1968 and 1969. With the focus of the data update being 1995 to present, these data were not included in the updates to the WARMF database, but can provide useful information for future efforts that include pre-1968 data. The data is embedded within the report which can be provided upon request.

WARMF Database Updates

The WARMF database was updated with all available information that could be gathered and incorporated within the time constraints of the work effort. The general data request did not provide any new data. The data received had either already been incorporated into WARMF, was outside the time range of the work effort, or could not be incorporated due to timing. As a result, the updates to the WARMF database come from four major online databases: USGS NWIS, DWR Library, CEDEN, and CDEC. The following sections describe the structure of the WARMF database and document the sources as well as the QA/QC process after incorporating the data obtained online through its incorporation into the WARMF database.

Database Format

The WARMF San Joaquin River (SJR) Model database is comprised of two file types related to hydrology and water quality. In the database, observed river hydrology (ORH) files contain discharge and water surface elevation data; observed river chemistry (ORC) files contain data for many water quality parameters, including dissolved ions, pH, temperature, suspended sediment, dissolved oxygen, EC, and TDS. The WARMF SJR Model database currently contains 61 ORH files and 91 ORC files. Each of these files corresponds to one sampling site within the SJR watershed. Many locations have both observed hydrology and observed chemistry data. The WARMF database was originally populated with data from 1984 through 2007. As a result of this effort, the WARMF database was updated with more recently collected data from 2008-2013.

There were no new data available for some of the ORH and ORC files. Of the 61 ORH files, new discharge data were only available at 44 locations. Of the 91 ORC files, 29 were in the Delta downstream of Vernalis and were not updated. New water quality data were available at 48 of the 62 remaining locations. A comprehensive list of data sources, location, and date ranges for each station is attached to this document in Attachment A –Tables AAa - AAg. ORH and ORC files that were updated with new data are identified by underlined titles or red font respectively.

[6] Personal Communication, 11/26/2013

The WARMF flow and water quality database is in the form of column format text files. These files are read and presented in tabular and graphical format in the WARMF Data Module. To make the WARMF database accessible without installing the WARMF software, macros were created to export the WARMF data files into Excel format. Because of the large quantity of data, hydrology and water quality data files were grouped into multiple Excel files with one tab per monitoring location. Each Excel file has a tab listing all the files whose data is included and a tab translating the WARMF data codes to parameter names and units. Separate index Excel files for hydrology and water quality were generated indicating in which file the data of each monitoring location is stored.

Data Sources and QA/QC

The files in the WARMF database were reviewed and updated with available data within the time period of October 1, 1976 to December 2013/January 2014 when the data were retrieved. To update the ORH and ORC files, four online databases that contain SJR hydrology and water quality datasets were consulted. They include USGS NWIS, DWR Library, CDEC, and CEDEN. CEDEN is a data aggregator which did not exist when WARMF was originally applied to the San Joaquin River. CEDEN data can be accessed at http://www.ceden.us/AdvancedQueryTool. The websites for the other three sources are listed above in Table A-1.

The USGS NWIS and the CDEC databases contain the most comprehensive hydrologic data and were used to update the ORH files. River discharge, or flow, was the only constituent updated in the ORH files. To update the ORC files, all four databases (NWIS, DWR, CEDEN, and CDEC) were searched for water quality data not already in the WARMF database. Many parameters were updated in the ORC files, including but not limited to: EC, total dissolved solids, dissolved calcium, magnesium, chloride, ammonia, nitrate, phosphate, organic carbon, pH, temperature, dissolved oxygen, and alkalinity.

Some of the databases used to update these files contain duplicate data and care was taken to avoid duplicating the data in the WARMF database. Some CDEC data are known to have quality problems, so where these data overlapped with data from other sources, the other sources were used. When there was doubt if a dataset was already in the database, the data were included to ensure that all currently available observed data from the above four databases are within the WARMF database. In most cases, new data incorporated into the WARMF database were available from the source databases as grab samples or a daily average. In cases where continuous monitoring data were available on an hourly or more frequent basis, results were converted to daily mean results before being integrated into an ORC or ORH file.

CDEC data quality can be poor because the data is often not verified before being uploaded to the online database. During the update of the WARMF database it was visually inspected and

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outliers were removed. The quality of data from USGS NWIS, DWR Library, and CEDEN is good because most of this data goes through a quality control process before being uploaded to their respective databases. Less quality assurance effort was spent incorporating those databases into the WARMF databases, which had already undergone a quality assurance process. Flagged or estimated data was included in the database as long as they were not outliers.

Some of the databases used to update the ORH and ORC files are comprised of data from multiple entities, agencies, or programs. The data from the USGS NWIS and the DWR Library databases indicate that they are only from those respective agencies. However, data from CEDEN and CDEC come from multiple sources. For example, CEDEN data include samples collected by the Surface Water Ambient Monitoring Program (SWAMP), the Grassland Bypass Project, from various TMDL studies, the Irrigated Lands Regulatory Program, and the Westside San Joaquin River Watershed Coalition.

CDEC data include stations maintained by a few agencies, including the California Department of Fish and Wildlife as well as the USGS. Each line of data that was updated in the ORH and ORC files includes a data source field with the database and station identifier from which the data were obtained. A summary of all sources within the database and links or references are included in Attachment A – Table AA-1. Continuous monitoring data collected within the Grassland Water District was not available for the database.

Conclusions

The data collected, as summarized above, consist of a massive amount of surface water quality and flow information that will be used for determining baseline salt loading to the San Joaquin River, evaluating current surface water quality conditions, and estimating compliance with surface WQOs being considered for the LSJR. Data are housed within WARMF .ORC and .ORH files, which contain site names, site locations in latitude and longitude, flow and/or constituent data that are available, and data source fields detailing the database and station identifier from which the data were taken.

The data compiled and described in this appendix will be used to analyze the baseline salt loading to the LSJR through the use of the WARMF model. While this appendix conveys and describes the data that are contained within the accompanying database, further analysis of the data is detailed as part of an update of baseline salt loading to the LSJR. The additional analysis includes identifying significant salt sources in the LSJR basin, quantifying salt loading from those sources, describing the timing of salt loading to the river, as well as providing a water balance and salt budget.

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Attachment A: DATA SOURCES
Tables AA-1 and AA-2a through AA-2g

Information regarding each of the data sources whose data has been incorporated into the ORH and ORC observed data files in the WARMF San Joaquin River database is provided in Table AA-1. The table includes the full name of each data source as well as the shortened name that is referenced in the data source field on each data line in the actual ORH and ORC files. The table includes a web-link or a reference document that provides metadata for each data source.

Documentation of what data sources were incorporated into the ORH and ORC files in the WARMF San Joaquin River database is provided in Tables AA-2a through AA-2g. Each of the ORC and ORH files corresponds to a specific location in the San Joaquin River watershed and these locations are listed in Tables AA-2a through AA-2g, along with their respective latitude and longitude. In WARMF each ORC and ORH file is assigned to a specific river segment and is given a WARMF River ID which is also listed in the table. Two locations, the Delta-Mendota Canal at Head and the Smith Canal, do not have a WARMF River ID listed and this is because these stations are currently not being used in the model. The dates of the first and last data point associated with the location are listed in Table AA-1. Finally, all data sources for each station are listed.

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Table AA-1. Sources of Observed Data used to Create WARMF ORH and ORC Files.

Data Source	ORH/ORC File Abbreviation	Weblink or Reference Document	Description of Source
California Data Exchange Center	CDEC	http://cdec.water.ca.gov/queryCSV.html	Online state database for Department of Water Resources
United States Geological Survey National Water Information System	USGS	http://maps.waterdata.usgs.gov/mapper/index.html	Online federal database for United States Geological Survey
California Department of Water Resources Water Data Library	DWR	http://www.water.ca.gov/waterdatalibrary/	Online state database for Department of Water Resources
California Environmental Data Exchange Network	CEDEN	http://www.ceden.us/AdvancedQueryTool	Online state database for the State Water Board
Bay Delta and Tributaries Project	BDAT	http://www.water.ca.gov/iep/products/data/bdatnotice.cfm	A online state database for DWR and the Interagency Ecological Program that has been archived.
Surface Water Ambient Monitoring Program	SWAMP	http://www.waterboards.ca.gov/water_issues/programs/swamp/	Online state database for the State Water board for surface waters
San Joaquin River Data Atlas	SJR Data Atlas	http://sjrdotmdl.org/rsrcs-datasets.html	A compiled database of all available data on the SJR and DWSC flow and water quality conditions for 1984 – 2003. Part of the San Joaquin River Dissolved Oxygen Study. Database is housed on a CD.
California Department of Water Resources Interagency Ecological Program Monitoring	DWR-IEP Monitoring	http://www.water.ca.gov/iep/activities/monitoring.cfm#	Online state database for Department of Water Resources
Dissolved Oxygen Total Maximum Daily Load Upstream Studies Water Quality Data	DO TMDL WQ Data	Stringfellow et. al. 2008, contact Dr. Nigel Quinn (nwquinn@lbl.gov) for more information	Stockton Deep Water Ship Channel Dissolved Oxygen TMDL Upstream Studies
Dissolved Oxygen Total Maximum Daily Load Estuary Studies	DO TMDL Estuary Studies	Contact Dr. Will Stringfellow, University of the Pacific, for more information	This data has not been published as of this time
Central Valley Regional Water Quality Control Board	CVRWQCB	In CEDEN: http://www.ceden.us/AdvancedQueryTool	One of the references within CEDEN
City of Stockton	City of Stockton	Contact Dr. Will Stringfellow, University of the Pacific, for more information	This data has not been published as of this time
Dissolved Oxygen TMDL Upstream Studies Continuous Monitoring	Continuous Monitoring	Stringfellow et. al. 2008, contact Dr. Nigel Quinn (nwquinn@lbl.gov) for more information	Stockton Deep Water Ship Channel Dissolved Oxygen TMDL Upstream Studies
EPA National Aquatic Resource Survey Data	EPA National Aquatic Resource Survey Data	http://www.epa.gov/watertrain/monitoring/nationalsurveys.html	Compilation of survey data from the federal EPA
Fresno River Water Quality Monitoring	Fresno River Water Quality Monitoring	http://ofmpub.epa.gov/apex/STORETSummary/f?p=101:4:0::NO::P4_HUC,P4_ORG_ID,P4_CHAR_TYPE:18040007,CAFRESNO,	Data can be obtained from EPA STORET data warehouse
Dissolved Oxygen TMDL Upstream Studies Task 4 March 06 Report	Task 4 March 06 Report	Stringfellow et. al. 2008, contact Dr. Nigel Quinn (nwquinn@lbl.gov) for more information	Stockton Deep Water Ship Channel Dissolved Oxygen TMDL Upstream Studies
Dissolved Oxygen TMDL Upstream Studies Task 8 Report	Task 8 Report	Stringfellow et. al. 2008, contact Dr. Nigel Quinn (nwquinn@lbl.gov) for more information	Stockton Deep Water Ship Channel Dissolved Oxygen TMDL Upstream Studies

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Table AA- 2a.[1] Sources of Data and Locations of WARMF San Joaquin River Database Hydrology and Water Quality Stations.

Location	Bear Creek at McKee Road	Bear Creek near Bert Crane Road	CA DWR site SJ051E/SJ051M (Dos Reis)	CA DWR site TB (Turning Basin)	Calaveras River at UOP	Chowchilla Bypass / Eastside Bypass	Chowchilla R blw Buchanan Dam nr Raymond CA	Coarse Gold Creek near Fresno River	Cottonwood Creek near Friant	Del Puerto Creek at Vineyard Road near Patterson	Delta-Mendota Canal at head	Dry Creek near Snelling CA	Dry Creek at Modesto	Eastside Bypass near El Nido
WARMF River ID	65	23	693	884	903	278	72	34	55	339		342	303	396
Latitude	37.309	37.2555	37.8306	37.95	37.9813	36.774	37.2156	37.1683	37.0023	37.5208	37.8161	37.555	37.657	37.1475
Longitude	-120.444	-120.652	-121.312	-121.31	-121.314	-120.285	-119.99	-119.836	-119.722	-121.149	-121.56	-120.462	-120.923	-120.605
Min Date	12/31/1996	10/26/2000	3/30/1994	6/20/2000	5/5/2011	10/1/1997	10/1/1976	6/4/2003	2/4/1998	10/1/1976	10/1/1976	10/1/1976	3/21/1997	1/1/1984
Max Date	12/22/2013	5/9/2011	5/31/2007	10/25/2001	12/13/2012	12/26/2013	9/30/1990	3/31/2004	12/26/2013	12/29/2013	12/26/2013	9/30/1992	12/29/2013	12/26/2013
Source 1	SJR Data Atlas	CEDEN Bear Creek near Bert Crane Road	DWR	DWR	DO TMDL Estuary Studies	CDEC CBP	USGS 11259000	Fresno River Water Quality Monitoring CG	CDEC CTK	SJR Data Atlas	USGS 11313000	USGS 11271320	CDEC DCM	CDEC ELN
Source 2	CDEC MCK	CVRWQCB MER007	DO TMDL WQ Data 2007	DO TMDL Estuary Studies	--	--	--	--	--	USGS 11274630	CDEK TRP	--	--	--
Source 3	--	--	DO TMDL Estuary Studies	--	--	--	--	--	--	USGS 11274653	--	--	--	--
Source 4	--	--	--	--	--	--	--	--	--	CDEC DPC	--	--	--	--
Source 5	--	--	--	--	--	--	--	--	--	DO TMDL WQ Data 2005	--	--	--	--
Source 6	--	--	--	--	--	--	--	--	--	DO TMDL WQ Data 2006	--	--	--	--
Source 7	--	--	--	--	--	--	--	--	--	DO TMDL WQ Data 2007	--	--	--	--
Source 8	--	--	--	--	--	--	--	--	--	CVRWQCB STC516	--	--	--	--
Source 9	--	--	--	--	--	--	--	--	--	DO TMDL Estuary Studies	--	--	--	--
Source 10	--	--	--	--	--	--	--	--	--	CEDEN Del Puerto Creek at Vineyard Ave.	--	--	--	--
Source 11	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 12	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 13	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 14	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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[1] Underline – updated .ORH files; Red Font – updated .ORC files

Table AA- 3b.[1] Sources of Data and Locations of WARMF San Joaquin River Database Hydrology and Water Quality Stations.

Location	Fourteen Mile Slough	French Camp Slough	Fresno R blw Hidden Dam nr Daulton CA	Fresno River above the confluence with Miami Creek	Fresno River below Coarse Gold Creek above Hensley Reservoir	Hensley Lake inflow	Hospital Creek	Ingram Creek	Little Dry Creek (USBR)	Los Banos Creek at Highway 140	Mariposa Creek	Marshall Road Drain	Merced R at McConnell State Park nr Livingston CA	Merced River at River Road near Newman	Merced River at Shaffer Bridge near Cressy
WARMF River ID	923	851	45	9	35	35	305	313	50	444	1	201	124	108	129
Latitude	38.006	37.9161	37.0975	37.3352	37.1519	37.1585	37.6103	37.6003	36.942	37.2755	37.46	37.4361	37.4139	37.3511	37.4542
Longitude	-121.397	-121.304	-119.889	-119.707	-119.856	-119.862	-121.231	-121.225	-119.683	-120.955	-119.94	-121.036	-120.709	-120.961	-120.608
Min Date	6/9/2011	10/19/2006	10/1/1976	5/28/2003	6/3/2003	12/1/1988	10/24/2000	10/24/2000	2/3/1998	1/1/1984	8/27/2002	1/1/2005	7/29/1992	6/13/1985	10/1/1976
Max Date	11/8/2012	9/27/2012	9/30/1990	3/31/2004	3/31/2004	12/26/2013	9/9/2012	1/7/2013	12/26/2013	10/12/2013	8/27/2002	10/15/2012	7/17/2002	9/20/2012	12/26/2013
Source 1	DO TMDL Estuary Studies	DO TMDL WQ Data 2006	USGS 11258000	Fresno River Water Quality Monitoring FR	Fresno River Water Quality Monitoring FR	CDEC HID	CDEC HSP	CDEC ING	CDEC LDC	SJR Data Atlas	EPA National Aquatic Resource Survey Data	DO TMDL WQ Data 2005	USGS 372450120423300	SJR Data Atlas	SJR Data Atlas
Source 2	--	DO TMDL WQ Data 2007	--	--	--	--	DO TMDL WQ Data 2005	DO TMDL WQ Data 2005	--	Task 4 March 06 Report	--	DO TMDL WQ Data 2006	--	USGS 11273500	USGS 11271290
Source 3	--	DO TMDL Estuary Studies	--	--	--	--	DO TMDL WQ Data 2006	DO TMDL WQ Data 2006	--	DO TMDL WQ Data 2006	--	CEDEN Marshall Road Drain near River Road	--	DO TMDL WQ Data 2005	CDEC CRS
Source 4	--		--	--	--	--	DO TMDL WQ Data 2007	DO TMDL WQ Data 2007	--	Continuous Monitoring	--	CDEC MSR	--	DO TMDL WQ Data 2006	--
Source 5	--	--	--	--	--	--	CVRWQCB STC042	CVRWQCB STC040	--	CEDEN Los Banos Creek @ Hwy 140	--	--	--	DO TMDL WQ Data 2007	--
Source 6	--	--	--	--	--	--	CEDEN Hospital Creek at River Road	DO TMDL Estuary Studies	--	--	--	--	--	CVRWQCB MER546	--
Source 7	--	--	--	--	--	--	--	CEDEN Ingram Creek at River Road	--	--	--	--	--	DO TMDL Estuary Studies	--
Source 8	--	--	--	--	--	--	--	--	--	--	--	--	--	CEDEN Merced River at River Road	--
Source 9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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[1] Underline – updated .ORH files; Red Font – updated .ORC files

Table AA- 4c.[1] Sources of Data and Locations of WARMF San Joaquin River Database Hydrology and Water Quality Stations.

Location	Merced River below Merced Falls Dam near Snelling	Merced River near Stevinson	Modesto Irrigation District Lateral 4 Spill	Modesto Irrigation District Lateral 5 Spill	Modesto Irrigation District Lateral 6 Spill	Modesto Irrigation District Main Canal Spill	Moran Drain	Mosher Slough	Mud Slough above San Luis Drain (Gun Club Road)	Mud Slough near Gustine	Newman Wasteway at Brazo Road	Orestimba Creek at River Road near Crows Landing	Orestimba Creek near Newman	Panoche Crk at I-5 nr Silver Crk CA
WARMF River ID	123	107	208	207	210	209	199	937	969	387	259	165	164	14
Latitude	37.522	37.371	37.6306	37.6145	37.7038	37.6703	37.4355	38.0325	37.2542	37.2625	37.3038	37.4136	37.3156	36.6525
Longitude	-120.331	-120.931	-121.159	-121.143	-121.141	-121.219	-121.036	-121.365	-120.907	-120.906	-120.996	-121.015	-121.124	-120.631
Min Date	10/1/1976	10/1/1940	11/22/2003	3/1/2005	3/1/2005	3/1/2005	1/1/2005	5/5/2011	10/27/1995	8/2/1985	9/23/1985	4/15/1992	10/1/1976	12/1/1997
Max Date	12/26/2013	12/26/2013	11/25/2007	11/25/2007	11/25/2007	8/18/2011	12/29/2007	12/13/2012	12/26/2012	12/27/2013	2/11/2013	12/27/2013	12/28/2013	12/27/2013
Source 1	SJR Data Atlas	SJR Data Atlas	DO TMDL WQ Data 2005	Task 4 March 06 Report	DO TMDL WQ Data 2005	Task 4 March 06 Report	DO TMDL WQ Data 2005	DO TMDL Estuary Studies	SWAMP	SJR Data Atlas	DO TMDL WQ Data 2005	CDEC OCL	SJR Data Atlas	USGS 11255575
Source 2	USGS 11270900	USGS 11272500	DO TMDL WQ Data 2007	DO TMDL WQ Data 2005	DO TMDL WQ Data 2007	DO TMDL WQ Data 2005	DO TMDL WQ Data 2007	--	CEDEN Mud Slough Upstream of SLD Terminus	CDEC MSG	DO TMDL WQ Data 2006	SJR Data Atlas	USGS 11274500	--
Source 3	CDEC MSN	CDEC MST	Task 4 March 06 Report	DO TMDL WQ Data 2006	--	DO TMDL WQ Data 2006	CDEC MON	--	--	USGS 11262900	USGS 371903120585400	USGS 11274538	--	--
Source 4	DWR Merced River below Merced Falls Dam	DWR - MERCED R NR STEVINSO	CEDEN MID Lateral 4 @ Paradise Rd	DO TMDL WQ Data 2007	--	DO TMDL WQ Data 2007	--	--	--	DWR - Mud Sl @ Hwy 140	CEDEN: Newman Wasteway near Hills Ferry Road	DO TMDL WQ Data 2005	--	--
Source 5	--	DO TMDL WQ Data 2005	--	--	--	DO TMDL Estuary Studies	--	--	--	DWR - MUD SLU NR STEVINSON	--	DO TMDL WQ Data 2006	--	--
Source 6	--	--	--	--	--	--	--	--	--	DO TMDL WQ Data 2005	--	DO TMDL WQ Data 2007	--	--
Source 7	--	--	--	--	--	--	--	--	--	Task 4 March 06 Report	--	CVRWQCB STC019	--	--
Source 8	--	--	--	--	--	--	--	--	--	DO TMDL WQ Data 2006	--	DO TMDL Estuary Studies	--	--
Source 9	--	--	--	--	--	--	--	--	--	DO TMDL WQ Data 2007	--	CEDEN Orestimba Creek @ River Road	--	--
Source 10	--	--	--	--	--	--	--	--	--	CVRWQCB MER542	--	--	--	--
Source 11	--	--	--	--	--	--	--	--	--	Continuous Monitoring	--	--	--	--
Source 12	--	--	--	--	--	--	--	--	--	DO TMDL Estuary Studies	--	--	--	--
Source 13	--	--	--	--	--	--	--	--	--	CEDEN Mud Slough downstream of San Luis Drain	--	--	--	--
Source 14	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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[1] Underline – updated .ORH files; Red Font – updated .ORC files

Table AA- 5d.[1] Sources of Data and Locations of WARMF San Joaquin River Database Hydrology and Water Quality Stations.

Location	Salado Creek at Highway 33	Salt Slough at Highway 165	San Joaquin R blw Friant CA	San Joaquin R near Mendota CA	San Joaquin River 500 yards upstream of Lights 33 and 34	San Joaquin River at Brandt Bridge	San Joaquin River at Buckley Cove	San Joaquin River at Crows Landing Bridge	San Joaquin River at Donny Bridge	San Joaquin River at Fremont Ford	San Joaquin River at Gravelly Ford	San Joaquin River at Highway 41	San Joaquin River at Jersey Point	San Joaquin River at Laird Park
WARMF River ID	344	249	381	60	913	769	912	733	67	747	69	68	541	714
Latitude	37.4816	37.248	36.9844	36.8106	37.9899	37.8647	37.9782	37.4283	36.8335	37.301	36.798	36.8762	38.053	37.5595
Longitude	-121.135	-120.851	-119.723	-120.377	-121.402	-121.323	-121.382	-121.003	-119.966	-120.93	-120.16	-119.793	-121.688	-121.153
Min Date	10/24/2000	1/1/1984	10/1/1921	12/6/1999	9/17/1984	1/1/1984	1/1/1984	1/1/1984	6/23/2004	4/1/1937	6/27/1997	8/25/2005	1/1/1984	1/1/1977
Max Date	9/6/2007	12/27/2013	12/28/2013	12/27/2013	11/8/2012	11/8/2012	12/14/2010	12/27/2013	12/27/2013	12/27/2013	12/27/2013	1/7/2014	12/31/2005	10/20/2010
Source 1	BDAT Project 541STC515	SJR Data Atlas	USGS 11251000	USGS 11254000	BDAT Project 911MWT	SJR Data Atlas	SJR Data Atlas	SJR Data Atlas	CDEC DNB	SJR Data Atlas	CDEC GRF	CDEC H41	SJR Data Atlas	BDAT Project 373324121090401
Source 2	DO TMDL WQ Data 2007	CDEC SSH	DWR WQ Library	--	DO TMDL Estuary Studies	City of Stockton R1	DWR-IEP Monit. & Anal.	USGS 11274550	--	DO TMDL WQ Data 2005	--	USGS 11252275	BDAT Project B9D80311413	DO TMDL WQ Data 2005
Source 3	CVRWQCB STC515	USGS 11261100	CDEC SJF	--		DO TMDL Estuary Studies	City of Stockton R6	CEDEN SJR @ Crows Landing	--	DO TMDL WQ Data 2006	--	CEDEN SJR at Wildwood Native Park	CDEC SJJ	Task 4 March 06 Report
Source 4	CEDEN: Salado Creek @ Hwy 33	DWR WQ Library	--	--	--	--	BDAT Project P8	CDEC SCL	--	DO TMDL WQ Data 2007	--	--	--	DO TMDL WQ Data 2006
Source 5	--	DO TMDL WQ Data 2005	--	--	--	--	BDAT Project R6	DO TMDL WQ Data 2005	--	USGS 11261500	--	--	--	DWR:SAN JOAQUIN R NR GRAY A LAIR SLU
Source 6	--	DO TMDL WQ Data 2006	--	--	--	--	--	DO TMDL WQ Data 2006	--	CVRWQCB STC538	--	--	--	CEDEN SJR at Grayson
Source 7	--	DO TMDL WQ Data 2007	--	--	--	--	--	DO TMDL WQ Data 2007	--	CDEC FFB	--	--	--	--
Source 8	--	Continuous Monitoring	--	--	--	--	--	Continuous Monitoring	--	CEDEN SJR @ Fremont Ford	--	--	--	--
Source 9	--	CVRWQCB MER531	--	--	--	--	--	CVRWQCB STC504	--	DWR San Joaquin R at Fremont Ford Bridge	--	--	--	--
Source 10	--	DO TMDL Estuary Studies	--	--	--	--	--	--	--	--	--	--	--	--
Source 11	--	CEDEN: Salt Slough @ Lander Avenue	--	--	--	--	--	--	--	--	--	--	--	--
Source 12	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 13	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 14	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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[1] Underline – updated .ORH files; Red Font – updated .ORC files

Table AA- 6e.[1] Sources of Data and Locations of WARMF San Joaquin River Database Hydrology and Water Quality Stations.

Location	San Joaquin River at Light 18	San Joaquin River at Light 24	San Joaquin River at Light 45	San Joaquin River at Maze Road (Highway 132)	San Joaquin River at Mile 33.2	San Joaquin River at Mossdale	San Joaquin River at Newman	San Joaquin River at Patterson	San Joaquin River at Rough & Ready Island	San Joaquin River at Sack Dam	San Joaquin River at Stockton (Garwood Bridge)	San Joaquin River at Vernalis	San Joaquin River below Friant	San Joaquin River below Old River near Lathrop
WARMF River ID	920	916	894	703	915	310	739	725	899	349	870	184	381	691
Latitude	38.0173	37.9967	37.9549	37.64	37.9937	37.786	37.3506	37.494	37.963	36.9836	37.935	37.667	36.984	37.81
Longitude	-121.459	-121.445	-121.352	-121.228	-121.433	-121.306	-120.976	-121.081	-121.365	-120.5	-121.329	-121.267	-119.723	-121.323
Min Date	9/17/1984	9/17/1984	6/20/2000	12/12/1976	6/9/2011	1/1/1984	1/1/1984	1/1/1984	1/1/1984	10/26/2000	1/1/1984	10/1/1976	10/1/1921	10/13/2004
Max Date	11/8/2012	12/13/2007	11/8/2012	12/27/2013	11/8/2012	12/13/2012	12/28/2013	12/27/2013	5/3/2011	12/1/2012	12/28/2013	12/28/2013	12/28/2013	2/1/2012
Source 1	BDAT Project R8	BDAT Project R7	BDAT Project R4	SJR Data Atlas	DO TMDL Estuary Studies	SJR Data Atlas	SJR Data Atlas	SJR Data Atlas	SJR Data Atlas	BDAT Project 541MAD007	City of Stockton R2	DWR - VERNALIS	CDEC SJF	CDEC SJL
Source 2	DWR	BDAT Project 910MWT	City of Stockton R4	DWR San Joaquin R. @ Maze Rd. Bridge	--	CDEC MSD	BDAT Project	CDEC SJP	CDEC RRI	CEDEN SJR @ Sack Dam	DWR - SAN JOAQUIN R NR STE	SJR Data Atlas	USGS 11251000	DO TMDL WQ Data 2007
Source 3	BDAT Project 909MWT	City of Stockton R7	DO TMDL Estuary Studies	DO TMDL WQ Data 2005	--	BDAT Project B9D74711184	USGS 11274000	SJDOTMDL DO71	--	--	BDAT Project P8A	USGS 11303500	DWR San Joaquin R Blw Friant BO788500	--
Source 4	City of Stockton R8	--	--	DO TMDL WQ Data 2006	--	DWR - SJRMOSSDALE	--	DO TMDL WQ Data 2005	--	--	DO TMDL WQ Data 2006	DO TMDL WQ Data 2005	--	--
Source 5	DO TMDL Estuary Studies	--	--	DO TMDL WQ Data 2007	--	DWR - SAN JOAQUIN R A MOSS	--	DO TMDL WQ Data 2006	--	--	BDAT Project B9D75571196	DO TMDL WQ Data 2006	--	--
Source 6	--	--	--	Continuous Monitoring	--	Task 8 Report / SJR 5	--	DO TMDL WQ Data 2007	--	--	SJR Data Atlas	DO TMDL WQ Data 2007	--	--
Source 7	--	--	--	CDEC MRB	--	DO TMDL WQ Data 2005	--	BDAT Project 11274570	--	--	USGS 11304810	Task 8 Report / SJR 1	--	--
Source 8	--	--	--	USGS 11290500	--	DO TMDL WQ Data 2006	--	Continuous Monitoring	--	--	CDEC SJG	BDAT Project CDEC-VNS	--	--
Source 9	--	--	--	CEDEN San Joaquin River above Maze Blvd.	--	DO TMDL WQ Data 2007	--	CDEC SJP	--	--	--	BDAT Project C10A	--	--
Source 10	--	--	--	CEDEN San Joaquin River at Maze Boulevard near Vernalis	--	BDAT Project C7A	--	DO TMDL Estuary Studies	--	--	--	Continous Monitoring	--	--
Source 11	--	--	--	--	--	DO TMDL Estuary Studies	--	USGS 11274570	--	--	--	CDEC SJR	--	--
Source 12	--	--	--	--	--	--	--	CEDEN SJR @ Patterson	--	--	--	DO TMDL Estuary Studies	--	--
Source 13	--	--	--	--	--	--	--	CEDEN San Joaquin River at PID Pumps	--	--	--	DWR B0702000	--	--
Source 14	--	--	--	--	--	--	--	DWR B0720000	--	--	--	--	--	--

[1] Underline – updated .ORH files; Red Font – updated .ORC files

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Table AA- 7f.[1] Sources of Data and Locations of WARMF San Joaquin River Database Hydrology and Water Quality Stations.

Location	San Joaquin River between Hog Island and Turner Cut	San Joaquin River near Dos Palos	San Joaquin River near Stevinson ("at Highway 165")	San Joaquin River upstream of the Merced River (Hill's Ferry)	San Luis Drain Site B nr Stevinson CA	Smith Canal	Spanish Grant Drain	Stanislaus River at Caswell State Park	Stanislaus River at confluence with San Joaquin River	Stanislaus River at Gambini Property	Stanislaus River at Goodwin	Stanislaus River at Jacob Myers Park	Stanislaus River at Oakdale	Stanislaus River at Oakdale Recreation Area	Stanislaus River at Orange Blossom Bridge
WARMF River ID	919	350	752	742	970		196	161	158	168	172	167	170	169	171
Latitude	38.0008	36.994	37.295	37.3331	37.2408	37.9674	37.4358	37.7025	37.67	37.772	37.8517	37.743	37.7775	37.771	37.783
Longitude	-121.449	-120.501	-120.851	-120.955	-120.877	-121.307	-121.036	-121.177	-121.225	-120.888	-120.637	-120.942	-120.853	-120.867	-120.75
Min Date	7/3/1984	12/3/2009	6/24/1985	5/2/1985	1/1/1984	5/5/2011	1/1/2005	1/28/1998	1/1/2001	1/1/2001	10/1/1976	1/1/2001	1/1/1984	1/1/2001	1/1/1984
Max Date	8/23/2004	12/27/2013	12/28/2013	7/9/2012	9/20/2012	12/13/2012	10/9/2007	8/18/2011	3/1/2004	8/29/2011	9/30/2012	7/23/2003	1/7/2014	4/17/2011	12/28/2013
Source 1	BDAT Project 910TNS	CDEC SDP	SJR Data Atlas	BDAT Project 372006120571701	SJR Data Atlas	DO TMDL Estuary Studies	DO TMDL WQ Data 2005	SJR Data Atlas	CDEC SBC	CDEC GMB	SJR Data Atlas	CDEC JMP	SJR Data Atlas	CDEC ORA	CDEC OBB
Source 2	--	--	CDEC SJS	CVRWQCB STC512	CVRWQCB	--	DO TMDL WQ Data 2006	DWR - Stanilaus River @ Caswell Park	--	--	USGS 11302000	--	CDEC SOK	--	--
Source 3	--	--	USGS 11260815	CEDEN SJR @ Hills Ferry	SWAMP	--	DO TMDL WQ Data 2007	DO TMDL WQ Data 2005	--	--	CDEC SNS	--	USGS 11302500	--	--
Source 4	--	--	DWR - SJR@Hwy165	--	USGS 11262895	--	--	DO TMDL WQ Data 2006	--	--	DWR B3113000	--	--	--	--
Source 5	--	--	DWR San Joaquin River near Stevinson B0740000	--	DO TMDL Estuary Studies	--	--	DO TMDL WQ Data 2007	--	--	--	--	--	--	--
Source 6	--	--	DO TMDL WQ Data 2005	--	CEDEN 541MER535	--	--	CVRWQCB STC514	--	--	--	--	--	--	--
Source 7	--	--	DO TMDL WQ Data 2006	--	--	--	--	DO TMDL Estuary Studies	--	--	--	--	--	--	--
Source 8	--	--	DO TMDL WQ Data 2007	--	--	--	--	USGS 374209121103800	--	--	--	--	--	--	--
Source 9	--	--	Continuous Monitoring	--	--	--	--	CEDEN 535STC514	--	--	--	--	--	--	--
Source 10	--	--	DO TMDL Estuary Studies	--	--	--	--	--	--	--	--	--	--	--	--
Source 11	--	--	CEDEN San Joaquin River at Lander Ave 541MER522	--	--	--	--	--	--	--	--	--	--	--	--
Source 12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Source 14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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[1] Underline – updated .ORH files; Red Font – updated .ORC files

Table AA- 8g.[1] Sources of Data and Locations of WARMF San Joaquin River Database Hydrology and Water Quality Stations.

Location	Stanislaus River at Ripon	Tuolumne at Modesto USGS	Tuolumne River at Modesto	Tuolumne River at Shiloh Road	Tuolumne River below La Grange Dam	Turlock ID Harding Drain	Turlock ID Lateral 6 & 7 at Levee	Turlock ID Westport Drain Flow Station	Turlock Irrigation District Lateral 2	Turner Cut near Holt	Westley Wasteway Flow Station
WARMF River ID	162	141	149	141	306	202	198	204	205	921	206
Latitude	37.73	37.627	37.6271	37.6031	37.6664	37.4643	37.3977	37.5424	37.5652	37.9928	37.5582
Longitude	-121.109	-120.986	-120.987	-121.131	-120.441	-121.031	-120.96	-121.094	-121.138	-121.454	-121.164
Min Date	10/1/1940	4/1/1940	4/1/1940	10/9/1979	10/1/1976	10/25/2000	8/15/1977	3/24/1993	8/15/1977	2/15/2006	1/1/2005
Max Date	12/28/2013	12/28/2013	12/28/2013	8/18/2011	12/28/2013	9/20/2012	12/31/2007	12/31/2007	12/31/2007	12/28/2013	12/10/2012
Source 1	SJR Data Atlas	DO TMDL WQ Data 2005	USGS 11290000	SJR Data Atlas	SJR Data Atlas	SJR Data Atlas	Task 4 March 06 Report	DO TMDL WQ Data 2005	DO TMDL WQ Data 2005	CDEC TRN	DO TMDL WQ Data 2005
Source 2	USGS 11303000	DO TMDL WQ Data 2006	--	CDEC TSB	DWR - Station Tuolumne River @ Shiloh	USGS 11289660	DO TMDL WQ Data 2005	DO TMDL WQ Data 2006	DO TMDL WQ Data 2006	DO TMDL Estuary Studies	BDAT Project 541STC029
Source 3	DO TMDL WQ Data 2005	DO TMDL WQ Data 2007	--	USGS 11290000	DO TMDL WQ Data 2005	DO TMDL Estuary Studies	DO TMDL WQ Data 2006	DO TMDL WQ Data 2007	DO TMDL WQ Data 2007	--	DO TMDL WQ Data 2006
Source 4	CDEC RIP	SJR DO TMDL Data	--	DO TMDL Estuary Studies	DO TMDL WQ Data 2006	CEDEN TID 5 Harding Drain @ Carpenter Road 535STC501	DO TMDL WQ Data 2007	USGS 373232121053 900	DWR: TURLOCK ID LATERAL DR NO 2	--	DO TMDL WQ Data 2007
Source 5	--	USGS 11290000	--	CEDEN 535STC513	DO TMDL WQ Data 2007	--	CEDEN TID Lateral 6&7 @ Central	--	CEDEN: Lower Lateral 2 at Grayson Road	--	CDEC WSW
Source 6	--	--	--	--	CVRWQCB STC513	--	DWR: Turlock ID Lateral Drain No 6 & 7	--	--	--	CEDEN 541XWWNCR
Source 7	--	--	--	--	USGS 11290200	--	--	--	--	--	--
Source 8	--	--	--	--	--	--	--	--	--	--	--
Source 9	--	--	--	--	--	--	--	--	--	--	--
Source 10	--	--	--	--	--	--	--	--	--	--	--
Source 11	--	--	--	--	--	--	--	--	--	--	--
Source 12	--	--	--	--	--	--	--	--	--	--	--
Source 13	--	--	--	--	--	--	--	--	--	--	--
Source 14	--	--	--	--	--	--	--	--	--	--	--

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[1] Underline – updated .ORH files; Red Font – updated .ORC files

APPENDIX B
HOFFMAN MODELING MEMO

Water Boards

Central Valley Regional Water Quality Control Board

TO: Lower San Joaquin River Committee

FROM: Jim Brownell
Engineering Geologist
Central Valley Regional Water Quality Control Board

DATE: 17 October 2014

SUBJECT: HOFFMAN MODELING RESULTS

In March 2010, Central Valley Regional Water Quality Control Board staff released the draft report titled *Salt Tolerance of Crops in the Lower San Joaquin River (Stanislaus to Merced River Reaches)* (Draft Report) for public review and comment. Staff presented the Draft Report to a joint meeting of the CV-SALTS Executive and Technical Advisory Committees on 11 March 2010. The public comment period closed on 19 May 2010. Minor editorial comments received from stakeholders during the meeting and in public comment letters were incorporated into a revised Draft Report released in June 2010. The comments that were not addressed in the revised Draft Report are to be addressed by the Lower San Joaquin River Committee (LSJRC), a subcommittee of CV-SALTS. The LSJRC has taken over the responsibility for developing the science and policy needed to develop salinity water quality objectives (WQOs) for the San Joaquin River upstream of Vernalis.

To assist with development of Lower San Joaquin River (LSJR) salinity WQOs, the Draft Report utilized the modeling approach that Dr. Glenn J. Hoffman presented in his report titled *Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta* (2010). Some of the inputs utilized in the 2010 model were based on policy decisions, such as protecting for 100% yield for the most salt sensitive crop in the irrigated area. Subsequently, the LSJRC developed science and policy recommendations specific to agriculture irrigated with LSJR water to assist with the establishment of locally protective WQOs. The Committee recommendations have expanded the crop tolerance modeling results presented in the Draft Report. The purpose of this memorandum is to document the results of the revised modeling which was conducted by Central Valley Water Board staff in June and October 2014.

Model Parameter Recommendations

The LSJRC policy recommendations for developing WQOs for the LSJR require changes to model parameters used in modeling for the 2010 Draft Report. The committee has determined that protection of agriculture from salinity in San Joaquin River irrigation water should be based on almond crop sensitivity rather than on bean crop sensitivity as the 2010 Draft Report was based on. The change in crop was based on the most salt sensitive crop included in 95% of the commercially cropped acreage irrigated with LSJR water. The soil water salinity threshold for almond is 3.0 deciSiemens per meter (dS/m) rather than 2.0 dS/m for bean.

The LSJRC also recommended that the effect of rainfall on crop sensitivity be modeled during a year when the annual rainfall is at the 5th percentile of total annual precipitation rather than

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during a minimum rainfall year as the 2010 Draft Report modeled. The 2014 modeling generated statistical data for climate and annual rainfall measured between 1951 and 2013, whereas the 2010 modeling generated statistical data from measurements collected between 1951 and 2008.

The committee decided that a leaching fraction of 15 percent is appropriate for LSJR Basin agriculture. However, the committee considered a leaching fraction of 10 percent as a means of evaluating possible conditions during a drought.

Daily climate data for various model runs presented in the Draft Report were taken from two weather stations: NCDC station no. 6168 (Newman C) for Crows Landing/Patterson modeling and NCDC station no. 5738 (Modesto C) for Maze modeling. The Crows Landing/Patterson model results were more conservative than the Maze results. That is, the Draft Report modeling predicted higher soil water salinity values using Crows Landing/Patterson climate records when all other parameters such as leaching fraction and irrigation water salinity were held constant. Therefore, staff only utilized Newman C daily climate data for the 2014 model runs.

The CV-SALTS Policy Committee and the LSJRC have recommended the use of the exponential crop water uptake pattern for modeling rather than the 40-30-20-10 pattern. Also, the Central Valley Water Board received many comments on the Draft Report in support of using the exponential over the 40-30-20-10 pattern. Therefore, staff only utilized the exponential pattern for the 2014 modeling.

For the 2014 modeling, staff updated the model spreadsheets used to predict almond soil water salinity values presented in the 2010 Draft Report by including the parameter changes mentioned above. The modeling and cropping assumptions made for both the 2010 and the 2014 modeling are presented in Sections 5.1.1 and 5.1.2 of both the March and June 2010 Draft Report versions.. Also, references for setting model crop coefficients and growth periods for estimating crop evapotranspiration requirements are presented in Section 5.1.3 of both versions. Figure 5.5 of the Draft Report presents the almond crop coefficients and growth periods that were used in the 2010 and 2014 modeling.

Summarizing the task given to Central Valley Water Board staff by the LSJRC, the 2014 modeling was performed to establish the soil water salinity necessary to result in a 95 percent almond crop yield when applying a leaching fraction of 15 percent during a fifth percentile total annual precipitation water year in the LSJR Basin. Also, staff evaluated a 10 percent leaching fraction in modeling to evaluate possible soil water salinity under drought conditions.

2014 Modeling

Table 1 presents model parameters for the Central Valley Water Board staff 2014 Hoffman modeling runs. Using the parameters presented in Table 1, with an assumed leaching fraction of 15 percent applied by irrigators in the LSJR Basin, staff ran the model 16 times, each time varying the irrigation water salinity electrical conductivity value by 0.1 dS/m, from an initial value of 0.5 dS/m through a final value of 2.0 dS/m. The resulting soil water salinity and crop yield values predicted by the model for each of the 16 runs are presented in Table 2. Figure 1 is a plot of irrigation water salinity versus soil water salinity presented in Table 2. Figure 2 is a plot of irrigation water salinity versus relative crop yield presented in Table 2.

Figure 2 shows that the predicted irrigation water salinity necessary for an almond crop yield of 95 percent when the leaching fraction is set at 15 percent is approximately 1.5 dS/m. Through

an iteration process, staff determined that the predicted value to two decimal points is approximately 1.55 dS/m. Table 3 is the model input and output table for that run: irrigation water salinity set at 1.55 dS/m and the leaching fraction set at 15 percent. The bottom cell of the total annual precipitation column near the left side of the table shows that the computed 5th percentile annual rainfall total from the 1952 through the 2013 water years was 6.07 inches. The bottom cell of the far right column in Table 3 shows that the model predicts a soil water salinity of 3.53 dS/m during a 5th percentile annual rainfall year.

Figure 3 is a plot of the annual precipitation versus soil water salinity values from Table 3. The plot shows the impact of rainfall on soil water salinity when the irrigation water salinity is 1.55 dS/m and the leaching fraction is 15 percent. Observe that the predicted soil water salinity plot passes through the intersection of the 5th percentile annual precipitation line and the 95 percent crop yield salinity line.

To inform discussions of the LSJRC on drought impacts, Central Valley Water Board staff was asked to perform modeling runs using a leaching fraction of 10 percent, with the parameters presented in Table 1 to establish the irrigation water EC necessary to maintain an almond crop yield of 95 percent. Staff ran the model 16 times, each time varying the irrigation water salinity electrical conductivity value by 0.1 dS/m, from an initial value of 0.5 dS/m through a final value of 2.0 dS/m. The resulting soil water salinity and crop yield values predicted by the model for each of the 16 runs are presented in Table 4. Figure 4 is a plot of irrigation water salinity versus soil water salinity presented in Table 4. Figure 5 is a plot of irrigation water salinity versus relative crop yield presented in Table 4.

Figure 5 shows that the predicted irrigation water salinity necessary for crop yield of 95 percent when the leaching fraction is set at 10 percent is approximately 1.0 dS/m. Through an iteration process, staff determined that the predicted value to two decimal points is approximately 1.01 dS/m.

Results

Table 5 summarizes the results. To achieve an almond crop yield of at least 95 percent during a 5th percentile annual rainfall year with a leaching fraction of 15 percent, the model predicts that the irrigation water EC must be no more than 1.55 dS/m; with a leaching fraction of 10 percent, the model predicts that the irrigation water EC must be no more than 1.01 dS/m.

cc: Administrative Record for the Basin Plan Amendment to establish Lower San Joaquin River Salinity Water Quality Objectives

Table 1

Input Parameters for Hoffman Modeling of Almond Salinity Requirements

Model Parameters:

1 Patterson Weather Station
data 01/01/52 thru 09/30/13

2 5th percentile precipitation = 6.1 inches

3 Exponential crop water uptake pattern

4 Almond crop soil water EC threshold = 3.0

5 95% crop yield protection

6 Bare soil ET = 0.7 inches/month

7 Runoff coefficient = 77

8 Almond growth stage crop coefficients: B
Kc1 = 0.5
C Kc2 = 0.9
E Kc3 = 0.5

9 Almond growth stage dates:

A	15-Feb
B	15-Feb
C	1-Jun
D	1-Sep
E	10-Nov

10 S = (1000/CN) - 10 = 3.0

11 Extraterrestrial radiation (mm/day) at 37º latitude

Month	Ra
1	6.88
2	9.00
3	11.65
4	14.47
5	16.31
6	17.04
7	16.65
8	15.18
9	12.69
10	9.84
11	7.39
12	6.31

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Table 2

Predicted Soil Water Salinity and Crop Yield at a LF of 15% at Varying Irrigation Water Salinities (S/m)

Irrigation Water	Soil-Water	Crop Yield
0.5	1.14	100
0.6	1.37	100
0.7	1.60	100
0.8	1.82	100
0.9	2.05	100
1.0	2.28	100
1.1	2.51	100
1.2	2.74	100
1.3	2.96	100
1.4	3.19	98.2
1.5	3.42	96.0
1.6	3.65	93.8
1.7	3.88	91.6
1.8	4.10	89.6
1.9	4.33	87.4
2.0	4.56	85.2

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Table 3

Model Output Scenario: Irrigation Water Salinity of 1.55 S/m and LF of 15%

Water Year	Input Variables						Model Output
	EC_I = **1.55**			LF = 0.15			
	P_T (in.)	P_{NG} (in.)	E_S (in.)	P_{GS} (in.)	P_{EFF} (in.)	ET_C (in.)	EC_{SWb-2} (dS/m)
1952	16.89	8.72	2.2093	8.17	14.6807	46.9106	2.7949
1953	6.78	5.09	2.2323	1.69	4.5477	44.7044	3.4786
1954	6.51	2.69	2.2093	3.82	4.3007	44.3594	3.4940
1955	9.75	6.15	2.2093	3.6	7.5407	45.9497	3.2767
1956	10.89	8.09	2.2093	2.8	8.6807	46.2963	3.2010
1957	8.68	2.85	2.2323	5.83	6.4477	45.9620	3.3538
1958	19.69	6.92	2.2093	12.77	17.4807	45.5127	2.5647
1959	10.84	5.12	2.2093	5.72	8.6307	45.5745	3.1949
1960	6.61	5.29	2.2093	1.32	4.4007	44.9699	3.4911
1961	7.11	5.08	2.2323	2.03	4.8777	44.0289	3.4493
1962	12.00	9.58	2.2093	2.42	9.7907	44.2539	3.0918
1963	14.02	8.48	2.2093	5.54	11.8107	41.3296	2.8829
1964	6.47	2.55	2.2093	3.92	4.2607	42.5748	3.4839
1965	10.28	4.78	2.2323	5.5	8.0477	41.9786	3.1873
1966	10.57	8.86	2.2093	1.71	8.3607	44.9451	3.2058
1967	13.48	7.94	2.2093	5.54	11.2707	43.2268	2.9639
1968	6.06	3.3	2.2093	2.76	3.8507	44.3121	3.5266
1969	18.84	11.23	2.2323	7.61	16.6077	43.5097	2.5724
1970	8.64	5.19	2.2093	3.45	6.4307	44.4480	3.3396
1971	13.36	7.84	2.2093	5.52	11.1507	42.6483	2.9616
1972	6.16	5.56	2.2093	0.6	3.9507	44.5548	3.5208
1973	17.01	11.18	2.2323	5.83	14.7777	43.6354	2.7117
1974	11.53	5.46	2.2093	6.07	9.3207	44.1445	3.1245
1975	10.73	5.72	2.2093	5.01	8.5207	44.9755	3.1947
1976	4.31	0.86	2.2093	3.45	2.1007	44.7450	3.6559
1977	5.66	2.72	2.2323	2.94	3.4277	44.9956	3.5613
1978	17.25	9.61	2.2093	7.64	15.0407	45.0319	2.7268
1979	10.38	5.91	2.2093	4.47	8.1707	46.4518	3.2385
1980	13.03	6.63	2.2093	6.4	10.8207	43.4361	3.0015
1981	8.24	4.47	2.2323	3.77	6.0077	46.0953	3.3860
1982	14.81	6.54	2.2093	8.27	12.6007	43.3500	2.8670
1983	19.78	8.37	2.2093	11.41	17.5707	42.9837	2.4848
1984	8.42	6.56	2.2093	1.86	6.2107	46.8274	3.3786
1985	8.22	4.8	2.2323	3.42	5.9877	45.1595	3.3787
1986	12.90	6.15	2.2093	6.75	10.6907	44.8472	3.0363
1987	6.32	3.63	2.2093	2.69	4.1107	46.4298	3.5213
1988	11.02	6.92	2.2093	4.1	8.8077	46.4231	3.1938
1989	8.15	4.74	2.2323	3.41	5.9177	45.7273	3.3890
1990	6.50	3.11	2.2093	3.39	4.2907	45.5038	3.5027
1991	8.77	2.31	2.2093	6.46	6.5607	42.6840	3.3104
1992	10.80	5.63	2.2093	5.17	8.5907	44.8405	3.1878
1993	17.84	10.9	2.2323	6.94	15.6077	42.2683	2.6127
1994	8.93	4.44	2.2093	4.49	6.7207	43.2184	3.3045
1995	18.72	9.71	2.2093	9.01	16.5107	40.9028	2.5013
1996	14.15	7.66	2.2093	6.49	11.9407	43.9054	2.9276
1997	13.61	11.97	2.2323	1.64	11.3777	44.2045	2.9748
1998	26.02	16.59	2.2093	9.43	23.8107	40.4260	1.9015
1999	8.70	3.71	2.2093	4.99	6.4907	42.4877	3.3134
2000	11.51	5.83	2.2093	5.68	9.3007	43.9027	3.1222
2001	11.14	4.46	2.2323	6.68	8.9077	45.0462	3.1678
2002	7.61	6.09	2.2093	1.52	5.4007	45.0023	3.4194
2003	10.45	4.97	2.2093	5.48	8.2407	43.3956	3.1932
2004	9.77	5.76	2.2093	4.01	7.5607	46.0418	3.2763
2005	15.29	7.11	2.2323	8.18	13.0577	43.2947	2.8317
2006	12.10	5.48	2.2093	6.62	9.8907	47.3294	3.1315
2007	4.34	3.05	2.2093	1.29	2.1307	48.1548	3.6646
2008	8.76	6.84	2.2093	1.92	6.5507	48.9043	3.3743
2009	6.54	3.78	2.2323	2.76	4.3077	42.5211	3.4799
2010	13.99	6.46	2.2093	7.53	11.7807	37.9015	2.8018
2011	12.95	5.46	2.2093	7.49	10.7407	37.4409	2.8793
2012	6.28	1.51	2.2093	4.77	4.0707	40.5814	3.4832
2013	7.74	6.31	2.2323	1.43	5.5077	40.6549	3.3694
5th Percentile	**6.07**						**3.53**

ET_C = crop evapotranspiration
E_S = off-season surface evaporation
P_{GS} = precipitation during growing season P_T = total annual (infiltrating) precipitation

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Table 4

Predicted Soil Water Salinity and Crop Yield at a LF of 10% at Varying Irrigation Water Salinities (µS/cm)

Irrigation Water	Soil-Water	Crop Yield
0.5	1.75	100
0.6	2.09	100
0.7	2.44	100
0.8	2.79	100
0.9	3.14	98.7
1.0	3.49	95.3
1.1	3.84	92.0
1.2	4.19	88.7
1.3	4.54	85.4
1.4	4.89	82.1
1.5	5.24	78.8
1.6	5.59	75.4
1.7	5.93	72.1
1.8	6.28	68.8
1.9	6.63	65.5
2.0	6.98	62.2

Table 5

Hoffman Modeling Results for Almond[1]

Leaching Fraction	ECi (dS/m)	ECsw (dS/m)
10%	1.01	3.53
15%	1.55	3.53

1) 95% crop yield, 5th percentile rainfall year

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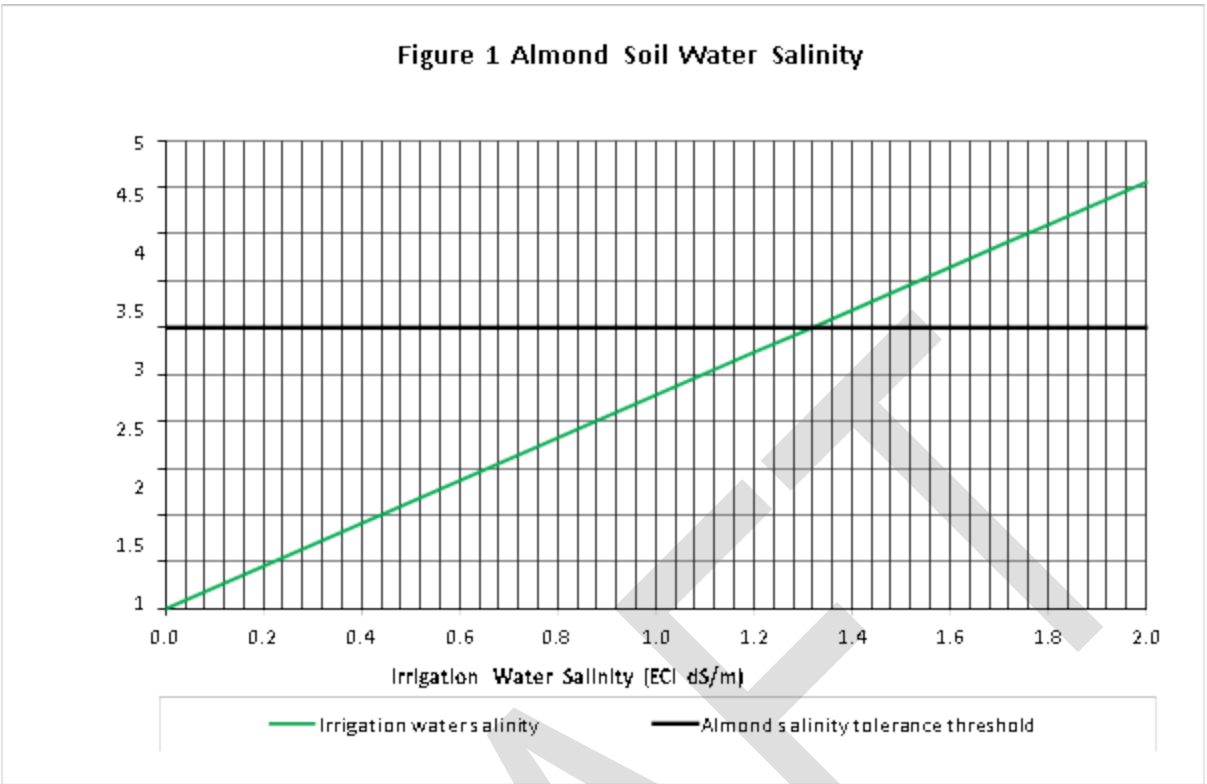
Figure 1 Almond Soil Water Salinity
5
4.5
4
3.5
3
2.5
2
1.5
1
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Irrigation Water Salinity (ECI dS/m)
Irrigation water salinity
Almond salinity tolerance threshold

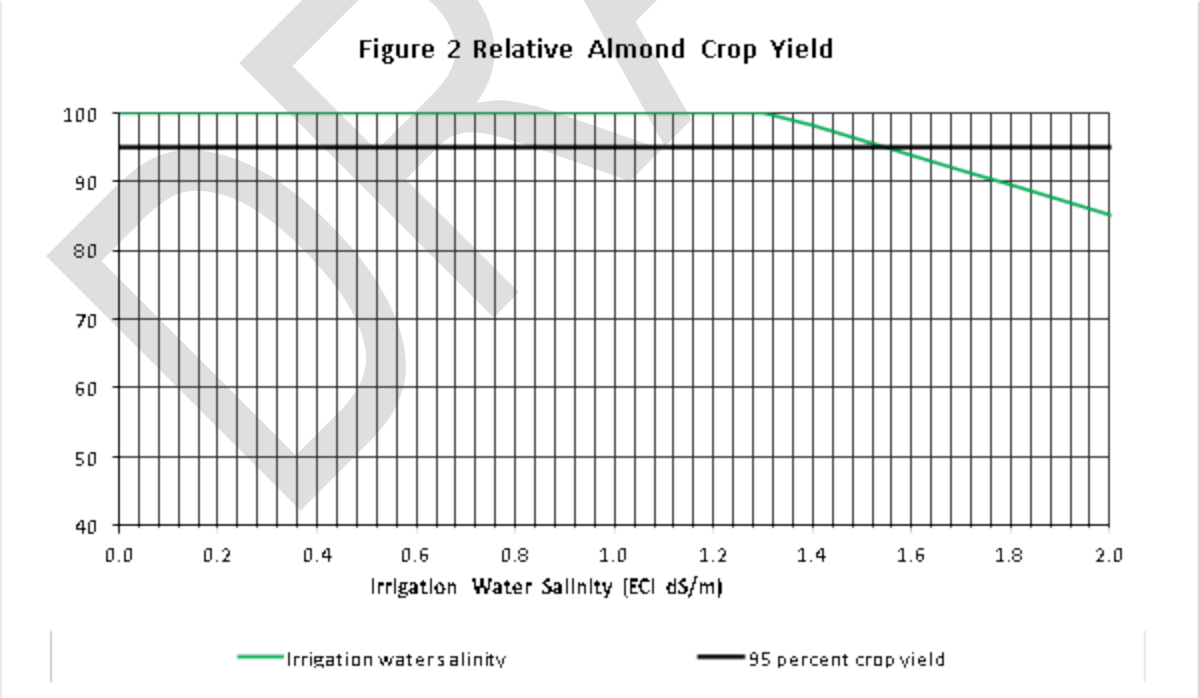
Figure 2 Relative Almond Crop Yield
100
90
80
70
60
50
40
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Irrigation Water Salinity (ECI dS/m)
Irrigation water salinity
95 percent crop yield

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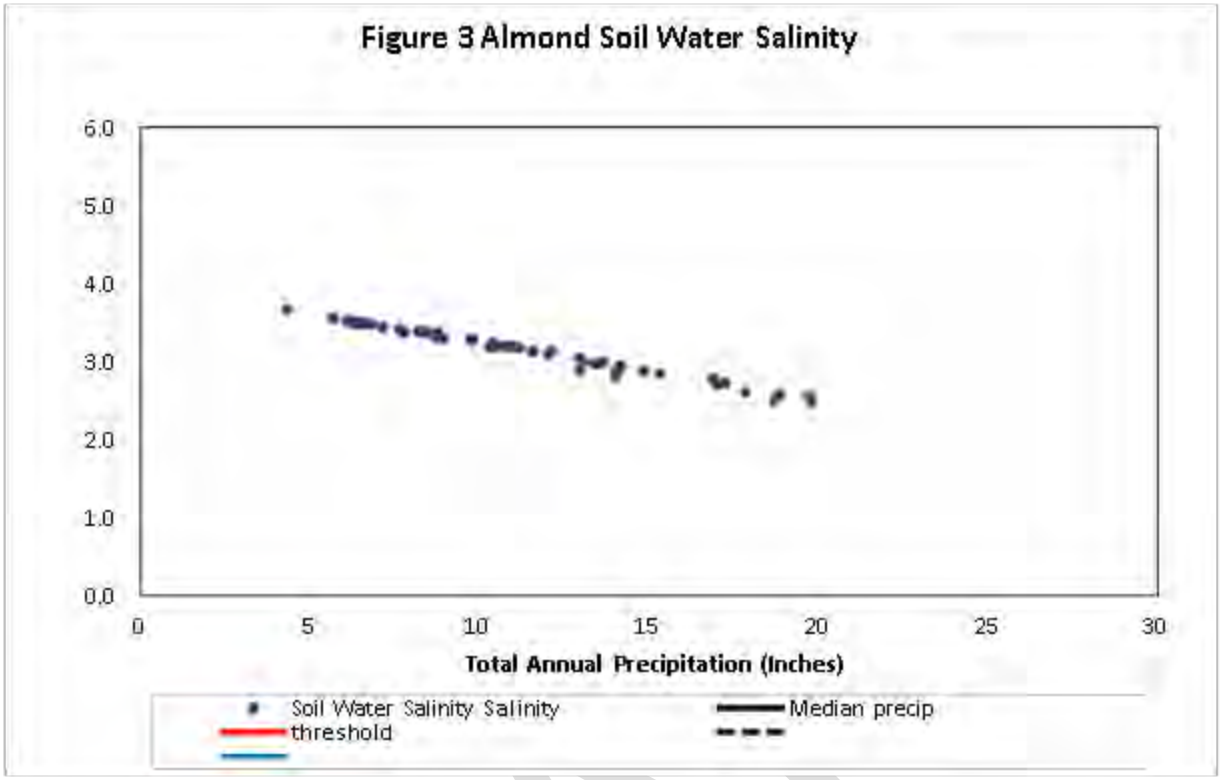
Figure 3 Almond Soil Water Salinity
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
5
10
15
20
25
30
Total Annual Precipitation (Inches)
Soil Water Salinity Salinity
threshold
Median precip

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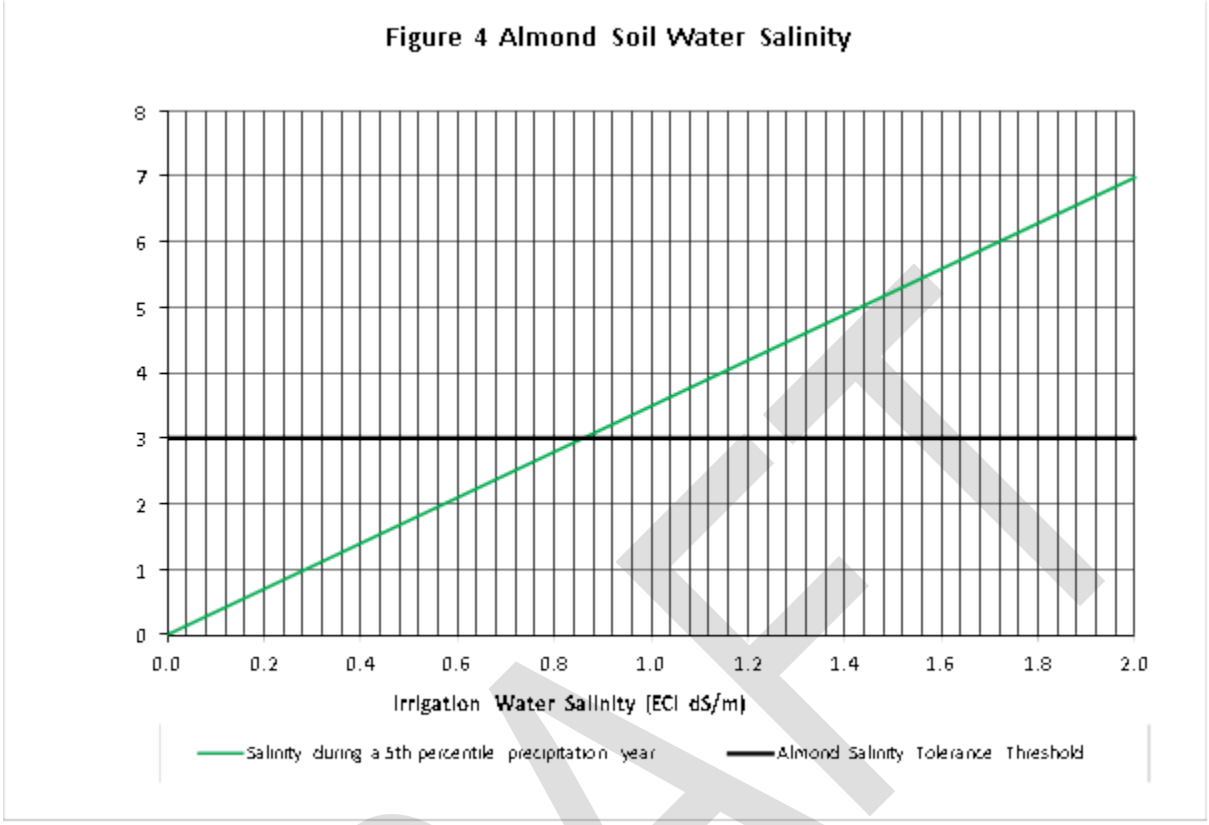
Figure 4 Almond Soil Water Salinity
8
7
6
5
4
3
2
1
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Irrigation Water Salinity (ECI dS/m)
Salinity during a 5th percentile precipitation year
Almond Salinity Tolerance Threshold

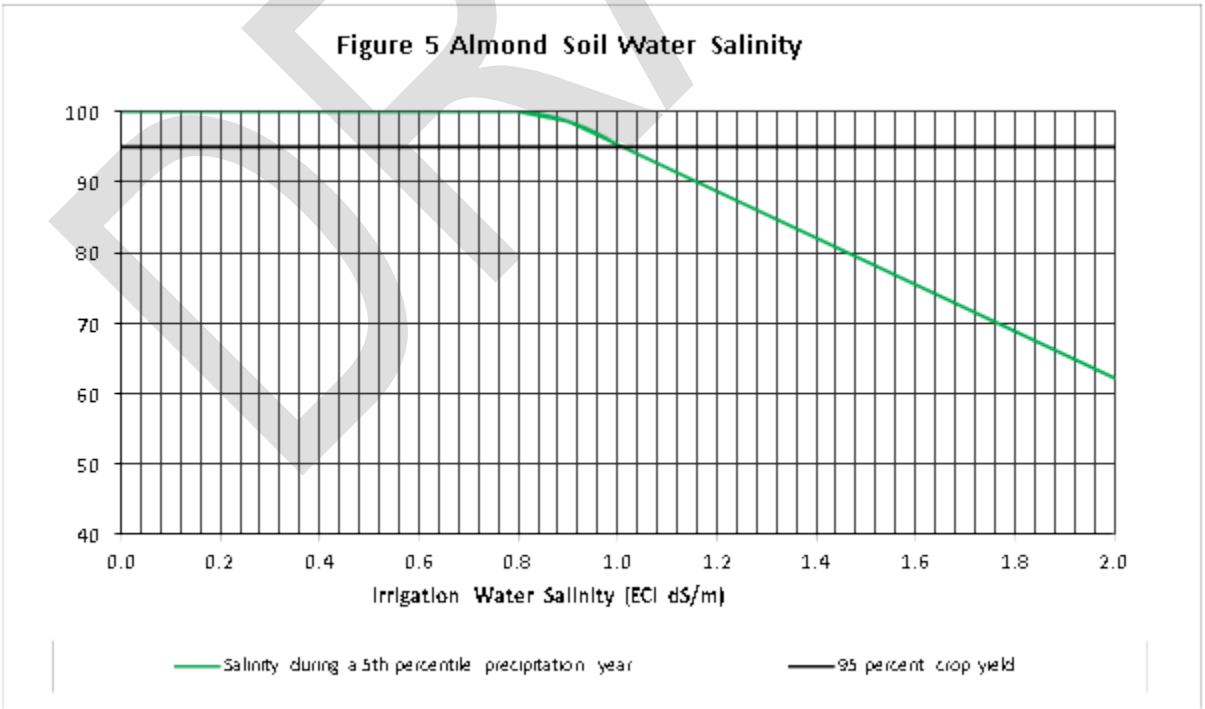
Figure 5 Almond Soil Water Salinity
100
90
80
70
60
50
40
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Irrigation Water Salinity (ECI dS/m)
Salinity during a 5th percentile precipitation year
95 percent crop yield

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APPENDIX C
TREND ANALYSES OF BORON CONCENTRATION IN THE LSJR AT CROWS LANDING

Introduction

The Central Valley Water Board staff reviewed monitoring station data collected from the Lower San Joaquin River (LSJR) to evaluate the potential for existing boron Water Quality Objectives (WQOs) within the river between the mouth of the Merced River and the Airport Way Bridge near Vernalis (Reach 83) to be exceeded during times when the electrical conductivity (EC) concentration approaches or reaches the proposed Basin Plan Amendment (BPA) EC WQOs. The proposed Monitoring and Surveillance program in the BPA staff report designates the Crows Landing monitoring station as a compliance point for EC and boron WQOs because the highest concentrations of both constituents observed within Reach 83 of the river have been measured there. Crows Landing is upstream of the major agricultural diversion and discharge points on Reach 83 but downstream of the Merced River inflows. The concentration of boron entering Reach 83 is further diluted downstream of Crows Landing by high quality waters of two additional Sierra Nevada east side tributaries—the Tuolumne and Stanislaus Rivers. This dilution is evidenced by the improved water quality in the river farther downstream at the Maze Road monitoring station which is downstream of the Tuolumne River and the Vernalis monitoring station which is downstream of the Stanislaus River (Figure C-1).

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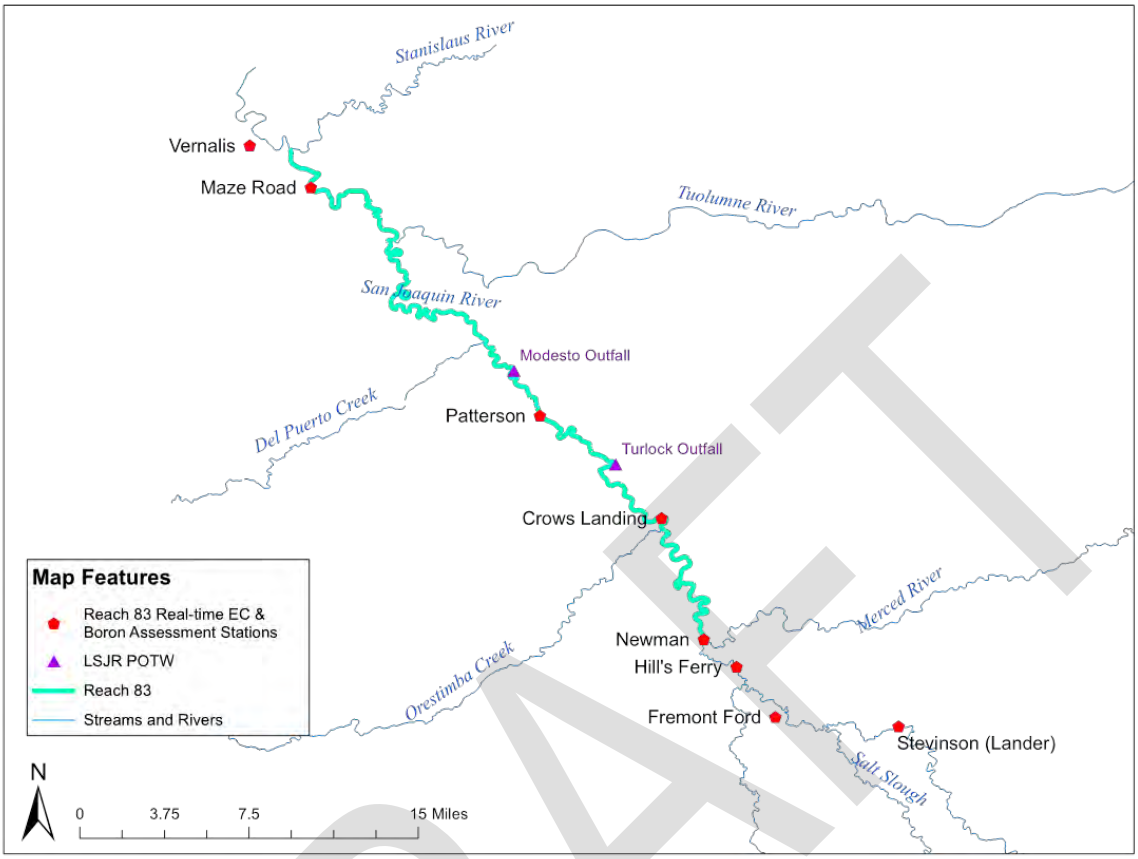
Figure C-1 LSJR Study Location and Monitoring Sites



The boron WQOs of concern for the LSJR are listed in Table III-1 of the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (Basin Plan) and presented below in Table C-1.

Table C-1. Numeric Boron Water Quality Objectives in the Lower San Joaquin River

Concentration (mg/L)	Statistical Parameter	Enforcement Period	Water-Year Type
0.8	monthly mean	15 March through 15 September	All, except Critically Dry
1.0	monthly mean	16 September through 14 March	All, except Critically Dry
1.3	monthly mean	1 October through 30 September	Critically Dry
2.0	maximum	15 March through 15 September	All
2.6	maximum	16 September through 14 March	All

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Hydrologic and Analytical Considerations

When the Control Program for Salt and Boron Discharges to the LSJR was adopted into the Basin Plan in 2006, a correlation between EC and boron was identified for water samples collected at Vernalis—the furthest downstream point on Reach 83 and boundary to the Sacramento-San Joaquin Delta. The correlation noted that when EC concentrations remained below 1,000 µS/cm, the boron WQOs would be met. EC concentrations in water between Crows Landing and Vernalis are different with Vernalis comprised of all LSJR inflows including the three major eastside tributaries and Crows Landing receiving greater influence from groundwater, wetland discharges and flows from the Grassland Bypass Project (GBP) (San Francisco Estuary Institute, 2016). The GBP was implemented in 1996 and consolidates subsurface agricultural drainage from approximately 90,000 acres into the San Luis Drain (SLD). The drain then discharges into Mud Slough (north) which in turn discharges into the San Joaquin River upstream of the Merced River. The GBP discharge volume has sequentially decreased since 1996 and is scheduled to end in 2019.

To evaluate potential impacts to boron concentrations with the implementation of the Preferred Alternative, which includes completion of the Grasslands Bypass Project and 30-day running average EC concentrations up to 1,550 µS/cm during most time periods and 2,470 µS/cm during Extended Dry Periods[1], the following analyses were conducted:

- Compared historic boron concentrations to existing WQOs;
- Compared historic EC to boron concentrations in the San Joaquin River at Crows Landing; and
- Evaluated historic impact of GBP flows and boron loads on conditions at Crows Landing.

To complete the evaluations, staff utilized flow (daily composite), EC and boron data from the San Joaquin River at Crows Landing and the discharge from the San Luis Drain that had been collected as part of implementing the GBP. Data utilized is compiled in Attachment A of this Appendix.

Since the initiation of the GBP, several distinct hydrologic conditions have occurred which have had an impact on water quality conditions at Crows Landing. The first was the initiation of the GBP itself which consolidated agricultural subsurface drainage from 90,000-acres to a single discharge point in 1996. The second was the initiation of significant discharge reductions from the GBP in 2005. The third was the beginning of

[1] See Chapter 6 for a detailed description and definition of an Extended Dry Period

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the longest Extended Dry Period in the San Joaquin Basin which commenced in 2013. To determine if these key events impacted water quality conditions, some initial evaluations were conducted comparing overall flow and boron concentration trends.

Comparison of Flow and Boron Concentration Trends

The GBP has been collecting flow and boron data at the San Luis Drain's point of discharge into Mud Slough (north) and at the Crows Landing monitoring station since the project's beginning in 1996. Figure C-2 plots an estimated monthly percentage of flow at Crows Landing originating from the discharge of the San Luis Drain from October 1996 through December 2015. The estimate is conservative as there are approximately 28 discharge points and 12 diversion points between the discharge into Mud Slough (north) and Crows Landing that are not accounted for (Central Valley Water Board, 1989a and 1989b). Figure C-2 shows that the ratio of San Luis Drain to Crows Landing discharge flow ranged from about 1 percent to about 18 percent between 1996 and 2004. Between 2004 and 2015 the discharge flow ratio ranged from about 1 percent to 9 percent. This change corresponds with the second phase of the GBP which reduced discharge. Thre project is expected to cease discharge in 2019. An exception to the reductions occurred in 2014 and 2015 when the GBP at times potentially contributed almost 20 percent of the flow at Crows Landing. This increase occurred during an Extended Dry Period. The data used to generate Figure C-2 are presented in the tables in Attachment A.

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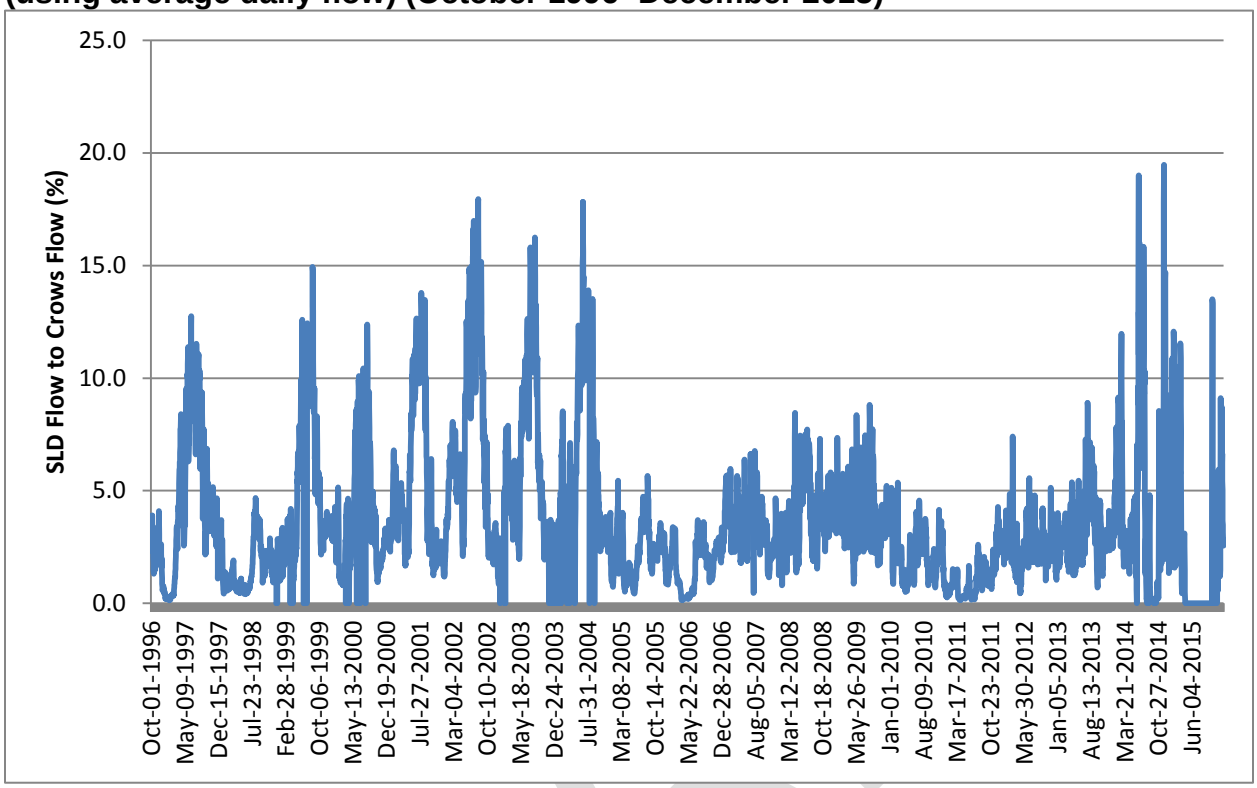
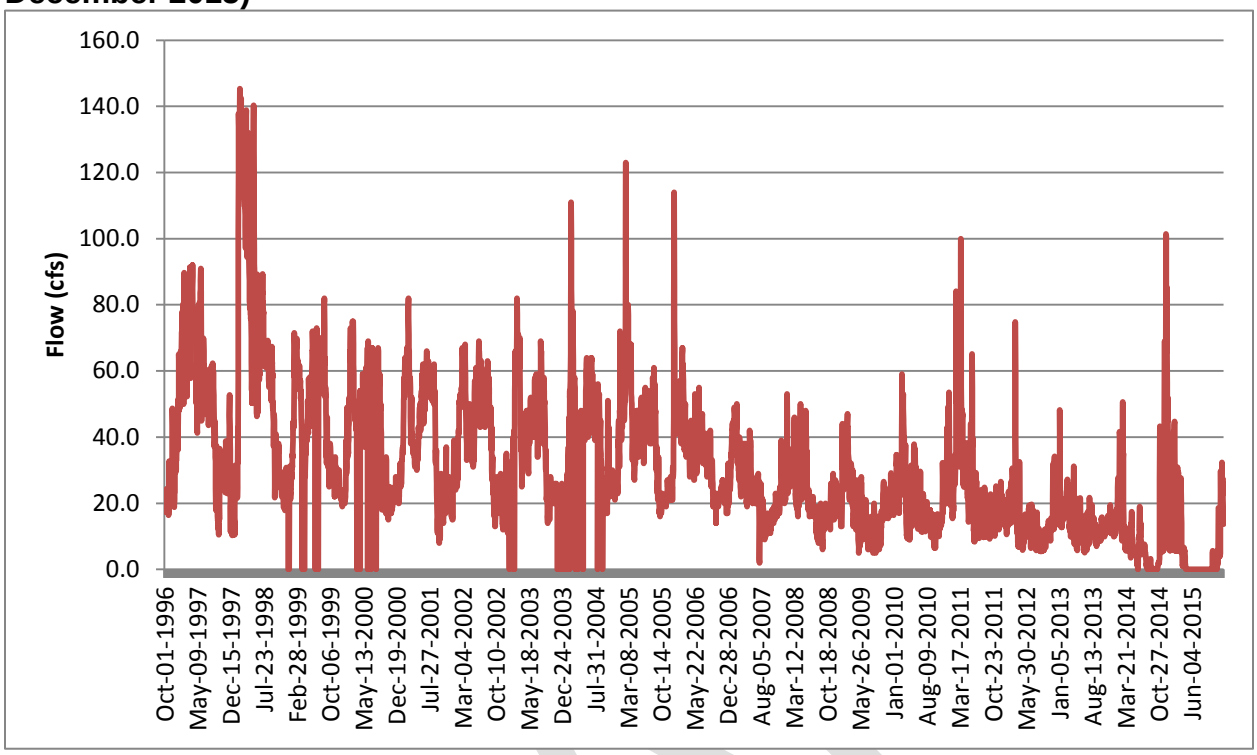
Figure C-2. Crows Landing flow percentage originating from the San Luis Drain (using average daily flow) (October 1996- December 2015)



Beginning with implementation of the GBP in 1996, subsurface agricultural drainage discharges from 90,000 acres of agricultural lands on the west side of the LSJR Basin have been diverted into the San Luis Drain and around managed wetlands into the San Luis Drain which conveys the discharges to Mud Slough. Over time, the discharge has gradually decreased. By the end of 2019, the GBP is scheduled to cease discharge to the San Luis Drain.

Figure C-3 displays the gradual decrease in the volume of discharge water entering the LSJR from the San Luis Drain through Mud Slough from October 1996 through December 2015. The figure plots the average daily flow. A decreasing trend in discharge occurred in 2005. Before then, the discharge volume typically fluctuated between 20 cubic feet per sec (cfs) and 80 cfs, except during the Wet Water Years (WY) of 1996, 1997, and 2005 when the maximum discharge at times was over 100 cfs. After 2005, the minimum and maximum flows gradually decreased, except that the maximum flow was relatively high during the Wet WYs of 2006 and 2011. Of note, the maximum flow in December of the 2015 Critically Dry WY (2014 calendar year) was also relatively high, possibly due to several large winter storms during that month. The data used to generate Figure C-3 are presented in the tables in Attachment A.

Figure C-3. San Luis Drain average daily discharge to Mud Slough (October 1996-December 2015)



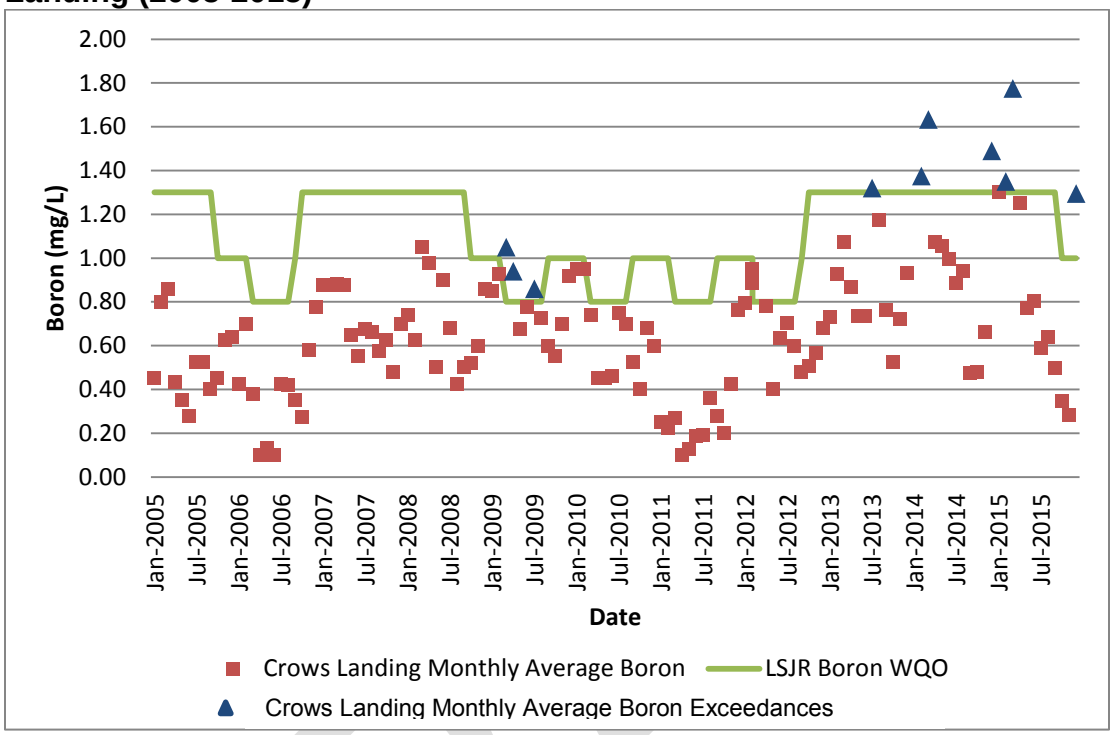
Due to the change in GBP discharge in 2005 and its decreasing influence on the water quality in the LSJR at Crows Landing, evaluations of EC and boron data were limited to the 2005-2015 time period.

Comparison of Historic Boron Concentrations to Existing Water Quality Objectives

Central Valley Water Board staff next evaluated the boron concentration trend in the LSJR at Crows Landing. Figure C-4 presents the monthly average boron concentrations at Crows Landing along with the existing boron WQOs for the LSJR. The figure shows that there were ten exceedances of the monthly average boron WQOs during the period: three occurred during the 2009 Below Normal Water Year (March, April and July), one in July of the 2013 Critically Dry WY, two in the 2014 Critically Dry WY (February and March), three during the 2015 Critically Dry WY (December 2014, and February and March 2015) and one in the 2016 Dry WY (December 2015). With the exception of the three slightly elevated exceedances that occurred in the 2009 Water Year, monthly average boron WQOs were not exceeded after 2005 until the beginning of the drought in the 2012 WY and into the start of the 2016 WY. The maximum boron WQO was also exceeded twice during this period: samples collected on 30 December 2014 and 27 March 2015 had boron concentrations of 2.7 mg/L and

2.1 mg/L, respectively. The data used to generate Figure C-4 are presented in the tables in Attachment A.

Figure C-4. Monthly average boron concentrations in the LSJR River at Crows Landing (2005-2015)



Correlation between EC and Boron in the San Joaquin River at Crows Landing

The correlation between EC and boron data collected at Crows Landing from January 2005 to December 2015 was evaluated to predict if boron concentrations would exceed the boron WQOs after discharge from the San Luis Drain stops at the end of 2019. Figures C-5, C-6 and C-7 compare weekly EC as µS/cm to boron concentrations in mg/L during three separate time periods: January 2005 to December 2015; January 2010 to December 2015; and January 2013 to December 2015, respectively. Correlation between the two constituents decreased as comparisons are weighted toward drought conditions (2013 to 2015), with R^2 decreasing from about 0.72 to 0.41. The correlation coefficient was 0.0006 during all three of the time periods. The data used to generate Figures C-5, C-6 and C-7 are presented in the tables in Attachment A.

Figure C-5. Weekly EC vs. Boron Concentrations in the LSJR at Crows Landing (2005-2015)

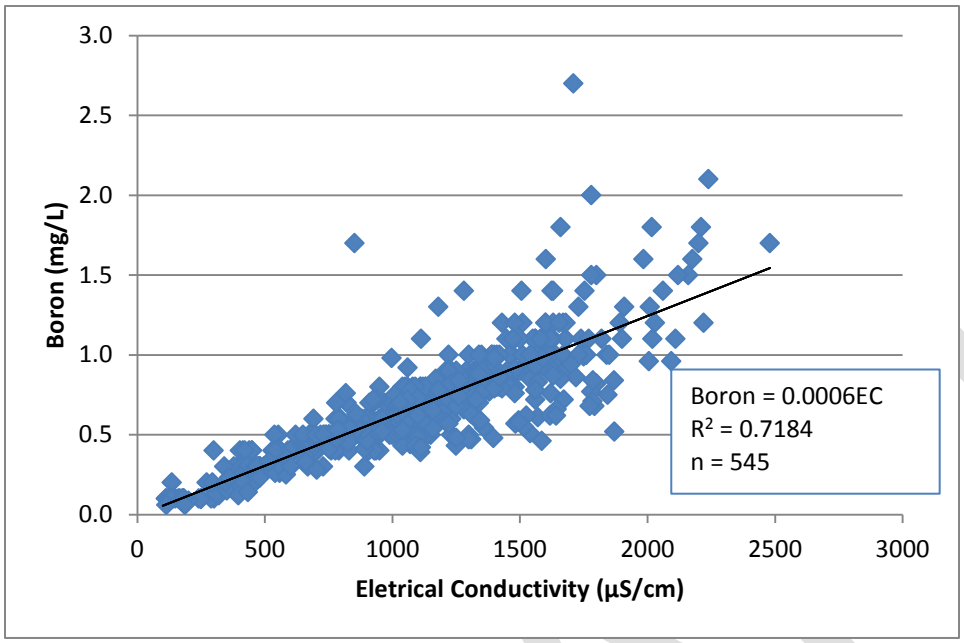


Figure C-6 Weekly EC vs. Boron Concentrations in the LSJR at Crows Landing (2010-2015)

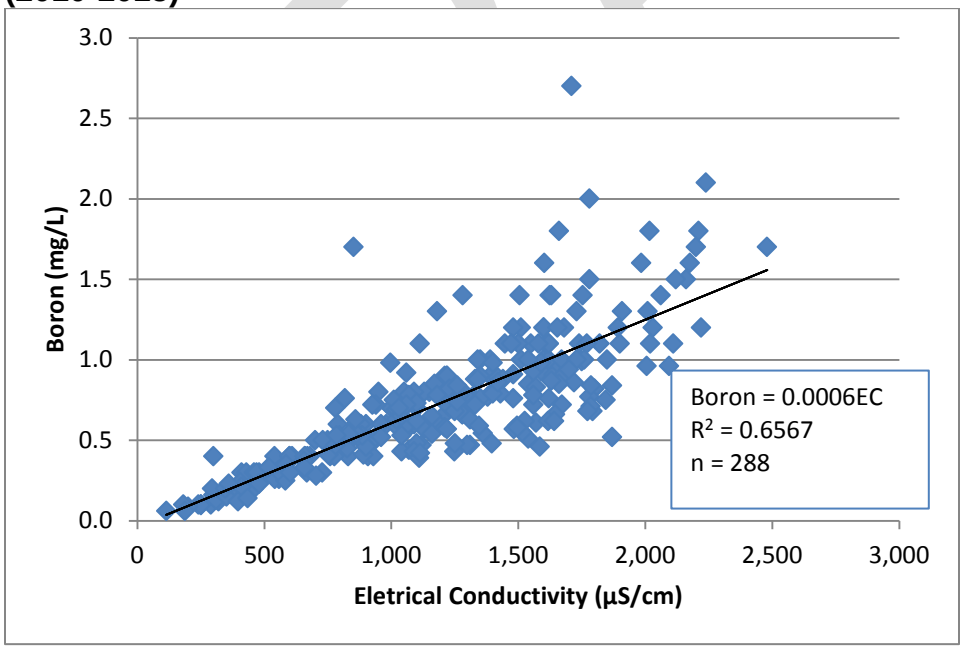
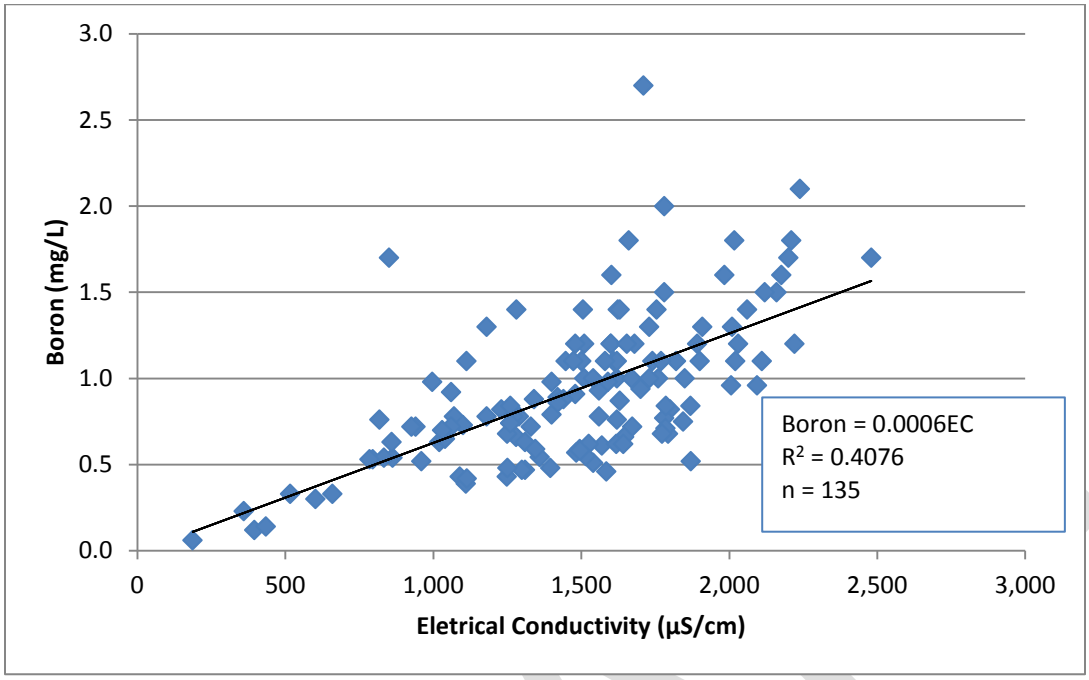


Figure C-7 Weekly EC vs. Boron Concentrations in the LSJR at Crows Landing (2013-2015)



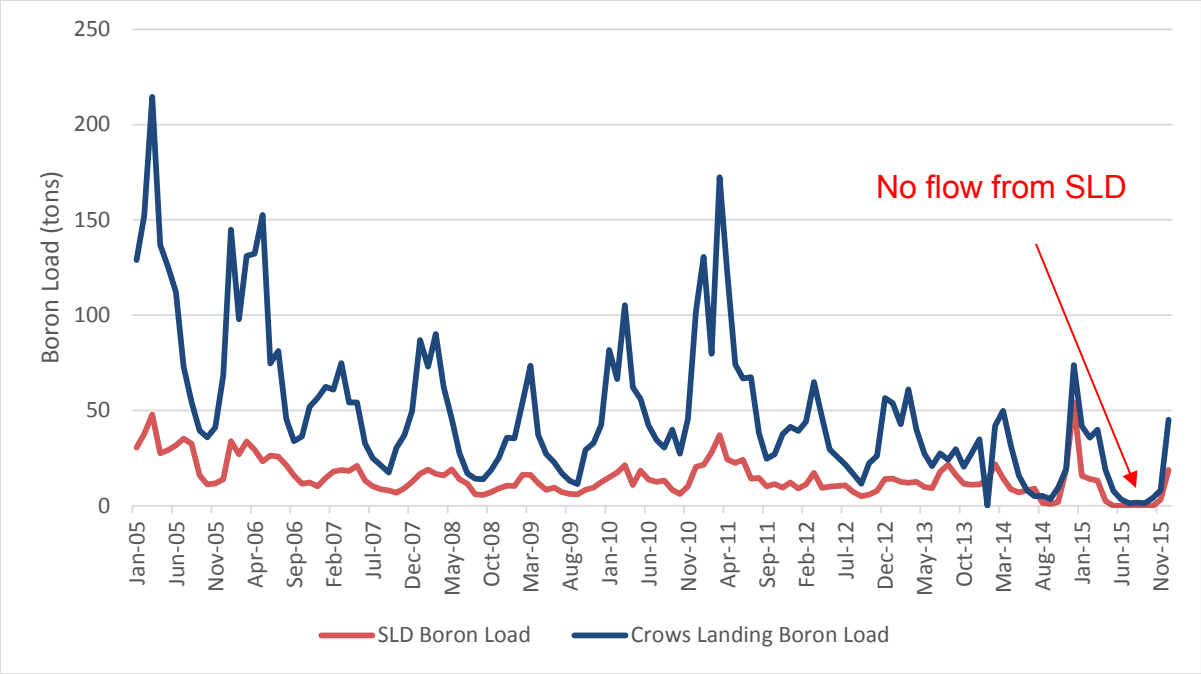
The proposed EC WQO is 1,550 µS/cm as a 30-day running average for all time periods except Extended Dry Periods when the WQO increases to 2,470 µS/cm as a 30-day running average and 2,200 µS/cm as an average of the previous 4 consecutive quarters. Using the correlation coefficient of 0.0006, boron concentration of 0.93 mg/L was calculated when the EC concentration is 1,550 µS/cm, 1.482 mg/L when the EC concentration is 2,470 µS/cm, and 1.32 mg/L when the EC concentration is 2,200 µS/cm.

Based on these calculations, the boron concentration at Crows Landing during the irrigation season of non-Extended Dry Periods would exceed the WQO of 0.8 mg/L when the EC concentration is 1,550 µS/cm. During Extended Dry Periods, the boron critical year WQO of 1.3 mg/L would be exceeded when the EC concentration at Crows Landing is 2,470 µS/cm. However, since there is considerable uncertainty in the precision and accuracy of the correlation factor, especially during the Extended Dry Period, the data was also evaluated by determining the historic impact of boron loading into the river by the GBP and potential concentrations shifts if the GBP goes to zero discharge.

Comparison of Boron Load Trends

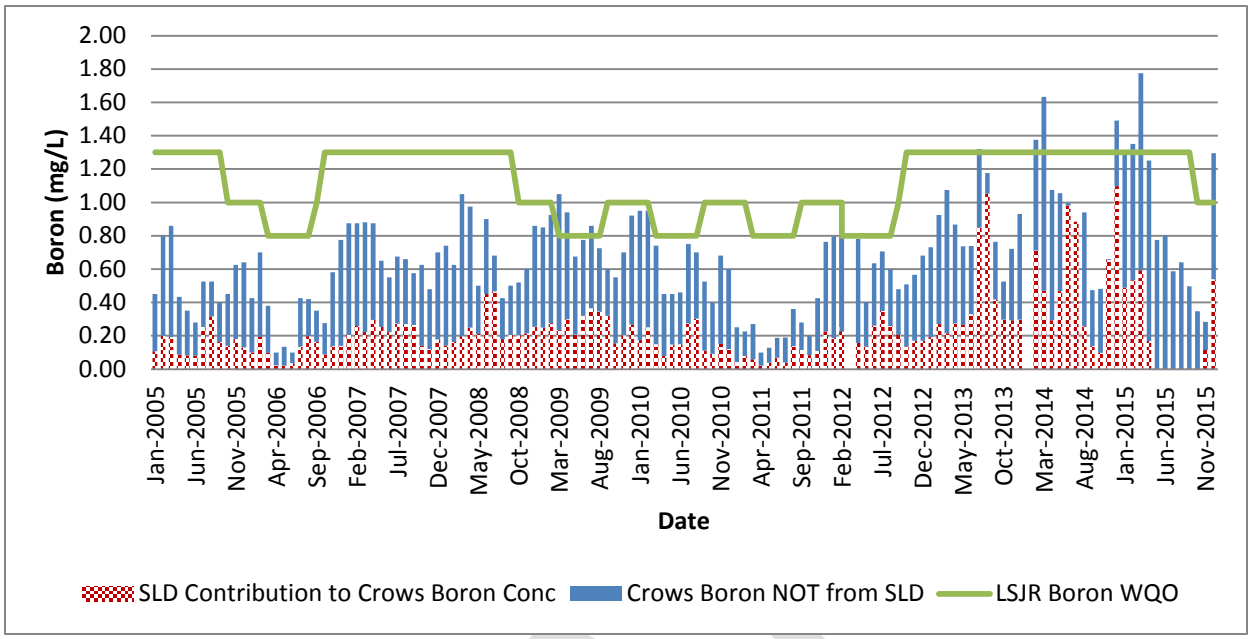
Using daily boron and daily average flow values collected from San Luis Drain for the Grasslands Bypass Project and weekly boron and daily average flow values collected at Crows Landing, the monthly boron discharge loads (in tons) were calculated for the period of 2005-2015 and presented in Figure C-8. Of note is the period from May 2015 through October 2015 when there were no monthly boron loads coming from SLD, due to a lack of flows. Implementation of the proposed EC WQOs rely on the completion of the GBP and the termination of such flows from the San Luis Drain. This graph shows that a decrease in flow from the SLD resulted in a substantial decrease of boron loads in the SJR River during 2015. The data used to generate Figure C-8 are presented in the tables in Attachment A.

Figure C-8 Monthly Boron loads from San Luis Drain and LSJR Crows Landing (in tons)



Using the ratio of San Luis Drain boron load to Crows Landing boron load, a conservative estimated contribution from the San Luis Drain to the monthly average Crows Landing boron concentrations is shown in Figure C-9.

Figure C-9 San Luis Drain's Contribution to Crows Landing Monthly Boron Concentration using the San Luis Drain to Crows Landing Boron Load Ratio



As a prediction of what boron concentrations may have been at Crows Landing without the boron load from the San Luis Drain, Figure C-10 backs out the potential contribution from San Luis Drain.

Figure C-10 Prediction of Monthly Boron Concentration at Crows Landing when Boron Contributions from San Luis Drain are not included.

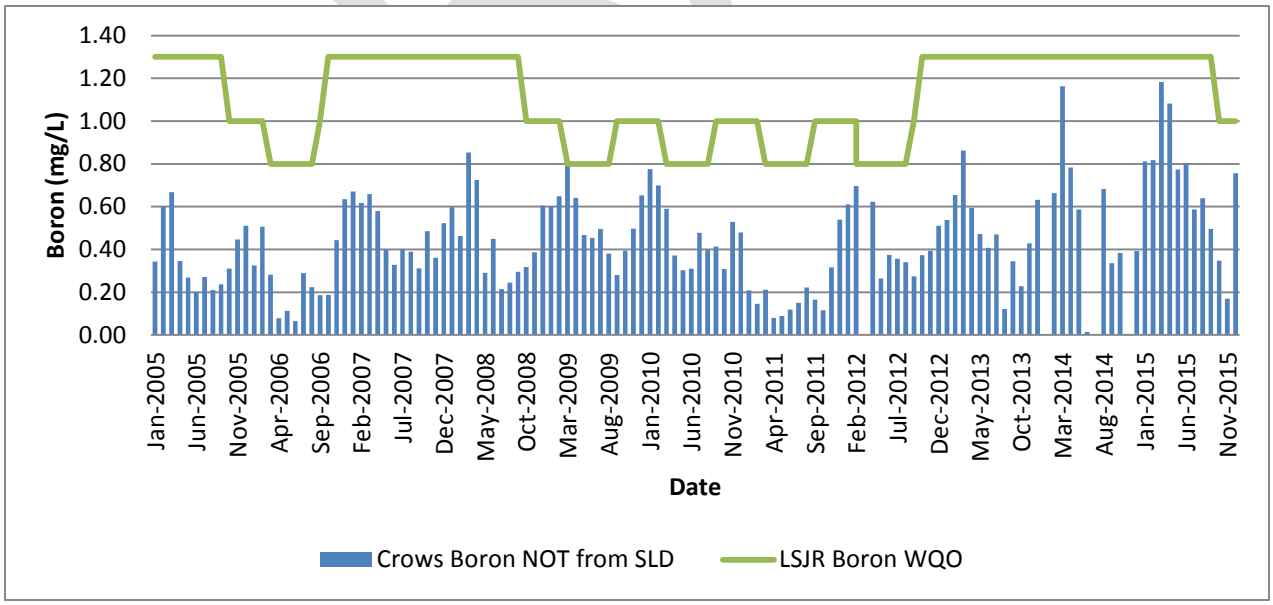


Figure C-10 indicates that without the boron loads from the Grasslands Bypass Project via the San Luis Drain, the boron concentrations in the LSJR at Crows Landing would remain below the boron WQOs.

Conclusion and Recommendations

These preliminary evaluations suggest that the EC to boron correlation in the LSJR River at Crows Landing may substantially change with conditions like more frequent Extended Dry Periods and the termination of flows from the Grasslands Bypass Project. Although a direct correlation to EC based on historic information indicates boron objectives will be exceeded at Crows Landing, boron loads from the San Luis Drain will no longer reach the LSJR after the end of 2019. As a result, it appears that the boron WQOs will be met at Crows Landing. Currently however, there is not enough data to be certain. Monitoring of the boron concentrations at Crows Landing and downstream after the adoption of the EC WQOs is necessary to determine impacts on boron concentrations and inform any decisions pertaining to the Basin Plan re-opener provision that is part of the proposed Implementation Program.

References

Central Valley Water Board. *Water Diversion and Discharge Points Along the San Joaquin River: Mendota Pool Dam to Mossdale Bridge*. 1989a.

Central Valley Water Board. *Hydrology Survey of Mud Slough (North). Merced County*. 1989b.

San Francisco Estuary Institute, Grasslands Bypass Project Website: http://www.sfei.org/projects/grassland-bypass-project#sthash.gCZWsUFf.dpbs. Last accessed on 2016 November 14.

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Attachment A – Data Tables

Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8

Table 2. Crows Landing Weekly Boron Data for Figures C-4, C-5, C-6, C-7, and C-8

Table 3. Average Weekly Crows Landing EC for Figures C-5, C-6, and C-7

Table 4 San Luis Drain Daily Boron Data for Figure C-8

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Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-01-1996	677	21.8
Oct-02-1996	660	20.0
Oct-03-1996	718	18.1
Oct-04-1996	681	18.3
Oct-05-1996	587	17.3
Oct-06-1996	556	17.7
Oct-07-1996	561	19.8
Oct-08-1996	545	19.3
Oct-09-1996	502	19.6
Oct-10-1996	569	21.2
Oct-11-1996	766	20.6
Oct-12-1996	819	23.7
Oct-13-1996	903	23.3
Oct-14-1996	1,040	23.8
Oct-15-1996	1,000	22.8
Oct-16-1996	1,170	24.1
Oct-17-1996	1,400	24.3
Oct-18-1996	1,520	21.7
Oct-19-1996	1,560	21.6
Oct-20-1996	1,640	21.5
Oct-21-1996	1,470	22.0
Oct-22-1996	1,330	19.5
Oct-23-1996	1,310	19.4
Oct-24-1996	1,280	19.6
Oct-25-1996	1,260	18.3
Oct-26-1996	1,180	19.3
Oct-27-1996	1,070	17.5
Oct-28-1996	1,070	16.4
Oct-29-1996	1,070	17.8
Oct-30-1996	1,200	24.8
Oct-31-1996	1,290	28.3
Nov-01-1996	1,330	32.7
Nov-02-1996	1,340	30.1
Nov-03-1996	1,280	25.2
Nov-04-1996	1,190	22.1
Nov-05-1996	1,110	22.0
Nov-06-1996	1,020	21.4
Nov-07-1996	963	21.6
Nov-08-1996	893	21.2
Nov-09-1996	839	22.0
Nov-10-1996	804	21.8
Nov-11-1996	779	20.8
Nov-12-1996	757	21.0
Nov-13-1996	736	21.8
Nov-14-1996	713	21.9
Nov-15-1996	705	22.5
Nov-16-1996	711	24.3
Nov-17-1996	788	26.6
Nov-18-1996	847	27.0
Nov-19-1996	867	25.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-20-1996	888	28.7
Nov-21-1996	963	30.6
Nov-22-1996	1,110	34.0
Nov-23-1996	1,190	48.7
Nov-24-1996	1,410	43.5
Nov-25-1996	1,530	31.4
Nov-26-1996	1,460	30.0
Nov-27-1996	1,320	24.1
Nov-28-1996	1,180	22.0
Nov-29-1996	1,080	24.2
Nov-30-1996	1,010	22.1
Dec-01-1996	952	19.5
Dec-02-1996	908	19.2
Dec-03-1996	900	19.3
Dec-04-1996	863	18.8
Dec-05-1996	822	19.5
Dec-06-1996	798	20.9
Dec-07-1996	990	21.8
Dec-08-1996	1,320	22.9
Dec-09-1996	1,450	23.2
Dec-10-1996	1,490	29.5
Dec-11-1996	2,420	36.0
Dec-12-1996	3,400	37.8
Dec-13-1996	3,720	34.4
Dec-14-1996	3,890	33.6
Dec-15-1996	4,580	32.9
Dec-16-1996	4,960	29.4
Dec-17-1996	5,300	30.1
Dec-18-1996	5,350	32.9
Dec-19-1996	5,210	33.0
Dec-20-1996	5,060	34.1
Dec-21-1996	4,830	37.1
Dec-22-1996	5,460	40.3
Dec-23-1996	6,700	41.5
Dec-24-1996	7,070	46.7
Dec-25-1996	7,350	40.5
Dec-26-1996	8,140	36.5
Dec-27-1996	8,310	36.3
Dec-28-1996	8,210	38.0
Dec-29-1996	8,020	36.2
Dec-30-1996	8,050	36.2
Dec-31-1996	8,760	43.2
Jan-01-1997	11,100	51.6
Jan-02-1997	17,700	47.7
Jan-03-1997	23,000	49.9
Jan-04-1997	25,100	65.0
Jan-05-1997	25,800	60.1
Jan-06-1997	26,100	48.2
Jan-07-1997	27,500	55.8
Jan-08-1997	27,600	64.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-09-1997	25,800	59.1
Jan-10-1997	23,400	51.3
Jan-11-1997	21,600	48.7
Jan-12-1997	21,000	51.6
Jan-13-1997	20,800	54.1
Jan-14-1997	21,000	56.2
Jan-15-1997	21,500	56.9
Jan-16-1997	21,700	60.9
Jan-17-1997	22,000	65.9
Jan-18-1997	21,800	61.9
Jan-19-1997	22,200	57.6
Jan-20-1997	22,900	60.4
Jan-21-1997	22,900	64.8
Jan-22-1997	23,800	70.5
Jan-23-1997	26,500	71.6
Jan-24-1997	28,200	72.1
Jan-25-1997	30,300	75.3
Jan-26-1997	33,500	77.9
Jan-27-1997	36,000	76.4
Jan-28-1997	37,600	56.2
Jan-29-1997	36,300	50.1
Jan-30-1997	34,800	58.0
Jan-31-1997	34,200	67.0
Feb-01-1997	33,800	80.1
Feb-02-1997	33,000	75.9
Feb-03-1997	32,500	65.9
Feb-04-1997	32,000	64.7
Feb-05-1997	31,400	49.9
Feb-06-1997	30,200	81.1
Feb-07-1997	29,100	87.2
Feb-08-1997	28,100	87.6
Feb-09-1997	26,900	89.7
Feb-10-1997	25,700	84.3
Feb-11-1997	24,900	80.2
Feb-12-1997	23,800	76.5
Feb-13-1997	22,600	81.3
Feb-14-1997	22,100	81.2
Feb-15-1997	21,700	83.4
Feb-16-1997	21,300	81.7
Feb-17-1997	21,000	82.4
Feb-18-1997	20,500	83.6
Feb-19-1997	20,400	81.5
Feb-20-1997	19,700	83.3
Feb-21-1997	19,200	83.8
Feb-22-1997	18,800	80.5
Feb-23-1997	18,200	67.0
Feb-24-1997	17,400	58.7
Feb-25-1997	16,300	61.4
Feb-26-1997	15,400	56.4
Feb-27-1997	14,800	52.3

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-28-1997	14,100	62.4
Mar-01-1997	13,200	78.3
Mar-02-1997	11,400	83.1
Mar-03-1997	9,700	79.0
Mar-04-1997	9,140	80.5
Mar-05-1997	8,190	79.9
Mar-06-1997	7,380	84.3
Mar-07-1997	7,140	82.3
Mar-08-1997	6,770	78.1
Mar-09-1997	6,330	79.5
Mar-10-1997	5,690	79.2
Mar-11-1997	5,180	79.2
Mar-12-1997	4,580	79.2
Mar-13-1997	4,000	82.4
Mar-14-1997	3,490	80.9
Mar-15-1997	3,140	79.3
Mar-16-1997	2,920	81.8
Mar-17-1997	2,840	85.7
Mar-18-1997	2,720	89.9
Mar-19-1997	2,660	91.4
Mar-20-1997	2,560	86.8
Mar-21-1997	2,530	71.9
Mar-22-1997	2,450	68.2
Mar-23-1997	2,400	57.8
Mar-24-1997	2,350	64.3
Mar-25-1997	2,210	80.2
Mar-26-1997	2,160	77.4
Mar-27-1997	2,060	70.5
Mar-28-1997	1,970	78.8
Mar-29-1997	1,940	82.9
Mar-30-1997	1,980	85.8
Mar-31-1997	1,960	79.6
Apr-01-1997	1,810	75.7
Apr-02-1997	1,740	74.4
Apr-03-1997	1,690	85.3
Apr-04-1997	1,670	88.7
Apr-05-1997	1,550	92.0
Apr-06-1997	1,410	83.9
Apr-07-1997	1,280	76.7
Apr-08-1997	1,210	75.8
Apr-09-1997	1,150	72.8
Apr-10-1997	1,100	73.7
Apr-11-1997	1,030	71.7
Apr-12-1997	982	76.0
Apr-13-1997	982	76.4
Apr-14-1997	1,000	77.9
Apr-15-1997	941	79.0
Apr-16-1997	992	77.6
Apr-17-1997	1,180	78.2
Apr-18-1997	1,450	69.7

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-19-1997	1,610	72.7
Apr-20-1997	1,830	76.2
Apr-21-1997	1,980	75.3
Apr-22-1997	1,950	76.7
Apr-23-1997	1,660	74.3
Apr-24-1997	1,460	70.7
Apr-25-1997	1,340	69.3
Apr-26-1997	1,200	76.5
Apr-27-1997	1,100	73.3
Apr-28-1997	1,130	63.6
Apr-29-1997	1,090	60.9
Apr-30-1997	1,060	50.1
May-01-1997	1,340	62.0
May-02-1997	1,560	61.4
May-03-1997	1,710	59.4
May-04-1997	1,740	44.6
May-05-1997	1,650	42.8
May-06-1997	1,550	41.2
May-07-1997	1,570	42.4
May-08-1997	1,560	52.1
May-09-1997	1,540	62.8
May-10-1997	1,800	67.0
May-11-1997	2,030	71.6
May-12-1997	2,120	73.2
May-13-1997	1,860	72.9
May-14-1997	1,270	62.2
May-15-1997	1,090	68.4
May-16-1997	1,010	67.4
May-17-1997	960	67.6
May-18-1997	894	75.7
May-19-1997	880	77.1
May-20-1997	845	80.5
May-21-1997	820	71.9
May-22-1997	805	68.5
May-23-1997	823	69.8
May-24-1997	899	71.2
May-25-1997	906	77.4
May-26-1997	920	80.4
May-27-1997	875	83.6
May-28-1997	831	84.7
May-29-1997	872	87.3
May-30-1997	857	91.0
May-31-1997	782	87.0
Jun-01-1997	740	84.1
Jun-02-1997	706	80.4
Jun-03-1997	714	59.8
Jun-04-1997	713	44.9
Jun-05-1997	731	50.2
Jun-06-1997	683	53.4
Jun-07-1997	660	46.7

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-08-1997	666	48.7
Jun-09-1997	675	51.6
Jun-10-1997	618	51.9
Jun-11-1997	541	58.1
Jun-12-1997	566	56.5
Jun-13-1997	532	59.8
Jun-14-1997	581	64.4
Jun-15-1997	677	62.6
Jun-16-1997	645	60.2
Jun-17-1997	640	69.9
Jun-18-1997	626	66.1
Jun-19-1997	576	61.6
Jun-20-1997	516	60.8
Jun-21-1997	485	61.8
Jun-22-1997	542	59.1
Jun-23-1997	565	58.9
Jun-24-1997	574	58.9
Jun-25-1997	512	50.3
Jun-26-1997	520	48.2
Jun-27-1997	522	50.8
Jun-28-1997	497	52.3
Jun-29-1997	546	57.7
Jun-30-1997	573	53.4
Jul-01-1997	613	53.6
Jul-02-1997	614	54.0
Jul-03-1997	609	58.9
Jul-04-1997	554	58.4
Jul-05-1997	571	51.7
Jul-06-1997	590	58.3
Jul-07-1997	627	54.6
Jul-08-1997	607	57.0
Jul-09-1997	589	50.9
Jul-10-1997	538	50.8
Jul-11-1997	538	60.3
Jul-12-1997	540	58.1
Jul-13-1997	566	54.7
Jul-14-1997	552	54.1
Jul-15-1997	579	52.1
Jul-16-1997	580	46.6
Jul-17-1997	538	52.0
Jul-18-1997	506	54.8
Jul-19-1997	543	51.2
Jul-20-1997	590	44.3
Jul-21-1997	660	43.6
Jul-22-1997	631	46.2
Jul-23-1997	615	47.5
Jul-24-1997	606	51.1
Jul-25-1997	522	55.2
Jul-26-1997	515	59.4
Jul-27-1997	586	57.3

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-28-1997	619	55.3
Jul-29-1997	624	58.6
Jul-30-1997	615	52.2
Jul-31-1997	638	49.4
Aug-01-1997	667	48.5
Aug-02-1997	610	51.6
Aug-03-1997	617	51.2
Aug-04-1997	655	50.3
Aug-05-1997	649	48.2
Aug-06-1997	552	45.8
Aug-07-1997	504	49.8
Aug-08-1997	525	57.0
Aug-09-1997	555	61.4
Aug-10-1997	569	58.7
Aug-11-1997	633	58.2
Aug-12-1997	675	61.0
Aug-13-1997	638	59.4
Aug-14-1997	584	59.5
Aug-15-1997	597	59.3
Aug-16-1997	603	62.3
Aug-17-1997	719	58.5
Aug-18-1997	824	50.8
Aug-19-1997	772	46.1
Aug-20-1997	736	45.7
Aug-21-1997	649	59.8
Aug-22-1997	632	54.9
Aug-23-1997	612	52.7
Aug-24-1997	603	50.7
Aug-25-1997	610	44.4
Aug-26-1997	626	42.8
Aug-27-1997	594	40.7
Aug-28-1997	528	37.1
Aug-29-1997	491	39.2
Aug-30-1997	460	43.1
Aug-31-1997	483	43.9
Sep-01-1997	499	44.8
Sep-02-1997	477	40.4
Sep-03-1997	464	33.9
Sep-04-1997	459	32.8
Sep-05-1997	507	24.7
Sep-06-1997	477	17.9
Sep-07-1997	487	34.3
Sep-08-1997	557	33.0
Sep-09-1997	625	33.7
Sep-10-1997	555	35.7
Sep-11-1997	518	37.4
Sep-12-1997	476	36.8
Sep-13-1997	478	36.4
Sep-14-1997	512	31.4
Sep-15-1997	543	26.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-16-1997	550	22.6
Sep-17-1997	463	18.8
Sep-18-1997	432	16.2
Sep-19-1997	448	14.6
Sep-20-1997	464	14.7
Sep-21-1997	517	15.3
Sep-22-1997	569	12.3
Sep-23-1997	552	13.7
Sep-24-1997	504	13.8
Sep-25-1997	438	13.9
Sep-26-1997	472	10.5
Sep-27-1997	483	12.0
Sep-28-1997	495	15.4
Sep-29-1997	530	19.9
Sep-30-1997	484	15.1
Oct-01-1997	484	16.3
Oct-02-1997	515	27.5
Oct-03-1997	532	36.5
Oct-04-1997	550	31.1
Oct-05-1997	651	29.3
Oct-06-1997	660	30.0
Oct-07-1997	670	33.9
Oct-08-1997	665	33.7
Oct-09-1997	658	28.8
Oct-10-1997	640	34.1
Oct-11-1997	625	31.0
Oct-12-1997	608	28.6
Oct-13-1997	624	28.6
Oct-14-1997	621	26.6
Oct-15-1997	645	26.8
Oct-16-1997	648	30.2
Oct-17-1997	650	28.2
Oct-18-1997	651	27.2
Oct-19-1997	678	27.7
Oct-20-1997	682	26.5
Oct-21-1997	666	25.8
Oct-22-1997	734	25.2
Oct-23-1997	763	24.4
Oct-24-1997	716	25.3
Oct-25-1997	694	26.9
Oct-26-1997	688	30.4
Oct-27-1997	682	30.5
Oct-28-1997	690	31.4
Oct-29-1997	680	29.5
Oct-30-1997	678	26.9
Oct-31-1997	647	26.4
Nov-01-1997	696	26.3
Nov-02-1997	753	26.3
Nov-03-1997	740	25.8
Nov-04-1997	715	27.3

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-05-1997	690	25.5
Nov-06-1997	684	24.7
Nov-07-1997	657	23.7
Nov-08-1997	677	23.2
Nov-09-1997	679	25.7
Nov-10-1997	687	25.1
Nov-11-1997	728	25.9
Nov-12-1997	752	38.8
Nov-13-1997	783	35.5
Nov-14-1997	805	31.4
Nov-15-1997	820	29.2
Nov-16-1997	845	27.6
Nov-17-1997	856	27.3
Nov-18-1997	857	25.9
Nov-19-1997	864	25.9
Nov-20-1997	819	24.8
Nov-21-1997	764	24.8
Nov-22-1997	742	25.4
Nov-23-1997	722	23.0
Nov-24-1997	697	23.6
Nov-25-1997	671	23.1
Nov-26-1997	702	23.9
Nov-27-1997	735	24.2
Nov-28-1997	771	24.6
Nov-29-1997	785	23.3
Nov-30-1997	836	23.5
Dec-01-1997	867	31.4
Dec-02-1997	886	30.7
Dec-03-1997	1,020	26.3
Dec-04-1997	1,050	26.3
Dec-05-1997	1,080	34.6
Dec-06-1997	1,120	46.8
Dec-07-1997	1,130	52.8
Dec-08-1997	1,200	46.3
Dec-09-1997	1,220	42.5
Dec-10-1997	1,210	40.6
Dec-11-1997	1,170	36.3
Dec-12-1997	1,110	31.9
Dec-13-1997	1,030	11.3
Dec-14-1997	958	18.9
Dec-15-1997	928	20.9
Dec-16-1997	911	19.0
Dec-17-1997	872	14.5
Dec-18-1997	831	11.9
Dec-19-1997	789	16.8
Dec-20-1997	752	15.1
Dec-21-1997	741	14.4
Dec-22-1997	712	11.6
Dec-23-1997	671	13.2
Dec-24-1997	632	10.3

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-25-1997	620	12.0
Dec-26-1997	600	15.2
Dec-27-1997	579	13.8
Dec-28-1997	568	11.7
Dec-29-1997	546	10.7
Dec-30-1997	529	10.4
Dec-31-1997	520	10.4
Jan-01-1998	514	13.6
Jan-02-1998	528	16.6
Jan-03-1998	539	19.3
Jan-04-1998	590	21.8
Jan-05-1998	620	18.7
Jan-06-1998	680	19.7
Jan-07-1998	655	15.6
Jan-08-1998	628	13.7
Jan-09-1998	620	14.5
Jan-10-1998	646	10.5
Jan-11-1998	680	19.3
Jan-12-1998	843	23.2
Jan-13-1998	1,330	23.8
Jan-14-1998	2,040	31.5
Jan-15-1998	2,250	28.9
Jan-16-1998	3,250	30.5
Jan-17-1998	4,380	30.9
Jan-18-1998	4,560	28.9
Jan-19-1998	5,120	26.9
Jan-20-1998	5,290	23.9
Jan-21-1998	4,990	21.9
Jan-22-1998	4,600	23.0
Jan-23-1998	4,060	23.5
Jan-24-1998	3,480	21.5
Jan-25-1998	2,900	23.7
Jan-26-1998	2,470	28.1
Jan-27-1998	2,230	21.7
Jan-28-1998	2,060	22.0
Jan-29-1998	1,960	24.9
Jan-30-1998	2,270	31.5
Jan-31-1998	3,580	42.9
Feb-01-1998	4,470	32.2
Feb-02-1998	5,330	57.5
Feb-03-1998	7,680	101.7
Feb-04-1998	9,790	119.6
Feb-05-1998	10,700	137.8
Feb-06-1998	12,000	133.3
Feb-07-1998	15,700	132.0
Feb-08-1998	20,500	127.6
Feb-09-1998	22,500	129.2
Feb-10-1998	23,900	134.2
Feb-11-1998	24,300	135.3
Feb-12-1998	23,700	133.6

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-13-1998	22,900	145.3
Feb-14-1998	22,300	144.7
Feb-15-1998	21,800	135.9
Feb-16-1998	20,600	139.6
Feb-17-1998	21,500	135.7
Feb-18-1998	20,900	126.9
Feb-19-1998	19,700	127.8
Feb-20-1998	19,500	137.4
Feb-21-1998	18,600	142.4
Feb-22-1998	18,900	136.4
Feb-23-1998	18,900	130.8
Feb-24-1998	19,400	129.1
Feb-25-1998	19,700	135.0
Feb-26-1998	20,100	127.9
Feb-27-1998	20,100	132.4
Feb-28-1998	19,200	124.1
Mar-01-1998	17,000	128.7
Mar-02-1998	15,200	125.3
Mar-03-1998	13,900	115.8
Mar-04-1998	12,100	116.4
Mar-05-1998	11,500	119.5
Mar-06-1998	11,000	114.7
Mar-07-1998	10,500	116.6
Mar-08-1998	10,200	118.2
Mar-09-1998	10,200	117.1
Mar-10-1998	10,200	113.3
Mar-11-1998	9,980	117.4
Mar-12-1998	9,660	115.3
Mar-13-1998	9,340	120.8
Mar-14-1998	8,990	119.4
Mar-15-1998	8,320	118.9
Mar-16-1998	7,830	112.6
Mar-17-1998	7,610	109.6
Mar-18-1998	7,330	113.4
Mar-19-1998	7,050	111.8
Mar-20-1998	6,820	109.3
Mar-21-1998	6,640	107.0
Mar-22-1998	6,370	104.4
Mar-23-1998	6,110	97.1
Mar-24-1998	5,890	100.4
Mar-25-1998	6,020	115.1
Mar-26-1998	7,780	135.6
Mar-27-1998	10,700	138.9
Mar-28-1998	14,600	127.4
Mar-29-1998	15,900	113.4
Mar-30-1998	15,200	105.7
Mar-31-1998	14,200	103.6
Apr-01-1998	13,500	109.9
Apr-02-1998	12,900	103.8
Apr-03-1998	12,500	94.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-04-1998	12,500	97.4
Apr-05-1998	12,700	111.8
Apr-06-1998	13,100	131.1
Apr-07-1998	13,600	132.1
Apr-08-1998	14,100	117.2
Apr-09-1998	14,600	104.7
Apr-10-1998	14,500	103.3
Apr-11-1998	14,900	98.5
Apr-12-1998	15,800	100.8
Apr-13-1998	16,500	100.9
Apr-14-1998	16,800	95.0
Apr-15-1998	16,800	90.3
Apr-16-1998	16,600	89.9
Apr-17-1998	16,100	87.3
Apr-18-1998	15,600	81.4
Apr-19-1998	14,800	80.9
Apr-20-1998	14,100	80.5
Apr-21-1998	13,600	78.9
Apr-22-1998	13,500	79.6
Apr-23-1998	13,300	82.2
Apr-24-1998	13,000	81.5
Apr-25-1998	12,700	77.1
Apr-26-1998	12,500	76.7
Apr-27-1998	12,500	75.7
Apr-28-1998	12,400	78.2
Apr-29-1998	12,100	75.4
Apr-30-1998	11,900	70.1
May-01-1998	11,700	62.8
May-02-1998	11,400	54.1
May-03-1998	11,300	55.0
May-04-1998	10,900	59.2
May-05-1998	10,900	50.2
May-06-1998	11,400	63.8
May-07-1998	11,700	68.0
May-08-1998	11,800	66.8
May-09-1998	11,800	62.6
May-10-1998	11,700	57.6
May-11-1998	11,500	55.3
May-12-1998	11,700	58.4
May-13-1998	12,100	77.7
May-14-1998	12,400	126.9
May-15-1998	12,700	140.3
May-16-1998	13,100	134.9
May-17-1998	13,400	117.4
May-18-1998	13,300	108.1
May-19-1998	13,200	96.9
May-20-1998	13,100	92.4
May-21-1998	13,100	89.5
May-22-1998	13,000	85.4
May-23-1998	12,700	82.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-24-1998	12,400	78.1
May-25-1998	12,200	74.9
May-26-1998	12,000	71.2
May-27-1998	11,700	74.6
May-28-1998	11,600	70.7
May-29-1998	11,700	72.9
May-30-1998	11,700	80.0
May-31-1998	11,700	76.9
Jun-01-1998	11,600	66.4
Jun-02-1998	11,500	58.2
Jun-03-1998	11,400	48.8
Jun-04-1998	11,300	47.2
Jun-05-1998	11,000	46.8
Jun-06-1998	10,800	46.3
Jun-07-1998	10,500	49.9
Jun-08-1998	10,600	81.6
Jun-09-1998	10,900	89.2
Jun-10-1998	11,300	77.2
Jun-11-1998	11,600	62.1
Jun-12-1998	11,800	54.0
Jun-13-1998	11,700	47.3
Jun-14-1998	11,700	53.9
Jun-15-1998	11,800	59.4
Jun-16-1998	11,900	63.9
Jun-17-1998	12,300	71.4
Jun-18-1998	12,600	71.2
Jun-19-1998	12,600	64.4
Jun-20-1998	12,300	60.3
Jun-21-1998	12,600	57.2
Jun-22-1998	13,000	57.5
Jun-23-1998	13,000	59.5
Jun-24-1998	12,900	59.4
Jun-25-1998	12,800	58.9
Jun-26-1998	12,500	60.4
Jun-27-1998	12,400	67.4
Jun-28-1998	12,300	66.3
Jun-29-1998	12,000	61.7
Jun-30-1998	11,900	65.0
Jul-01-1998	11,700	68.7
Jul-02-1998	11,500	71.2
Jul-03-1998	11,300	77.1
Jul-04-1998	11,100	73.2
Jul-05-1998	11,300	72.9
Jul-06-1998	11,400	81.1
Jul-07-1998	11,400	81.0
Jul-08-1998	11,600	79.5
Jul-09-1998	11,700	78.3
Jul-10-1998	11,800	77.1
Jul-11-1998	11,600	84.2
Jul-12-1998	11,100	83.2

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-13-1998	10,100	84.0
Jul-14-1998	9,170	89.3
Jul-15-1998	8,770	88.7
Jul-16-1998	8,580	80.8
Jul-17-1998	8,190	80.9
Jul-18-1998	7,760	77.6
Jul-19-1998	7,330	77.1
Jul-20-1998	6,660	77.9
Jul-21-1998	6,080	71.7
Jul-22-1998	5,620	65.9
Jul-23-1998	5,330	64.1
Jul-24-1998	5,120	65.7
Jul-25-1998	4,650	61.5
Jul-26-1998	4,310	63.8
Jul-27-1998	4,210	66.4
Jul-28-1998	4,030	67.6
Jul-29-1998	3,730	65.5
Jul-30-1998	3,350	64.3
Jul-31-1998	2,960	64.5
Aug-01-1998	2,770	65.5
Aug-02-1998	2,530	66.9
Aug-03-1998	2,420	68.0
Aug-04-1998	2,280	67.8
Aug-05-1998	2,180	64.3
Aug-06-1998	2,040	61.0
Aug-07-1998	1,790	62.8
Aug-08-1998	1,650	65.6
Aug-09-1998	1,620	64.8
Aug-10-1998	1,670	65.7
Aug-11-1998	1,670	65.5
Aug-12-1998	1,630	66.0
Aug-13-1998	1,580	62.6
Aug-14-1998	1,560	64.0
Aug-15-1998	1,570	63.0
Aug-16-1998	1,530	62.7
Aug-17-1998	1,540	67.8
Aug-18-1998	1,480	69.2
Aug-19-1998	1,430	65.8
Aug-20-1998	1,520	65.0
Aug-21-1998	1,620	65.1
Aug-22-1998	1,630	63.6
Aug-23-1998	1,640	59.3
Aug-24-1998	1,710	57.3
Aug-25-1998	1,700	56.0
Aug-26-1998	1,630	55.1
Aug-27-1998	1,600	55.1
Aug-28-1998	1,580	55.4
Aug-29-1998	1,590	58.7
Aug-30-1998	1,620	62.4
Aug-31-1998	1,700	65.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-01-1998	1,680	61.6
Sep-02-1998	1,730	60.8
Sep-03-1998	1,700	57.2
Sep-04-1998	1,690	57.4
Sep-05-1998	1,760	61.7
Sep-06-1998	1,850	58.3
Sep-07-1998	1,900	56.8
Sep-08-1998	1,850	54.4
Sep-09-1998	1,790	51.0
Sep-10-1998	1,720	56.7
Sep-11-1998	1,680	55.1
Sep-12-1998	1,700	60.8
Sep-13-1998	1,770	64.2
Sep-14-1998	1,810	67.4
Sep-15-1998	1,850	62.2
Sep-16-1998	1,820	62.5
Sep-17-1998	1,800	58.0
Sep-18-1998	1,870	59.1
Sep-19-1998	2,060	51.5
Sep-20-1998	2,090	48.6
Sep-21-1998	1,970	50.7
Sep-22-1998	1,890	46.7
Sep-23-1998	1,820	46.7
Sep-24-1998	1,790	44.6
Sep-25-1998	1,790	37.3
Sep-26-1998	1,780	37.7
Sep-27-1998	1,990	42.2
Sep-28-1998	2,050	46.9
Sep-29-1998	2,000	46.8
Sep-30-1998	2,070	44.8
Oct-01-1998	2,100	42.0
Oct-02-1998	2,130	28.2
Oct-03-1998	2,380	21.7
Oct-04-1998	2,510	30.0
Oct-05-1998	2,550	30.7
Oct-06-1998	2,500	31.2
Oct-07-1998	2,490	34.2
Oct-08-1998	2,410	32.3
Oct-09-1998	2,460	35.9
Oct-10-1998	2,480	40.4
Oct-11-1998	2,530	40.9
Oct-12-1998	2,590	35.2
Oct-13-1998	2,540	32.9
Oct-14-1998	2,590	32.0
Oct-15-1998	2,620	36.0
Oct-16-1998	2,590	34.5
Oct-17-1998	2,540	30.7
Oct-18-1998	2,120	29.3
Oct-19-1998	1,900	28.6
Oct-20-1998	1,610	28.2

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-21-1998	1,420	28.7
Oct-22-1998	1,300	28.7
Oct-23-1998	1,330	30.5
Oct-24-1998	1,350	31.5
Oct-25-1998	1,550	31.1
Oct-26-1998	1,620	37.4
Oct-27-1998	1,670	37.8
Oct-28-1998	1,740	38.0
Oct-29-1998	1,800	36.8
Oct-30-1998	1,780	35.6
Oct-31-1998	1,660	37.2
Nov-01-1998	1,660	28.8
Nov-02-1998	1,680	27.8
Nov-03-1998	1,690	29.0
Nov-04-1998	1,670	29.9
Nov-05-1998	1,590	28.1
Nov-06-1998	1,490	29.8
Nov-07-1998	1,410	26.8
Nov-08-1998	1,390	26.8
Nov-09-1998	1,310	26.2
Nov-10-1998	1,240	28.5
Nov-11-1998	1,210	26.9
Nov-12-1998	1,180	25.1
Nov-13-1998	1,150	24.5
Nov-14-1998	1,120	24.6
Nov-15-1998	1,090	25.4
Nov-16-1998	1,050	25.4
Nov-17-1998	1,030	23.9
Nov-18-1998	1,020	22.0
Nov-19-1998	1,010	23.0
Nov-20-1998	988	28.5
Nov-21-1998	1,050	25.3
Nov-22-1998	1,080	23.7
Nov-23-1998	1,070	24.7
Nov-24-1998	1,090	22.3
Nov-25-1998	1,090	22.3
Nov-26-1998	1,060	23.0
Nov-27-1998	1,040	23.4
Nov-28-1998	1,050	23.9
Nov-29-1998	1,080	25.9
Nov-30-1998	1,260	22.7
Dec-01-1998	1,380	18.6
Dec-02-1998	1,310	21.9
Dec-03-1998	1,360	23.3
Dec-04-1998	1,500	25.6
Dec-05-1998	1,600	23.5
Dec-06-1998	1,700	19.8
Dec-07-1998	1,760	21.7
Dec-08-1998	1,790	19.9
Dec-09-1998	1,860	19.9

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-10-1998	1,920	17.8
Dec-11-1998	1,950	19.6
Dec-12-1998	1,920	26.8
Dec-13-1998	1,900	24.8
Dec-14-1998	1,890	22.7
Dec-15-1998	1,980	25.9
Dec-16-1998	1,990	25.6
Dec-17-1998	1,980	25.0
Dec-18-1998	1,800	27.2
Dec-19-1998	1,520	30.8
Dec-20-1998	1,480	26.8
Dec-21-1998	1,440	23.4
Dec-22-1998	1,360	23.4
Dec-23-1998	1,320	23.7
Dec-24-1998	1,280	23.8
Dec-25-1998	1,260	26.4
Dec-26-1998	1,200	26.2
Dec-27-1998	1,170	24.0
Dec-28-1998	1,150	18.9
Dec-29-1998	1,140	23.2
Dec-30-1998	1,120	24.0
Dec-31-1998	1,110	25.5
Jan-01-1999	1,110	25.0 e
Jan-02-1999	1,120	27.0 e
Jan-03-1999	1,110	24.0 e
Jan-04-1999	1,100	25.0 e
Jan-05-1999	1,090	24.0 e
Jan-06-1999	1,080	23.0 e
Jan-07-1999	1,070	25.0 e
Jan-08-1999	1,080	25.4
Jan-09-1999	1,080	28.2
Jan-10-1999	1,090	31.2
Jan-11-1999	1,100	28.0
Jan-12-1999	1,120	27.1
Jan-13-1999	1,160	22.0
Jan-14-1999	1,170	23.5
Jan-15-1999	1,180	21.2
Jan-16-1999	1,190	24.4
Jan-17-1999	1,200	24.3
Jan-18-1999	1,260	25.8
Jan-19-1999	1,330	26.5
Jan-20-1999	1,390	25.6
Jan-21-1999	1,460	29.2
Jan-22-1999	1,610	27.8
Jan-23-1999	2,280	28.8
Jan-24-1999	2,730	27.4
Jan-25-1999	2,950	30.4
Jan-26-1999	2,990	31.8
Jan-27-1999	2,950	30.9
Jan-28-1999	2,440	34.9

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-29-1999	2,180	33.8
Jan-30-1999	2,030	35.8
Jan-31-1999	1,760	38.9
Feb-01-1999	1,640	42.7
Feb-02-1999	1,590	44.5
Feb-03-1999	1,550	42.6
Feb-04-1999	1,500	42.6
Feb-05-1999	1,450	44.9
Feb-06-1999	1,410	44.5
Feb-07-1999	1,400	43.2
Feb-08-1999	1,440	47.3
Feb-09-1999	1,720	57.9
Feb-10-1999	3,120	71.5
Feb-11-1999	4,350	67.8
Feb-12-1999	4,910	58.0
Feb-13-1999	4,830	67.4
Feb-14-1999	4,170	63.2
Feb-15-1999	3,390	61.4
Feb-16-1999	3,060	61.7
Feb-17-1999	2,920	65.8
Feb-18-1999	2,890	65.3
Feb-19-1999	3,110	67.4
Feb-20-1999	3,320	68.0
Feb-21-1999	3,740	65.9
Feb-22-1999	4,120	69.6
Feb-23-1999	4,000	69.2
Feb-24-1999	3,740	66.9
Feb-25-1999	3,320	68.4
Feb-26-1999	3,070	69.8
Feb-27-1999	2,920	69.1
Feb-28-1999	2,760	60.5
Mar-01-1999	2,420	61.6
Mar-02-1999	2,310	61.2
Mar-03-1999	2,300	58.5
Mar-04-1999	2,330	63.3
Mar-05-1999	2,500	61.0
Mar-06-1999	2,430	61.6
Mar-07-1999	2,350	59.0
Mar-08-1999	2,290	61.8
Mar-09-1999	2,240	61.5
Mar-10-1999	2,140	60.4
Mar-11-1999	2,070	60.0
Mar-12-1999	2,080	58.1
Mar-13-1999	2,020	54.4
Mar-14-1999	1,770	56.7
Mar-15-1999	1,700	60.5
Mar-16-1999	1,650	61.7
Mar-17-1999	1,670	55.9
Mar-18-1999	1,690	57.4
Mar-19-1999	1,580	54.6

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-20-1999	1,560	55.2
Mar-21-1999	1,530	57.1
Mar-22-1999	1,490	56.2
Mar-23-1999	1,440	52.6
Mar-24-1999	1,420	51.6
Mar-25-1999	1,550	53.5
Mar-26-1999	1,640	54.0
Mar-27-1999	1,580	51.4
Mar-28-1999	1,500	45.5
Mar-29-1999	1,420	45.3
Mar-30-1999	1,350	43.3
Mar-31-1999	1,250	39.9
Apr-01-1999	1,170	37.3
Apr-02-1999	1,080	39.8
Apr-03-1999	1,040	40.9
Apr-04-1999	1,040	43.8 e
Apr-05-1999	1,030	43.3
Apr-06-1999	1,060	39.4
Apr-07-1999	1,070	38.2
Apr-08-1999	1,110	37.6
Apr-09-1999	1,190	36.5
Apr-10-1999	1,380	35.1
Apr-11-1999	1,530	36.1
Apr-12-1999	1,580	38.9
Apr-13-1999	1,980	38.3
Apr-14-1999	2,250	37.3
Apr-15-1999	2,330	26.6
Apr-16-1999	2,290	20.7 e
Apr-17-1999	2,290	31.9 e
Apr-18-1999	2,420	29.7 e
Apr-19-1999	2,520	29.2 e
Apr-20-1999	2,460	30.2
Apr-21-1999	2,460	30.9
Apr-22-1999	2,540	28.1
Apr-23-1999	2,870	29.3
Apr-24-1999	3,050	33.0
Apr-25-1999	3,090	33.5
Apr-26-1999	2,890	36.0
Apr-27-1999	2,480	36.7
Apr-28-1999	2,210	36.3
Apr-29-1999	1,900	35.0
Apr-30-1999	1,790	38.1
May-01-1999	1,710	41.5
May-02-1999	1,920	42.9
May-03-1999	2,100	41.3
May-04-1999	2,050	38.7
May-05-1999	2,070	40.0
May-06-1999	1,950	42.0
May-07-1999	1,920	44.1
May-08-1999	2,120	45.1

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-09-1999	2,130	45.7
May-10-1999	2,070	51.0
May-11-1999	1,870	46.1
May-12-1999	1,720	42.2
May-13-1999	1,690	41.1
May-14-1999	1,600	49.1
May-15-1999	1,500	50.8
May-16-1999	1,170	53.5
May-17-1999	1,060	57.7
May-18-1999	975	52.6
May-19-1999	910	53.2
May-20-1999	853	48.6
May-21-1999	822	49.9
May-22-1999	750	48.8
May-23-1999	764	51.3
May-24-1999	903	54.7
May-25-1999	907	58.2
May-26-1999	890	55.5
May-27-1999	870	51.1
May-28-1999	808	43.3
May-29-1999	745	45.5
May-30-1999	780	52.1
May-31-1999	756	54.4
Jun-01-1999	735	58.0
Jun-02-1999	735	51.0
Jun-03-1999	714	46.0
Jun-04-1999	713	49.0
Jun-05-1999	736	52.0
Jun-06-1999	764	56.0
Jun-07-1999	903	60.0
Jun-08-1999	898	64.0
Jun-09-1999	863	66.0
Jun-10-1999	840	66.0
Jun-11-1999	751	72.0
Jun-12-1999	688	68.0
Jun-13-1999	653	65.0
Jun-14-1999	745	65.0
Jun-15-1999	735	64.0
Jun-16-1999	690	63.0
Jun-17-1999	598	63.0
Jun-18-1999	537	67.0
Jun-19-1999	540	68.0
Jun-20-1999	563	68.0
Jun-21-1999	673	68.0
Jun-22-1999	594	66.0
Jun-23-1999	568	59.0
Jun-24-1999	585	45.0
Jun-25-1999	613	53.0
Jun-26-1999	577	61.0
Jun-27-1999	648	57.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-28-1999	652	65.0
Jun-29-1999	640	59.0 e
Jun-30-1999	561	57.0 e
Jul-01-1999	527	54.0
Jul-02-1999	501	55.0
Jul-03-1999	520	57.0
Jul-04-1999	523	58.0
Jul-05-1999	598	65.0
Jul-06-1999	607	69.0
Jul-07-1999	610	66.0
Jul-08-1999	596	70.0
Jul-09-1999	597	73.0
Jul-10-1999	569	66.0
Jul-11-1999	575	62.0
Jul-12-1999	558	65.0
Jul-13-1999	523	64.0
Jul-14-1999	503	59.0
Jul-15-1999	518	57.0
Jul-16-1999	519	60.0
Jul-17-1999	514	62.0 e
Jul-18-1999	533	64.0 e
Jul-19-1999	580	67.0 e
Jul-20-1999	568	62.0
Jul-21-1999	576	65.0
Jul-22-1999	565	60.0
Jul-23-1999	510	63.0
Jul-24-1999	531	66.0
Jul-25-1999	562	68.0
Jul-26-1999	631	68.0
Jul-27-1999	668	68.0
Jul-28-1999	660	58.0
Jul-29-1999	584	58.0
Jul-30-1999	606	59.0
Jul-31-1999	633	64.0
Aug-01-1999	652	64.0
Aug-02-1999	703	68.0
Aug-03-1999	710	70.0
Aug-04-1999	718	63.0
Aug-05-1999	675	59.0
Aug-06-1999	590	59.0
Aug-07-1999	600	61.0
Aug-08-1999	635	66.0
Aug-09-1999	661	67.0
Aug-10-1999	689	67.0
Aug-11-1999	653	60.0
Aug-12-1999	604	56.0
Aug-13-1999	548	56.0
Aug-14-1999	583	57.0
Aug-15-1999	587	60.0
Aug-16-1999	587	56.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-17-1999	557	54.0
Aug-18-1999	556	56.0
Aug-19-1999	533	53.0
Aug-20-1999	527	55.0
Aug-21-1999	560	58.0
Aug-22-1999	632	58.0
Aug-23-1999	659	60.0
Aug-24-1999	605	67.0
Aug-25-1999	579	68.0
Aug-26-1999	509	76.0
Aug-27-1999	549	81.0
Aug-28-1999	616	81.0
Aug-29-1999	630	82.0
Aug-30-1999	677	73.0
Aug-31-1999	677	62.0
Sep-01-1999	668	64.0
Sep-02-1999	631	56.0
Sep-03-1999	614	52.0
Sep-04-1999	631	55.0
Sep-05-1999	615	55.0
Sep-06-1999	635	54.0
Sep-07-1999	544	52.0
Sep-08-1999	541	48.0
Sep-09-1999	546	40.0
Sep-10-1999	530	34.0
Sep-11-1999	530	36.0
Sep-12-1999	583	39.0
Sep-13-1999	662	32.0
Sep-14-1999	623	36.0
Sep-15-1999	587	46.0
Sep-16-1999	555	46.0
Sep-17-1999	596	39.0
Sep-18-1999	613	35.0
Sep-19-1999	591	33.0
Sep-20-1999	581	31.0
Sep-21-1999	622	34.0
Sep-22-1999	602	36.0
Sep-23-1999	538	35.0
Sep-24-1999	491	37.0
Sep-25-1999	458	38.0
Sep-26-1999	530	36.0
Sep-27-1999	583	31.0
Sep-28-1999	543	27.0
Sep-29-1999	558	28.0
Sep-30-1999	562	25.0
Oct-01-1999	583	26.0
Oct-02-1999	595	31.0
Oct-03-1999	641	35.0
Oct-04-1999	689	38.0
Oct-05-1999	654	38.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-06-1999	683	38.0
Oct-07-1999	678	37.0
Oct-08-1999	694	37.0
Oct-09-1999	713	34.0
Oct-10-1999	734	32.0
Oct-11-1999	745	33.0
Oct-12-1999	621	33.0
Oct-13-1999	611	34.0
Oct-14-1999	626	32.0
Oct-15-1999	678	29.0
Oct-16-1999	742	28.0
Oct-17-1999	936	30.0
Oct-18-1999	1,080	29.0
Oct-19-1999	1,120	28.0
Oct-20-1999	1,160	28.0
Oct-21-1999	1,200	26.0
Oct-22-1999	1,090	27.0
Oct-23-1999	976	26.0
Oct-24-1999	999	27.0
Oct-25-1999	1,040	29.0
Oct-26-1999	963	28.0
Oct-27-1999	961	26.0
Oct-28-1999	976	28.0
Oct-29-1999	997	29.0
Oct-30-1999	994	29.0
Oct-31-1999	980	28.0
Nov-01-1999	981	30.0
Nov-02-1999	964	31.0
Nov-03-1999	969	33.0
Nov-04-1999	940	22.0
Nov-05-1999	937	31.0
Nov-06-1999	917	30.0
Nov-07-1999	903	29.0
Nov-08-1999	944	34.0
Nov-09-1999	950	32.0
Nov-10-1999	937	31.0
Nov-11-1999	962	30.0
Nov-12-1999	976	31.0
Nov-13-1999	1,000	29.0
Nov-14-1999	988	29.0
Nov-15-1999	954	28.0
Nov-16-1999	934	28.0
Nov-17-1999	914	27.0
Nov-18-1999	907	29.0
Nov-19-1999	846	30.0
Nov-20-1999	812	30.0
Nov-21-1999	800	28.0
Nov-22-1999	787	26.0
Nov-23-1999	762	25.0
Nov-24-1999	736	24.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-25-1999	733	23.0
Nov-26-1999	733	27.0
Nov-27-1999	728	29.0
Nov-28-1999	738	30.0
Nov-29-1999	769	29.0
Nov-30-1999	811	29.0
Dec-01-1999	805	26.0
Dec-02-1999	781	27.0
Dec-03-1999	766	27.0
Dec-04-1999	781	30.0
Dec-05-1999	792	26.0
Dec-06-1999	775	24.0
Dec-07-1999	750	24.0
Dec-08-1999	736	23.0
Dec-09-1999	723	22.0
Dec-10-1999	707	23.0
Dec-11-1999	700	24.0
Dec-12-1999	692	23.0
Dec-13-1999	691	22.0
Dec-14-1999	680	22.0
Dec-15-1999	669	22.0
Dec-16-1999	666	21.0
Dec-17-1999	640	22.0
Dec-18-1999	637	22.0
Dec-19-1999	634	22.0
Dec-20-1999	671	22.0
Dec-21-1999	666	21.0
Dec-22-1999	633	21.0
Dec-23-1999	620	21.0
Dec-24-1999	623	21.0
Dec-25-1999	621	19.0
Dec-26-1999	622	19.0
Dec-27-1999	612	20.0
Dec-28-1999	612	22.0
Dec-29-1999	618	24.0
Dec-30-1999	663	22.0
Dec-31-1999	703	22.0
Jan-01-2000	723	23.0
Jan-02-2000	751	21.0
Jan-03-2000	743	21.0
Jan-04-2000	723	21.0
Jan-05-2000	712	20.0
Jan-06-2000	687	21.0
Jan-07-2000	663	20.0
Jan-08-2000	678	20.0
Jan-09-2000	729	20.0
Jan-10-2000	727	20.0
Jan-11-2000	709	20.0
Jan-12-2000	694	23.0
Jan-13-2000	682	22.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-14-2000	695	21.0
Jan-15-2000	712	22.0
Jan-16-2000	752	23.0
Jan-17-2000	789	24.0
Jan-18-2000	859	27.0
Jan-19-2000	856	35.0
Jan-20-2000	911	39.0
Jan-21-2000	922	31.0
Jan-22-2000	921	29.0
Jan-23-2000	963	31.0
Jan-24-2000	1,100	37.0
Jan-25-2000	1,240	47.0
Jan-26-2000	1,400	49.0
Jan-27-2000	1,770	40.0
Jan-28-2000	1,880	34.0
Jan-29-2000	1,770	34.0
Jan-30-2000	1,590	34.0
Jan-31-2000	1,450	36.0
Feb-01-2000	1,380	36.0
Feb-02-2000	1,320	36.0
Feb-03-2000	1,270	35.0
Feb-04-2000	1,200	38.0
Feb-05-2000	1,150	39.0
Feb-06-2000	1,140	43.0
Feb-07-2000	1,080	44.0
Feb-08-2000	1,030	46.0
Feb-09-2000	1,010	51.0
Feb-10-2000	1,010	52.0
Feb-11-2000	1,000	48.0
Feb-12-2000	1,100	48.0
Feb-13-2000	1,640	50.0
Feb-14-2000	3,060	56.0
Feb-15-2000	3,780	66.0
Feb-16-2000	4,950	63.0
Feb-17-2000	5,790	66.0
Feb-18-2000	6,270	73.0
Feb-19-2000	6,150	68.0
Feb-20-2000	5,750	63.0
Feb-21-2000	5,280	69.0
Feb-22-2000	5,030	65.0
Feb-23-2000	5,310	60.0
Feb-24-2000	5,590	67.0
Feb-25-2000	5,820	61.0
Feb-26-2000	6,000	54.0
Feb-27-2000	5,860	67.0
Feb-28-2000	5,670	73.0
Feb-29-2000	6,060	72.0
Mar-01-2000	6,260	71.0
Mar-02-2000	6,550	75.0
Mar-03-2000	6,590	75.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-04-2000	6,300	73.0
Mar-05-2000	5,950	68.0
Mar-06-2000	5,850	70.0
Mar-07-2000	6,170	75.0
Mar-08-2000	6,220	68.0
Mar-09-2000	6,200	62.0
Mar-10-2000	6,250	59.0
Mar-11-2000	6,310	54.0
Mar-12-2000	6,100	49.0
Mar-13-2000	5,750	51.0
Mar-14-2000	5,390	49.0
Mar-15-2000	5,050	49.0
Mar-16-2000	4,840	49.0
Mar-17-2000	4,370	48.0
Mar-18-2000	4,030	50.0
Mar-19-2000	3,900	47.0
Mar-20-2000	3,840	45.0
Mar-21-2000	3,690	46.0
Mar-22-2000	3,540	50.0
Mar-23-2000	3,250	46.0
Mar-24-2000	2,900	46.0
Mar-25-2000	2,680	46.0
Mar-26-2000	2,400	44.0
Mar-27-2000	1,950	42.0
Mar-28-2000	1,740	46.0
Mar-29-2000	1,600	45.0
Mar-30-2000	1,520	41.0
Mar-31-2000	1,390	40 e
Apr-01-2000	1,270	42.0
Apr-02-2000	1,160	43.0
Apr-03-2000	1,120	44.0
Apr-04-2000	1,100	42.0
Apr-05-2000	1,090	45.0
Apr-06-2000	1,040	46.0
Apr-07-2000	1,080	40 e
Apr-08-2000	1,030	38 e
Apr-09-2000	965	41 e
Apr-10-2000	951	39 e
Apr-11-2000	932	42 e
Apr-12-2000	874	38 e
Apr-13-2000	805	37 e
Apr-14-2000	781	35.0
Apr-15-2000	817	38.0
Apr-16-2000	909	41.0
Apr-17-2000	1,150	45 e
Apr-18-2000	1,400	50 e
Apr-19-2000	1,640	76 e
Apr-20-2000	2,560	72 e
Apr-21-2000	3,120	57 e
Apr-22-2000	3,110	54.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-23-2000	3,050	48.0
Apr-24-2000	2,970	44.0
Apr-25-2000	2,930	44.0
Apr-26-2000	2,810	43.0
Apr-27-2000	2,600	41.0
Apr-28-2000	2,430	38.0
Apr-29-2000	2,380	39.0
Apr-30-2000	2,370	41.0
May-01-2000	2,390	40.0
May-02-2000	2,270	41.0
May-03-2000	1,860	40.0
May-04-2000	1,760	45.0
May-05-2000	1,630	45.0
May-06-2000	1,520	47.0
May-07-2000	1,550	48.0
May-08-2000	1,680	54.0
May-09-2000	1,730	59.0
May-10-2000	1,720	56.0
May-11-2000	1,710	54.0
May-12-2000	1,710	53.0
May-13-2000	1,710	47.0
May-14-2000	1,440	42.0
May-15-2000	1,250	41.0
May-16-2000	1,230	40.0
May-17-2000	1,190	39.0
May-18-2000	1,160	41.0
May-19-2000	1,150	42.0
May-20-2000	1,190	38.0
May-21-2000	1,120	37.0
May-22-2000	1,100	39.0
May-23-2000	1,060	39.0
May-24-2000	1,020	39.0
May-25-2000	974	46.0
May-26-2000	926	50.0
May-27-2000	943	52.0
May-28-2000	900	52.0
May-29-2000	851	57.0
May-30-2000	796	61.0
May-31-2000	750	53.0
Jun-01-2000	800	51.0
Jun-02-2000	791	53.0
Jun-03-2000	762	55.0
Jun-04-2000	693	55.0
Jun-05-2000	687	57.0
Jun-06-2000	716	56.0
Jun-07-2000	720	59.0
Jun-08-2000	726	60.0
Jun-09-2000	779	67.0
Jun-10-2000	830	75 e
Jun-11-2000	835	75 e

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-12-2000	895	75 e
Jun-13-2000	825	71 e
Jun-14-2000	827	69.0
Jun-15-2000	808	66.0
Jun-16-2000	702	63.0
Jun-17-2000	679	60.0
Jun-18-2000	745	59.0
Jun-19-2000	829	57.0
Jun-20-2000	768	55.0
Jun-21-2000	697	59.0
Jun-22-2000	674	61.0
Jun-23-2000	615	61.0
Jun-24-2000	605	58.0
Jun-25-2000	575	58.0
Jun-26-2000	723	60.0
Jun-27-2000	709	62.0
Jun-28-2000	632	57.0
Jun-29-2000	644	56.0
Jun-30-2000	622	61 e
Jul-01-2000	582	58 e
Jul-02-2000	628	57 e
Jul-03-2000	693	57 e
Jul-04-2000	690	58.0
Jul-05-2000	743	57.0
Jul-06-2000	765	62.0
Jul-07-2000	722	62.0
Jul-08-2000	726	64.0
Jul-09-2000	740	66.0
Jul-10-2000	778	67.0
Jul-11-2000	751	64.0
Jul-12-2000	691	67.0
Jul-13-2000	695	62.0
Jul-14-2000	679	60.0
Jul-15-2000	659	59.0
Jul-16-2000	646	63.0
Jul-17-2000	712	59.0
Jul-18-2000	695	58.0
Jul-19-2000	682	56.0
Jul-20-2000	650	57.0
Jul-21-2000	642	58.0
Jul-22-2000	664	58.0
Jul-23-2000	634	62.0
Jul-24-2000	664	64.0
Jul-25-2000	604	63.0
Jul-26-2000	643	57.0
Jul-27-2000	629	55.0
Jul-28-2000	584	52.0
Jul-29-2000	601	52.0
Jul-30-2000	658	53.0
Jul-31-2000	727	56.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-01-2000	695	57.0
Aug-02-2000	668	55.0
Aug-03-2000	632	60.0
Aug-04-2000	614	59.0
Aug-05-2000	561	58 e
Aug-06-2000	596	54 e
Aug-07-2000	617	53 e
Aug-08-2000	642	57.0
Aug-09-2000	664	55.0
Aug-10-2000	632	57.0
Aug-11-2000	615	56.0
Aug-12-2000	612	56.0
Aug-13-2000	657	54.0
Aug-14-2000	686	52.0
Aug-15-2000	644	50.0
Aug-16-2000	608	50.0
Aug-17-2000	609	49.0
Aug-18-2000	556	55.0
Aug-19-2000	541	67.0
Aug-20-2000	616	66.0
Aug-21-2000	661	63.0
Aug-22-2000	683	57.0
Aug-23-2000	625	56.0
Aug-24-2000	623	58.0
Aug-25-2000	632	59.0
Aug-26-2000	695	55.0
Aug-27-2000	659	56.0
Aug-28-2000	628	57.0
Aug-29-2000	631	56.0
Aug-30-2000	629	59.0
Aug-31-2000	632	55.0
Sep-01-2000	654	51.0
Sep-02-2000	678	48.0
Sep-03-2000	747	48.0
Sep-04-2000	799	50.0
Sep-05-2000	758	50.0
Sep-06-2000	692	47.0
Sep-07-2000	644	46.0
Sep-08-2000	636	43.0
Sep-09-2000	610	41.0
Sep-10-2000	638	37.0
Sep-11-2000	685	31.0
Sep-12-2000	673	25.0
Sep-13-2000	683	22.0
Sep-14-2000	661	18.0
Sep-15-2000	603	19.0
Sep-16-2000	570	21.0
Sep-17-2000	571	22.0
Sep-18-2000	566	22.0
Sep-19-2000	548	21.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-20-2000	536	21.0
Sep-21-2000	491	23.0
Sep-22-2000	550	26.0
Sep-23-2000	564	28.0
Sep-24-2000	546	27.0
Sep-25-2000	578	23.0
Sep-26-2000	541	19.0
Sep-27-2000	556	18.0
Sep-28-2000	514	18.0
Sep-29-2000	488	19.0
Sep-30-2000	462	20.0
Oct-01-2000	458	18.0
Oct-02-2000	488	19.0
Oct-03-2000	460	19.0
Oct-04-2000	457	19.0
Oct-05-2000	515	21.0
Oct-06-2000	502	21.0
Oct-07-2000	529	20.0
Oct-08-2000	548	19.0
Oct-09-2000	632	17.0
Oct-10-2000	671	17.0
Oct-11-2000	788	24.0
Oct-12-2000	866	34.0
Oct-13-2000	904	33.0
Oct-14-2000	945	27.0
Oct-15-2000	910	25.0
Oct-16-2000	934	23.0
Oct-17-2000	1,180	21.0
Oct-18-2000	1,320	20.0
Oct-19-2000	1,400	21.0
Oct-20-2000	1,350	19.0
Oct-21-2000	1,270	17.0
Oct-22-2000	1,250	16.0
Oct-23-2000	1,530	16.0
Oct-24-2000	1,630	17.0
Oct-25-2000	1,580	15.0
Oct-26-2000	1,690	16.0
Oct-27-2000	1,810	19.0
Oct-28-2000	1,710	23.0
Oct-29-2000	1,600	22.0
Oct-30-2000	1,550	21.0
Oct-31-2000	1,480	19.0
Nov-01-2000	1,450	21.0
Nov-02-2000	1,450	20.0
Nov-03-2000	1,380	21.0
Nov-04-2000	1,320	25.0
Nov-05-2000	1,270	24.0
Nov-06-2000	1,210	20.0
Nov-07-2000	1,190	19.0
Nov-08-2000	1,170	19.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-09-2000	1,150	19.0
Nov-10-2000	1,110	18.0
Nov-11-2000	1,100	17.0
Nov-12-2000	1,080	18.0
Nov-13-2000	1,100	17.0
Nov-14-2000	1,080	17.0
Nov-15-2000	1,050	17.0
Nov-16-2000	1,040	19.0
Nov-17-2000	1,020	19.0
Nov-18-2000	989	19.0
Nov-19-2000	964	19.0
Nov-20-2000	980	18.0
Nov-21-2000	999	19.0
Nov-22-2000	984	19.0
Nov-23-2000	973	22.0
Nov-24-2000	994	21.0
Nov-25-2000	1,020	20.0
Nov-26-2000	1,020	20.0
Nov-27-2000	1,020	22.0
Nov-28-2000	1,020	22.0
Nov-29-2000	1,020	22.0
Nov-30-2000	1,020	22.0
Dec-01-2000	1,010	24.0
Dec-02-2000	999	24.0
Dec-03-2000	985	24.0
Dec-04-2000	964	23.0
Dec-05-2000	953	23.0
Dec-06-2000	914	23.0
Dec-07-2000	882	24.0
Dec-08-2000	866	25.0
Dec-09-2000	896	24.0
Dec-10-2000	868	23.0
Dec-11-2000	841	24.0
Dec-12-2000	848	25.0
Dec-13-2000	861	24.0
Dec-14-2000	846	28.0
Dec-15-2000	842	28.0
Dec-16-2000	822	25.0
Dec-17-2000	818	23.0
Dec-18-2000	810	23.0
Dec-19-2000	804	23.0
Dec-20-2000	842	23.0
Dec-21-2000	841	24.0
Dec-22-2000	823	24.0
Dec-23-2000	804	24.0
Dec-24-2000	798	23.0
Dec-25-2000	811	23.0
Dec-26-2000	822	23.0
Dec-27-2000	814	23.0
Dec-28-2000	790	24.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-29-2000	770	22.0
Dec-30-2000	754	21.0
Dec-31-2000	730	21.0
Jan-01-2001	724	21.0
Jan-02-2001	703	20.0
Jan-03-2001	701	20.0
Jan-04-2001	680	21.0
Jan-05-2001	648	22.0
Jan-06-2001	648	22.0
Jan-07-2001	664	23.0
Jan-08-2001	703	26.0
Jan-09-2001	754	27.0
Jan-10-2001	841	26.0
Jan-11-2001	997	25.0
Jan-12-2001	1,110	32.0
Jan-13-2001	1,170	32.0
Jan-14-2001	1,160	28.0
Jan-15-2001	1,140	27.0
Jan-16-2001	1,090	25.0
Jan-17-2001	1,050	28.0
Jan-18-2001	1,010	27.0
Jan-19-2001	969	26.0
Jan-20-2001	952	26.0
Jan-21-2001	906	26.0
Jan-22-2001	882	27.0
Jan-23-2001	902	30.0
Jan-24-2001	914	33.0
Jan-25-2001	933	33.0
Jan-26-2001	1,070	34.0
Jan-27-2001	1,210	36.0
Jan-28-2001	1,250	36.0
Jan-29-2001	1,200	37.0
Jan-30-2001	1,110	35.0
Jan-31-2001	1,050	35.0
Feb-01-2001	1,000	37.0
Feb-02-2001	938	41.0
Feb-03-2001	894	43.0
Feb-04-2001	893	49.0
Feb-05-2001	892	51.0
Feb-06-2001	888	53.0
Feb-07-2001	875	58.0
Feb-08-2001	854	58.0
Feb-09-2001	841	52.0
Feb-10-2001	846	52.0
Feb-11-2001	926	55.0
Feb-12-2001	1,040	59.0
Feb-13-2001	1,170	64.0
Feb-14-2001	1,210	62.0
Feb-15-2001	1,180	61.0
Feb-16-2001	1,120	58.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-17-2001	1,040	55.0
Feb-18-2001	985	55.0
Feb-19-2001	963	58.0
Feb-20-2001	950	58.0
Feb-21-2001	951	58.0
Feb-22-2001	957	57.0
Feb-23-2001	979	57.0
Feb-24-2001	1,060	60.0
Feb-25-2001	1,350	63.0
Feb-26-2001	1,430	67.0
Feb-27-2001	1,520	63.0
Feb-28-2001	1,500	63.0
Mar-01-2001	1,400	63.0
Mar-02-2001	1,330	57.0
Mar-03-2001	1,310	57.0
Mar-04-2001	1,330	57.0
Mar-05-2001	1,800	60.0
Mar-06-2001	2,080	67.0
Mar-07-2001	2,510	79.0
Mar-08-2001	2,720	82.0
Mar-09-2001	2,720	76.0
Mar-10-2001	2,460	71.0
Mar-11-2001	2,140	67.0
Mar-12-2001	1,870	66.0
Mar-13-2001	1,710	65.0
Mar-14-2001	1,650	61.0
Mar-15-2001	1,580	58.0
Mar-16-2001	1,530	56.0
Mar-17-2001	1,450	56.0
Mar-18-2001	1,380	54.0
Mar-19-2001	1,330	54.0
Mar-20-2001	1,220	58.0
Mar-21-2001	1,120	55.0
Mar-22-2001	1,080	46.0
Mar-23-2001	1,030	41.0
Mar-24-2001	988	38.0
Mar-25-2001	984	38.0
Mar-26-2001	992	41.0
Mar-27-2001	961	45.0
Mar-28-2001	955	50.0
Mar-29-2001	973	52.0
Mar-30-2001	946	47.0
Mar-31-2001	872	43.0
Apr-01-2001	845	41.0
Apr-02-2001	853	40.0
Apr-03-2001	861	41.0
Apr-04-2001	846	38.0
Apr-05-2001	853	39.0
Apr-06-2001	898	38.0
Apr-07-2001	905	35.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-08-2001	888	35.0
Apr-09-2001	956	35.0
Apr-10-2001	969	37.0
Apr-11-2001	966	37.0
Apr-12-2001	965	38.0
Apr-13-2001	948	37.0
Apr-14-2001	926	35.0
Apr-15-2001	919	34.0
Apr-16-2001	891	34.0
Apr-17-2001	839	34.0
Apr-18-2001	819	34.0
Apr-19-2001	866	32.0
Apr-20-2001	1,130	31.0
Apr-21-2001	1,510	33.0
Apr-22-2001	1,730	38.0
Apr-23-2001	1,940	37.0
Apr-24-2001	1,980	33.0
Apr-25-2001	1,920	34.0
Apr-26-2001	1,890	32.0
Apr-27-2001	1,800	37.0
Apr-28-2001	1,750	35.0
Apr-29-2001	1,440	34.0
Apr-30-2001	1,280	36.0
May-01-2001	1,200	33.0
May-02-2001	1,180	30.0
May-03-2001	1,110	34.0
May-04-2001	1,070	31.0
May-05-2001	1,060	32.0
May-06-2001	1,080	35.0
May-07-2001	1,160	35.0
May-08-2001	1,310	38.0
May-09-2001	1,410	33.0
May-10-2001	1,550	35.0
May-11-2001	1,700	35.0
May-12-2001	1,720	36.0
May-13-2001	1,750	38.0
May-14-2001	1,780	43.0
May-15-2001	1,790	42.0
May-16-2001	1,810	40.0
May-17-2001	1,790	40.0
May-18-2001	1,640	40.0
May-19-2001	1,360	40.0
May-20-2001	1,140	40.0
May-21-2001	990	46.0
May-22-2001	840	49.0
May-23-2001	790	46.0
May-24-2001	755	45.0
May-25-2001	758	50.0
May-26-2001	753	49.0
May-27-2001	744	42.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-28-2001	774	42.0
May-29-2001	758	42.0
May-30-2001	736	46.0
May-31-2001	721	50.0
Jun-01-2001	678	51.0
Jun-02-2001	642	52.0
Jun-03-2001	640	54.0
Jun-04-2001	678	52.0
Jun-05-2001	684	54.0
Jun-06-2001	688	58.0
Jun-07-2001	648	56.0
Jun-08-2001	593	59.0
Jun-09-2001	569	57.0
Jun-10-2001	582	59.0
Jun-11-2001	583	59.0
Jun-12-2001	571	62.0
Jun-13-2001	593	59.0
Jun-14-2001	539	51.0
Jun-15-2001	524	49.0
Jun-16-2001	540	45.0
Jun-17-2001	522	44.0
Jun-18-2001	517	46.0
Jun-19-2001	526	50.0
Jun-20-2001	534	50.0
Jun-21-2001	512	49.0
Jun-22-2001	490	50.0
Jun-23-2001	470	52.0
Jun-24-2001	511	50.0
Jun-25-2001	529	49.0
Jun-26-2001	531	48.0
Jun-27-2001	528	50.0
Jun-28-2001	547	54.0
Jun-29-2001	558	52.0
Jun-30-2001	525	56.0
Jul-01-2001	503	57.0
Jul-02-2001	529	59.0
Jul-03-2001	518	59.0
Jul-04-2001	531	59.0
Jul-05-2001	505	59.0
Jul-06-2001	512	60.0
Jul-07-2001	522	66.0
Jul-08-2001	539	62.0
Jul-09-2001	570	62.0
Jul-10-2001	557	60.0
Jul-11-2001	511	58.0
Jul-12-2001	550	60.0
Jul-13-2001	555	60.0
Jul-14-2001	561	59.0
Jul-15-2001	555	57.0
Jul-16-2001	575	59.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-17-2001	559	59.0
Jul-18-2001	530	63.0
Jul-19-2001	536	59.0
Jul-20-2001	530	59.0
Jul-21-2001	535	57.0
Jul-22-2001	563	55.0
Jul-23-2001	582	58.0
Jul-24-2001	548	57.0
Jul-25-2001	547	54.0
Jul-26-2001	525	53.0
Jul-27-2001	484	54.0
Jul-28-2001	519	52.0
Jul-29-2001	507	52.0
Jul-30-2001	531	52.0
Jul-31-2001	532	55.0
Aug-01-2001	517	56.0
Aug-02-2001	506	59.0
Aug-03-2001	511	55.0
Aug-04-2001	523	56.0
Aug-05-2001	530	57.0
Aug-06-2001	540	61.0
Aug-07-2001	492	61.0
Aug-08-2001	428	59.0
Aug-09-2001	429	56.0
Aug-10-2001	434	56.0
Aug-11-2001	441	55.0
Aug-12-2001	464	51.0
Aug-13-2001	487	54.0
Aug-14-2001	506	56.0
Aug-15-2001	463	59.0
Aug-16-2001	453	61.0
Aug-17-2001	458	60.0
Aug-18-2001	497	58.0
Aug-19-2001	516	57.0
Aug-20-2001	546	57.0
Aug-21-2001	483	56.0
Aug-22-2001	468	53.0
Aug-23-2001	509	50.0
Aug-24-2001	533	52.0
Aug-25-2001	516	62.0
Aug-26-2001	510	55.0
Aug-27-2001	515	52.0
Aug-28-2001	506	53.0
Aug-29-2001	440	50.0
Aug-30-2001	401	54.0
Aug-31-2001	399	51.0
Sep-01-2001	423	51.0
Sep-02-2001	452	50.0
Sep-03-2001	463	39.0
Sep-04-2001	430	33.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-05-2001	385	32.0
Sep-06-2001	358	36.0
Sep-07-2001	386	34.0
Sep-08-2001	387	33.0
Sep-09-2001	411	36.0
Sep-10-2001	445	31.0
Sep-11-2001	398	26.0
Sep-12-2001	375	24.0
Sep-13-2001	327	19.0
Sep-14-2001	358	19.0
Sep-15-2001	378	15.0
Sep-16-2001	376	12.0
Sep-17-2001	396	11.0
Sep-18-2001	401	13.0
Sep-19-2001	360	15.0
Sep-20-2001	353	16.0
Sep-21-2001	341	16.0
Sep-22-2001	317	15.0
Sep-23-2001	325	13.0
Sep-24-2001	339	13.0
Sep-25-2001	372	11.0
Sep-26-2001	375	10.0
Sep-27-2001	364	9.0
Sep-28-2001	366	8.0
Sep-29-2001	383	9.0
Sep-30-2001	391	10.0
Oct-01-2001	393	11.0
Oct-02-2001	367	10.0
Oct-03-2001	355	9.0
Oct-04-2001	379	10.0
Oct-05-2001	412	13.0
Oct-06-2001	450	16.0
Oct-07-2001	437	21.0
Oct-08-2001	483	21.0
Oct-09-2001	477	22.0
Oct-10-2001	475	23.0
Oct-11-2001	457	27.0
Oct-12-2001	452	29.0
Oct-13-2001	458	22.0
Oct-14-2001	499	18.0
Oct-15-2001	558	19.0
Oct-16-2001	588	19.0
Oct-17-2001	621	17.0
Oct-18-2001	792	18.0
Oct-19-2001	984	17.0
Oct-20-2001	1,040	17.0
Oct-21-2001	1,080	20.0
Oct-22-2001	1,120	19.0
Oct-23-2001	1,110	18.0
Oct-24-2001	1,090	17.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-25-2001	1,130	15.0
Oct-26-2001	1,130	14.0
Oct-27-2001	1,150	15.0
Oct-28-2001	1,130	17.0
Oct-29-2001	1,120	17.0
Oct-30-2001	1,140	17.0
Oct-31-2001	1,170	18.0
Nov-01-2001	1,180	20.0
Nov-02-2001	1,130	19.0
Nov-03-2001	1,070	19.0
Nov-04-2001	1,060	20.0
Nov-05-2001	1,050	21.0
Nov-06-2001	1,020	21.0
Nov-07-2001	1,000	20.0
Nov-08-2001	1,010	20.0
Nov-09-2001	1,030	19.0
Nov-10-2001	1,080	17.0
Nov-11-2001	1,100	18.0
Nov-12-2001	1,120	22.0
Nov-13-2001	1,110	27.0
Nov-14-2001	1,130	37.0
Nov-15-2001	1,160	28.0
Nov-16-2001	1,180	24.0
Nov-17-2001	1,160	24.0
Nov-18-2001	1,140	24.0
Nov-19-2001	1,110	22.0
Nov-20-2001	1,070	21.0
Nov-21-2001	1,020	20.0
Nov-22-2001	990	21.0
Nov-23-2001	958	22.0
Nov-24-2001	930	21.0
Nov-25-2001	944	21.0
Nov-26-2001	989	23.0
Nov-27-2001	992	21.0
Nov-28-2001	1,020	21.0
Nov-29-2001	1,030	21.0
Nov-30-2001	978	22.0
Dec-01-2001	959	23.0
Dec-02-2001	986	22.0
Dec-03-2001	992	27.0
Dec-04-2001	1,030	28.0
Dec-05-2001	1,090	23.0
Dec-06-2001	1,130	20.0
Dec-07-2001	1,130	20.0
Dec-08-2001	1,100	20.0
Dec-09-2001	1,050	21.0
Dec-10-2001	1,020	22.0
Dec-11-2001	998	20.0
Dec-12-2001	985	20.0
Dec-13-2001	915	19.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-14-2001	871	23.0
Dec-15-2001	828	22.0
Dec-16-2001	795	22.0
Dec-17-2001	782	18.0
Dec-18-2001	769	17.0
Dec-19-2001	760	16.0
Dec-20-2001	771	16.0
Dec-21-2001	823	18.0
Dec-22-2001	839	17.0
Dec-23-2001	849	17.0
Dec-24-2001	852	15.0
Dec-25-2001	846	15.0
Dec-26-2001	826	15.0
Dec-27-2001	812	15.0
Dec-28-2001	808	16.0
Dec-29-2001	887	18.0
Dec-30-2001	1,220	26.0
Dec-31-2001	1,800	28.0
Jan-01-2002	2,020	25.0
Jan-02-2002	2,030	25.0
Jan-03-2002	2,010	29.0
Jan-04-2002	2,230	39.0
Jan-05-2002	2,270	31.0
Jan-06-2002	2,270	27.0
Jan-07-2002	1,960	26.0
Jan-08-2002	1,660	25.0
Jan-09-2002	1,470	25.0
Jan-10-2002	1,340	26.0
Jan-11-2002	1,250	24.0
Jan-12-2002	1,170	24.0
Jan-13-2002	1,090	24.0
Jan-14-2002	1,030	24.0
Jan-15-2002	985	25.0
Jan-16-2002	927	27.0
Jan-17-2002	882	29.0
Jan-18-2002	841	28.0
Jan-19-2002	810	30.0
Jan-20-2002	775	29.0
Jan-21-2002	772	27.0
Jan-22-2002	783	27.0
Jan-23-2002	758	25.0
Jan-24-2002	733	25.0
Jan-25-2002	726	25.0
Jan-26-2002	712	25.0
Jan-27-2002	702	28.0
Jan-28-2002	699	27.0
Jan-29-2002	709	28.0
Jan-30-2002	728	31.0
Jan-31-2002	740	28.0
Feb-01-2002	747	33.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-02-2002	744	40.0
Feb-03-2002	738	40.0
Feb-04-2002	774	42.0
Feb-05-2002	771	42.0
Feb-06-2002	793	41.0
Feb-07-2002	825	42.0
Feb-08-2002	799	49.0
Feb-09-2002	801	51.0
Feb-10-2002	829	50.0
Feb-11-2002	833	51.0
Feb-12-2002	812	51.0
Feb-13-2002	789	49.0
Feb-14-2002	758	51.0
Feb-15-2002	754	53.0
Feb-16-2002	763	50.0
Feb-17-2002	770	50.0
Feb-18-2002	787	52.0
Feb-19-2002	811	51.0
Feb-20-2002	871	49.0
Feb-21-2002	880	51.0
Feb-22-2002	861	52.0
Feb-23-2002	864	52.0
Feb-24-2002	862	55.0
Feb-25-2002	846	54.0
Feb-26-2002	821	56.0
Feb-27-2002	813	59.0
Feb-28-2002	805	61.0
Mar-01-2002	831	67.0
Mar-02-2002	839	64.0
Mar-03-2002	899	60.0
Mar-04-2002	887	59.0
Mar-05-2002	883	56.0
Mar-06-2002	894	57.0
Mar-07-2002	928	60.0
Mar-08-2002	954	61.0
Mar-09-2002	969	58.0
Mar-10-2002	1,000	57.0
Mar-11-2002	983	59.0
Mar-12-2002	937	60.0
Mar-13-2002	910	62.0
Mar-14-2002	861	60.0
Mar-15-2002	803	55.0
Mar-16-2002	805	57.0
Mar-17-2002	819	60.0
Mar-18-2002	890	66.0
Mar-19-2002	886	68.0
Mar-20-2002	898	64.0
Mar-21-2002	901	58.0
Mar-22-2002	868	54.0
Mar-23-2002	885	51.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-24-2002	871	48.0
Mar-25-2002	912	44.0
Mar-26-2002	869	43.0
Mar-27-2002	794	41.0
Mar-28-2002	782	40.0
Mar-29-2002	768	40.0
Mar-30-2002	719	38.0
Mar-31-2002	734	33.0
Apr-01-2002	696	34.0
Apr-02-2002	669	36.0
Apr-03-2002	647	34.0
Apr-04-2002	614	35.0
Apr-05-2002	580	34.0
Apr-06-2002	569	35.0
Apr-07-2002	630	37.0
Apr-08-2002	658	38.0
Apr-09-2002	627	37.0
Apr-10-2002	615	34.0
Apr-11-2002	603	34.0
Apr-12-2002	609	35.0
Apr-13-2002	633	38.0
Apr-14-2002	629	39.0
Apr-15-2002	670	40.0
Apr-16-2002	690	44.0
Apr-17-2002	710	43.0
Apr-18-2002	706	46.0
Apr-19-2002	754	50.0
Apr-20-2002	752	47.0
Apr-21-2002	781	46.0
Apr-22-2002	787	48.0
Apr-23-2002	822	47.0
Apr-24-2002	837	44.0
Apr-25-2002	810	42.0
Apr-26-2002	776	44.0
Apr-27-2002	814	46.0
Apr-28-2002	836	46.0
Apr-29-2002	851	46.0
Apr-30-2002	813	46.0
May-01-2002	878	46.0
May-02-2002	1,090	43.0
May-03-2002	1,320	40.0
May-04-2002	1,440	39.0
May-05-2002	1,520	37.0
May-06-2002	1,550	33.0
May-07-2002	1,530	32.0
May-08-2002	1,500	36.0
May-09-2002	1,330	35.0
May-10-2002	1,250	34.0
May-11-2002	1,190	34.0
May-12-2002	1,230	31.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-13-2002	1,250	32.0
May-14-2002	1,070	32.0
May-15-2002	936	35.0
May-16-2002	781	36.0
May-17-2002	671	35.0
May-18-2002	605	33.0
May-19-2002	572	36.0
May-20-2002	650	42.0
May-21-2002	650	53.0
May-22-2002	652	57.0
May-23-2002	637	57.0
May-24-2002	601	56.0
May-25-2002	604	52.0
May-26-2002	642	54.0
May-27-2002	667	57.0
May-28-2002	620	53.0
May-29-2002	577	54.0
May-30-2002	550	57.0
May-31-2002	487	61.0
Jun-01-2002	449	55.0
Jun-02-2002	489	51.0
Jun-03-2002	564	51.0
Jun-04-2002	593	52.0
Jun-05-2002	583	52.0
Jun-06-2002	508	48.0
Jun-07-2002	457	51.0
Jun-08-2002	424	52.0
Jun-09-2002	422	56.0
Jun-10-2002	458	51.0
Jun-11-2002	425	57.0
Jun-12-2002	419	53.0
Jun-13-2002	422	51.0
Jun-14-2002	461	55.0
Jun-15-2002	491	59.0
Jun-16-2002	512	62.0
Jun-17-2002	542	64.0
Jun-18-2002	476	69.0
Jun-19-2002	464	69.0
Jun-20-2002	451	66.0
Jun-21-2002	446	66.0
Jun-22-2002	446	66.0
Jun-23-2002	495	63.0
Jun-24-2002	482	60.0
Jun-25-2002	470	62.0
Jun-26-2002	518	54.0
Jun-27-2002	524	43.0
Jun-28-2002	496	46.0
Jun-29-2002	496	45.0
Jun-30-2002	493	47.0
Jul-01-2002	511	46.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-02-2002	465	52.0
Jul-03-2002	421	63.0
Jul-04-2002	419	58.0
Jul-05-2002	399	58.0
Jul-06-2002	430	58.0
Jul-07-2002	473	58.0
Jul-08-2002	475	60.0
Jul-09-2002	454	58.0
Jul-10-2002	413	55.0
Jul-11-2002	376	58.0
Jul-12-2002	378	55.0
Jul-13-2002	313	52.0
Jul-14-2002	379	53.0
Jul-15-2002	369	55.0
Jul-16-2002	361	55.0
Jul-17-2002	318	54.0
Jul-18-2002	352	54.0
Jul-19-2002	342	54.0
Jul-20-2002	398	55.0
Jul-21-2002	401	56.0
Jul-22-2002	392	56.0
Jul-23-2002	398	53.0
Jul-24-2002	427	51.0
Jul-25-2002	435	47.0
Jul-26-2002	444	46.0
Jul-27-2002	444	50.0
Jul-28-2002	460	45.0
Jul-29-2002	460	43.0
Jul-30-2002	447	43.0
Jul-31-2002	455	44.0
Aug-01-2002	436	49.0
Aug-02-2002	411	57.0
Aug-03-2002	387	57.0
Aug-04-2002	409	58.0
Aug-05-2002	436	59.0
Aug-06-2002	424	58.0
Aug-07-2002	443	55.0
Aug-08-2002	429	57.0
Aug-09-2002	400	55.0
Aug-10-2002	351	52.0
Aug-11-2002	364	51.0
Aug-12-2002	394	55.0
Aug-13-2002	342	58.0
Aug-14-2002	347	61.0
Aug-15-2002	338	60.0
Aug-16-2002	351	63.0
Aug-17-2002	370	62.0
Aug-18-2002	434	60.0
Aug-19-2002	478	58.0
Aug-20-2002	463	58.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-21-2002	422	58.0
Aug-22-2002	451	56.0
Aug-23-2002	403	58.0
Aug-24-2002	438	57.0
Aug-25-2002	426	53.0
Aug-26-2002	495	55.0
Aug-27-2002	456	52.0
Aug-28-2002	425	47.0
Aug-29-2002	394	47.0
Aug-30-2002	382	45.0
Aug-31-2002	351	46.0
Sep-01-2002	348	48.0
Sep-02-2002	403	49.0
Sep-03-2002	342	44.0
Sep-04-2002	331	43.0
Sep-05-2002	323	49.0
Sep-06-2002	343	44.0
Sep-07-2002	355	42.0
Sep-08-2002	369	41.0
Sep-09-2002	346	40.0
Sep-10-2002	354	36.0
Sep-11-2002	364	43.0
Sep-12-2002	383	39.0
Sep-13-2002	350	30.0
Sep-14-2002	358	27.0
Sep-15-2002	399	29.0
Sep-16-2002	391	31.0
Sep-17-2002	333	32.0
Sep-18-2002	331	34.0
Sep-19-2002	366	28.0
Sep-20-2002	322	25.0
Sep-21-2002	326	23.0
Sep-22-2002	307	25.0
Sep-23-2002	345	23.0
Sep-24-2002	344	22.0
Sep-25-2002	341	21.0
Sep-26-2002	337	18.0
Sep-27-2002	311	19.0
Sep-28-2002	294	22.0
Sep-29-2002	352	19.0
Sep-30-2002	378	16.0
Oct-01-2002	365	19.0
Oct-02-2002	371	17.0
Oct-03-2002	346	16.0
Oct-04-2002	384	13.0
Oct-05-2002	379	13.0
Oct-06-2002	359	14.0
Oct-07-2002	370	16.0
Oct-08-2002	360	17.0
Oct-09-2002	345	19.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-10-2002	307	22.0
Oct-11-2002	308	18.0
Oct-12-2002	319	22.0
Oct-13-2002	371	19.0
Oct-14-2002	404	20.0
Oct-15-2002	405	18.0
Oct-16-2002	411	20.0
Oct-17-2002	572	22.0
Oct-18-2002	744	28.0
Oct-19-2002	893	27.0
Oct-20-2002	956	23.0
Oct-21-2002	1,010	22.0
Oct-22-2002	1,060	22.0
Oct-23-2002	1,100	23.0
Oct-24-2002	1,110	23.0
Oct-25-2002	1,090	22.0
Oct-26-2002	1,020	22.0
Oct-27-2002	929	22.0
Oct-28-2002	870	22.0
Oct-29-2002	828	21.0
Oct-30-2002	804	21.0
Oct-31-2002	779	22.0
Nov-01-2002	743	20.0
Nov-02-2002	700	19.0
Nov-03-2002	682	20.0
Nov-04-2002	693	21.0
Nov-05-2002	720	22.0
Nov-06-2002	730	22.0
Nov-07-2002	741	17.0
Nov-08-2002	857	24.0
Nov-09-2002	954	27.0
Nov-10-2002	1,060	29.0
Nov-11-2002	1,070	27.0
Nov-12-2002	1,050	21.0
Nov-13-2002	1,020	23.0
Nov-14-2002	982	21.0
Nov-15-2002	942	21.0
Nov-16-2002	909	18.0
Nov-17-2002	888	21.0
Nov-18-2002	866	20.0
Nov-19-2002	856	20.0
Nov-20-2002	837	19.0
Nov-21-2002	820	15.0
Nov-22-2002	789	14.0
Nov-23-2002	767	14.0
Nov-24-2002	753	13.0
Nov-25-2002	720	13.0
Nov-26-2002	690	12.0
Nov-27-2002	675	12.0
Nov-28-2002	673	15.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-29-2002	668	19.0
Nov-30-2002	659	19.0
Dec-01-2002	648	21.0
Dec-02-2002	654	21.0
Dec-03-2002	646	21.0
Dec-04-2002	651	21.0
Dec-05-2002	663	22.0
Dec-06-2002	671	23.0
Dec-07-2002	671	24.0
Dec-08-2002	696	23.0
Dec-09-2002	702	23.0
Dec-10-2002	704	22.0
Dec-11-2002	709	22.0
Dec-12-2002	714	22.0
Dec-13-2002	728	21.0
Dec-14-2002	750	20.0
Dec-15-2002	778	21.0
Dec-16-2002	877	26.0
Dec-17-2002	1,250	31.0
Dec-18-2002	1,210	35.0
Dec-19-2002	1,340	27.0
Dec-20-2002	1,660	33.0
Dec-21-2002	1,800	30.0
Dec-22-2002	1,760	26.0
Dec-23-2002	1,690	20.0
Dec-24-2002	1,630	20.0
Dec-25-2002	1,540	18.0
Dec-26-2002	1,440	16.0
Dec-27-2002	1,350	14.0
Dec-28-2002	1,310	11.0
Dec-29-2002	1,280	15.0
Dec-30-2002	1,300	16.0
Dec-31-2002	1,240	19.0
Jan-01-2003	1,330	26.0
Jan-02-2003	1,300	27.0
Jan-03-2003	1,280	24.0
Jan-04-2003	1,250	21.0
Jan-05-2003	1,210	28.0
Jan-06-2003	1,130	26 e
Jan-07-2003	1,040	28 e
Jan-08-2003	982	28 e
Jan-09-2003	940	23.0
Jan-10-2003	923	24.0
Jan-11-2003	932	27.0
Jan-12-2003	1,040	27.0
Jan-13-2003	1,150	24.0
Jan-14-2003	1,130	24.0
Jan-15-2003	1,080	23.0
Jan-16-2003	1,050	20.0
Jan-17-2003	1,010	19.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-18-2003	980	15.0
Jan-19-2003	953	15.0
Jan-20-2003	912	20.0
Jan-21-2003	879	20.0
Jan-22-2003	863	21.0
Jan-23-2003	855	22.0
Jan-24-2003	844	23.0
Jan-25-2003	828	20.0
Jan-26-2003	819	19.0
Jan-27-2003	823	18.0
Jan-28-2003	821	21.0
Jan-29-2003	812	20.0
Jan-30-2003	819	24.0
Jan-31-2003	807	26.0
Feb-01-2003	809	32.0
Feb-02-2003	812	40.0
Feb-03-2003	813	37 e
Feb-04-2003	837	36 e
Feb-05-2003	841	36 e
Feb-06-2003	830	36 e
Feb-07-2003	815	42.0
Feb-08-2003	801	48 e
Feb-09-2003	791	49 e
Feb-10-2003	791	51 e
Feb-11-2003	782	53.0
Feb-12-2003	816	54.0
Feb-13-2003	810	59.0
Feb-14-2003	804	61.0
Feb-15-2003	836	65.0
Feb-16-2003	855	66.0
Feb-17-2003	877	62.0
Feb-18-2003	890	57.0
Feb-19-2003	904	56.0
Feb-20-2003	932	58.0
Feb-21-2003	946	60.0
Feb-22-2003	927	59.0
Feb-23-2003	940	63.0
Feb-24-2003	986	62.0
Feb-25-2003	1,010	65.0
Feb-26-2003	1,020	75.0
Feb-27-2003	1,040	82.0
Feb-28-2003	1,060	77.0
Mar-01-2003	1,070	73.0
Mar-02-2003	1,100	70.0
Mar-03-2003	1,130	69.0
Mar-04-2003	1,090	66.0
Mar-05-2003	1,110	68.0
Mar-06-2003	1,130	69.0
Mar-07-2003	1,170	71.0
Mar-08-2003	1,150	68.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-09-2003	1,140	66.0
Mar-10-2003	1,130	64.0
Mar-11-2003	1,150	63.0
Mar-12-2003	1,160	63.0
Mar-13-2003	1,160	63.0
Mar-14-2003	1,170	61.0
Mar-15-2003	1,180	61.0
Mar-16-2003	1,210	65.0
Mar-17-2003	1,280	70.0
Mar-18-2003	1,270	61.0
Mar-19-2003	1,210	48.0
Mar-20-2003	1,120	46.0
Mar-21-2003	1,070	44.0
Mar-22-2003	1,030	42.0
Mar-23-2003	1,010	40.0
Mar-24-2003	995	39.0
Mar-25-2003	968	36.0
Mar-26-2003	952	37.0
Mar-27-2003	945	46.0
Mar-28-2003	930	41.0
Mar-29-2003	906	35.0
Mar-30-2003	909	30.0
Mar-31-2003	887	25.0
Apr-01-2003	841	28.0
Apr-02-2003	847	40.0
Apr-03-2003	814	45.0
Apr-04-2003	832	45.0
Apr-05-2003	817	46.0
Apr-06-2003	811	46.0
Apr-07-2003	822	45.0
Apr-08-2003	796	44.0
Apr-09-2003	774	46.0
Apr-10-2003	741	47.0
Apr-11-2003	726	44.0
Apr-12-2003	752	34.0
Apr-13-2003	880	32.0
Apr-14-2003	1,010	31.0
Apr-15-2003	1,010	33.0
Apr-16-2003	1,000	44.0
Apr-17-2003	1,060	43.0
Apr-18-2003	1,080	44.0
Apr-19-2003	1,140	46.0
Apr-20-2003	1,190	45.0
Apr-21-2003	1,180	43.0
Apr-22-2003	1,160	45.0
Apr-23-2003	1,080	44.0
Apr-24-2003	993	40.0
Apr-25-2003	961	33.0
Apr-26-2003	987	38.0
Apr-27-2003	965	40.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-28-2003	992	43.0
Apr-29-2003	997	43.0
Apr-30-2003	984	45.0
May-01-2003	962	47.0
May-02-2003	995	48.0
May-03-2003	1,140	46.0
May-04-2003	1,370	39.0
May-05-2003	1,610	42.0
May-06-2003	1,680	45.0
May-07-2003	1,710	48.0
May-08-2003	1,710	41.0
May-09-2003	1,720	38.0
May-10-2003	1,750	35.0
May-11-2003	1,760	35.0
May-12-2003	1,730	34.0
May-13-2003	1,400	30.0
May-14-2003	1,100	29.0
May-15-2003	943	32.0
May-16-2003	812	39.0
May-17-2003	752	42.0
May-18-2003	726	47.0
May-19-2003	738	42.0
May-20-2003	691	39.0
May-21-2003	672	38.0
May-22-2003	613	41.0
May-23-2003	591	46.0
May-24-2003	558	45.0
May-25-2003	548	42.0
May-26-2003	555	41.0
May-27-2003	556	43.0
May-28-2003	561	51.0
May-29-2003	556	52.0
May-30-2003	529	49.0
May-31-2003	490	47.0
Jun-01-2003	482	43.0
Jun-02-2003	552	42.0
Jun-03-2003	516	42.0
Jun-04-2003	532	43.0
Jun-05-2003	541	42.0
Jun-06-2003	527	44.0
Jun-07-2003	530	45.0
Jun-08-2003	524	49.0
Jun-09-2003	534	48.0
Jun-10-2003	538	43.0
Jun-11-2003	490	45.0
Jun-12-2003	496	43.0
Jun-13-2003	475	40.0
Jun-14-2003	472	42.0
Jun-15-2003	505	50.0
Jun-16-2003	548	52.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-17-2003	540	52.0
Jun-18-2003	475	51.0
Jun-19-2003	452	47.0
Jun-20-2003	443	48.0
Jun-21-2003	475	47.0
Jun-22-2003	505	49.0
Jun-23-2003	550	51.0
Jun-24-2003	538	57.0
Jun-25-2003	547	58.0
Jun-26-2003	532	56.0
Jun-27-2003	500	51.0
Jun-28-2003	472	48.0
Jun-29-2003	472	52.0
Jun-30-2003	512	53.0
Jul-01-2003	532	54.0
Jul-02-2003	510	55.0
Jul-03-2003	473	56.0
Jul-04-2003	494	59.0
Jul-05-2003	467	59.0
Jul-06-2003	460	56.0
Jul-07-2003	517	55.0
Jul-08-2003	467	56.0
Jul-09-2003	478	57.0
Jul-10-2003	448	55.0
Jul-11-2003	503	48.0
Jul-12-2003	461	39.0
Jul-13-2003	424	34.0
Jul-14-2003	465	34.0
Jul-15-2003	402	37.0
Jul-16-2003	426	42.0
Jul-17-2003	408	49.0
Jul-18-2003	439	47.0
Jul-19-2003	429	46.0
Jul-20-2003	413	49.0
Jul-21-2003	443	49.0
Jul-22-2003	415	50.0
Jul-23-2003	386	57.0
Jul-24-2003	374	59.0
Jul-25-2003	367	58.0
Jul-26-2003	387	57.0
Jul-27-2003	453	57.0
Jul-28-2003	481	55.0
Jul-29-2003	487	56.0
Jul-30-2003	488	56.0
Jul-31-2003	484	59.0
Aug-01-2003	470	58.0
Aug-02-2003	464	60.0
Aug-03-2003	540	64.0
Aug-04-2003	576	69.0
Aug-05-2003	571	66.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-06-2003	511	63.0
Aug-07-2003	507	66.0
Aug-08-2003	498	66.0
Aug-09-2003	531	59.0
Aug-10-2003	517	53.0
Aug-11-2003	510	55.0
Aug-12-2003	469	54.0
Aug-13-2003	472	50.0
Aug-14-2003	373	47.0
Aug-15-2003	349	45.0
Aug-16-2003	333	42.0
Aug-17-2003	315	39.0
Aug-18-2003	351	38.0
Aug-19-2003	365	42.0
Aug-20-2003	334	47.0
Aug-21-2003	332	52.0
Aug-22-2003	363	55.0
Aug-23-2003	357	58.0
Aug-24-2003	402	58.0
Aug-25-2003	438	55.0
Aug-26-2003	438	54.0
Aug-27-2003	398	50.0
Aug-28-2003	377	50.0
Aug-29-2003	393	51.0
Aug-30-2003	392	48.0
Aug-31-2003	412	48.0
Sep-01-2003	422	43.0
Sep-02-2003	384	37.0
Sep-03-2003	379	35.0
Sep-04-2003	338	34.0
Sep-05-2003	301	30.0
Sep-06-2003	313	31.0
Sep-07-2003	290	31.0
Sep-08-2003	330	36.0
Sep-09-2003	305	29.0
Sep-10-2003	306	24.0
Sep-11-2003	337	21.0
Sep-12-2003	318	22.0
Sep-13-2003	293	22.0
Sep-14-2003	333	22.0
Sep-15-2003	368	22.0
Sep-16-2003	295	19.0
Sep-17-2003	271	16.0
Sep-18-2003	259	14.0
Sep-19-2003	257	16.0
Sep-20-2003	258	17.0
Sep-21-2003	305	18.0
Sep-22-2003	314	17.0
Sep-23-2003	319	16.0
Sep-24-2003	305	17.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-25-2003	332	19.0
Sep-26-2003	331	21.0
Sep-27-2003	327	20.0
Sep-28-2003	375	20.0
Sep-29-2003	415	17.0
Sep-30-2003	398	15.0
Oct-01-2003	395	15.0
Oct-02-2003	386	17.0
Oct-03-2003	417	19.0
Oct-04-2003	427	23.0
Oct-05-2003	489	26.0
Oct-06-2003	534	28.0
Oct-07-2003	529	28.0
Oct-08-2003	520	28.0
Oct-09-2003	556	26.0
Oct-10-2003	558	26.0
Oct-11-2003	545	24.0
Oct-12-2003	571	26.0
Oct-13-2003	615	24.0
Oct-14-2003	611	23.0
Oct-15-2003	557	22.0
Oct-16-2003	518	23.0
Oct-17-2003	611	22.0
Oct-18-2003	620	22.0
Oct-19-2003	683	23.0
Oct-20-2003	822	23.0
Oct-21-2003	900	21.0
Oct-22-2003	931	20.0
Oct-23-2003	1,010	20.0
Oct-24-2003	1,080	21.0
Oct-25-2003	1,030	21.0
Oct-26-2003	910	22.0
Oct-27-2003	840	21.0
Oct-28-2003	780	21.0
Oct-29-2003	750	23.0
Oct-30-2003	711	22.0
Oct-31-2003	690	23.0
Nov-01-2003	709	23.0
Nov-02-2003	746	21.0
Nov-03-2003	779	20.0
Nov-04-2003	759	20.0
Nov-05-2003	777	23.0
Nov-06-2003	791	26.0
Nov-07-2003	790	26.0
Nov-08-2003	787	25.0
Nov-09-2003	782	25.0
Nov-10-2003	777	25.0
Nov-11-2003	770	24.0
Nov-12-2003	757	24.0
Nov-13-2003	735	25.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-14-2003	716	26.0
Nov-15-2003	714	24.0
Nov-16-2003	727	23.0
Nov-17-2003	719	22.0
Nov-18-2003	727	21.0
Nov-19-2003	732	20.0
Nov-20-2003	725	20.0
Nov-21-2003	726	21.0
Nov-22-2003	730	22 e
Nov-23-2003	741	19 e
Nov-24-2003	713	19 e
Nov-25-2003	684	20 e
Nov-26-2003	675	21 e
Nov-27-2003	672	20 e
Nov-28-2003	667	20.0
Nov-29-2003	658	20.0
Nov-30-2003	644	20.0
Dec-01-2003	636	21.0
Dec-02-2003	628	22.0
Dec-03-2003	619	23.0
Dec-04-2003	607	20.0
Dec-05-2003	617	20.0
Dec-06-2003	615	20.0
Dec-07-2003	620	21.0
Dec-08-2003	615	21.0
Dec-09-2003	601	20.0
Dec-10-2003	618	20.0
Dec-11-2003	634	22.0
Dec-12-2003	670	20.0
Dec-13-2003	669	21.0
Dec-14-2003	652	22.0
Dec-15-2003	658	22 e
Dec-16-2003	673	22 e
Dec-17-2003	676	22 e
Dec-18-2003	673	20 e
Dec-19-2003	673	16.0
Dec-20-2003	699	18.0
Dec-21-2003	715	24.0
Dec-22-2003	742	26.0
Dec-23-2003	756	23.0
Dec-24-2003	759	19.0
Dec-25-2003	783	21.0
Dec-26-2003	808	24 e
Dec-27-2003	836	25 e
Dec-28-2003	846	22 e
Dec-29-2003	841	18.0
Dec-30-2003	892	21.0
Dec-31-2003	924	20.0
Jan-01-2004	979	18.0
Jan-02-2004	1,070	23.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-03-2004	1,060	25 e
Jan-04-2004	1,130	25 e
Jan-05-2004	1,160	23 e
Jan-06-2004	1,120	23 e
Jan-07-2004	1,070	22.0
Jan-08-2004	1,040	23.0
Jan-09-2004	1,020	23.0
Jan-10-2004	978	22.0
Jan-11-2004	936	24 e
Jan-12-2004	915	25.0
Jan-13-2004	877	23.0
Jan-14-2004	860	23.0
Jan-15-2004	845	23.0
Jan-16-2004	816	23.0
Jan-17-2004	804	24.0
Jan-18-2004	797	24.0
Jan-19-2004	785	24.0
Jan-20-2004	774	25 e
Jan-21-2004	780	26 e
Jan-22-2004	767	25 e
Jan-23-2004	756	26 e
Jan-24-2004	760	28.0
Jan-25-2004	769	30 e
Jan-26-2004	771	30 e
Jan-27-2004	788	29.0
Jan-28-2004	787	29.0
Jan-29-2004	770	23 e
Jan-30-2004	773	22 e
Jan-31-2004	770	25.0
Feb-01-2004	758	32 e
Feb-02-2004	778	34.0
Feb-03-2004	796	37.0
Feb-04-2004	842	41 e
Feb-05-2004	913	43 e
Feb-06-2004	939	43 e
Feb-07-2004	935	46.0
Feb-08-2004	903	43.0
Feb-09-2004	867	40.0
Feb-10-2004	828	52 e
Feb-11-2004	816	55 e
Feb-12-2004	821	54.0
Feb-13-2004	800	52.0
Feb-14-2004	793	54.0
Feb-15-2004	786	54.0
Feb-16-2004	788	57.0
Feb-17-2004	811	58.0
Feb-18-2004	889	65.0
Feb-19-2004	948	78.0
Feb-20-2004	1,160	99.0
Feb-21-2004	1,330	111.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-22-2004	1,370	101.0
Feb-23-2004	1,320	85.0
Feb-24-2004	1,260	79.0
Feb-25-2004	1,270	65.0
Feb-26-2004	1,890	70.0
Feb-27-2004	1,990	68.0
Feb-28-2004	2,310	58.0
Feb-29-2004	2,610	70.0
Mar-01-2004	2,650	69.0
Mar-02-2004	2,440	73.0
Mar-03-2004	2,200	78.0
Mar-04-2004	2,130	78.0
Mar-05-2004	2,020	71.0
Mar-06-2004	1,880	63.0
Mar-07-2004	1,760	50.0
Mar-08-2004	1,650	49.0
Mar-09-2004	1,560	47.0
Mar-10-2004	1,500	49.0
Mar-11-2004	1,440	45.0
Mar-12-2004	1,400	45.0
Mar-13-2004	1,280	47.0
Mar-14-2004	1,230	57.0
Mar-15-2004	1,220	58.0
Mar-16-2004	1,130	56.0
Mar-17-2004	1,100	55.0
Mar-18-2004	1,040	54.0
Mar-19-2004	996	52 e
Mar-20-2004	988	47 e
Mar-21-2004	1,030	43 e
Mar-22-2004	1,050	44 e
Mar-23-2004	1,040	45 e
Mar-24-2004	1,030	46 e
Mar-25-2004	973	40 e
Mar-26-2004	975	38 e
Mar-27-2004	984	43 e
Mar-28-2004	984	48 e
Mar-29-2004	977	49 e
Mar-30-2004	899	46 e
Mar-31-2004	875	47 e
Apr-01-2004	854	39 e
Apr-02-2004	813	39 e
Apr-03-2004	747	39 e
Apr-04-2004	726	39 e
Apr-05-2004	736	39 e
Apr-06-2004	723	41 e
Apr-07-2004	663	41 e
Apr-08-2004	639	43.0
Apr-09-2004	604	43.0
Apr-10-2004	611	40.0
Apr-11-2004	613	37.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-12-2004	656	35.0
Apr-13-2004	665	36.0
Apr-14-2004	736	35.0
Apr-15-2004	750	34.0
Apr-16-2004	786	34.0
Apr-17-2004	832	36.0
Apr-18-2004	853	37.0
Apr-19-2004	896	34.0
Apr-20-2004	924	34.0
Apr-21-2004	924	38.0
Apr-22-2004	938	44.0
Apr-23-2004	911	42.0
Apr-24-2004	956	43.0
Apr-25-2004	1,080	47.0
Apr-26-2004	1,210	48.0
Apr-27-2004	1,170	45.0
Apr-28-2004	1,120	45.0
Apr-29-2004	1,130	47.0
Apr-30-2004	1,140	40.0
May-01-2004	1,140	40.0
May-02-2004	1,260	39.0
May-03-2004	1,460	41.0
May-04-2004	1,690	44.0
May-05-2004	1,710	44.0
May-06-2004	1,700	42.0
May-07-2004	1,670	37.0
May-08-2004	1,670	34 e
May-09-2004	1,690	34 e
May-10-2004	1,730	36 e
May-11-2004	1,730	38 e
May-12-2004	1,680	41.0
May-13-2004	1,420	46.0
May-14-2004	1,110	47.0
May-15-2004	912	44.0
May-16-2004	822	48.0
May-17-2004	786	48.0
May-18-2004	787	46.0
May-19-2004	714	41.0
May-20-2004	676	39.0
May-21-2004	608	39.0
May-22-2004	581	39.0
May-23-2004	581	43.0
May-24-2004	573	46.0
May-25-2004	558	43.0
May-26-2004	565	41.0
May-27-2004	587	44.0
May-28-2004	584	50.0
May-29-2004	544	54.0
May-30-2004	556	56.0
May-31-2004	578	60.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-01-2004	565	61.0
Jun-02-2004	525	62.0
Jun-03-2004	519	64.0
Jun-04-2004	472	58.0
Jun-05-2004	455	54.0
Jun-06-2004	482	54.0
Jun-07-2004	490	51.0
Jun-08-2004	482	50.0
Jun-09-2004	491	47.0
Jun-10-2004	481	48.0
Jun-11-2004	465	48.0
Jun-12-2004	446	41.0
Jun-13-2004	467	40.0
Jun-14-2004	499	44.0
Jun-15-2004	482	49.0
Jun-16-2004	463	47.0
Jun-17-2004	407	41.0
Jun-18-2004	389	41.0
Jun-19-2004	429	47.0
Jun-20-2004	443	47.0
Jun-21-2004	438	44.0
Jun-22-2004	430	44.0
Jun-23-2004	444	43.0
Jun-24-2004	396	41.0
Jun-25-2004	397	45.0
Jun-26-2004	394	45.0
Jun-27-2004	424	47.0
Jun-28-2004	453	50.0
Jun-29-2004	408	53.0
Jun-30-2004	384	58.0
Jul-01-2004	368	57.0
Jul-02-2004	348	62.0
Jul-03-2004	374	62.0
Jul-04-2004	409	64.0
Jul-05-2004	448	63.0
Jul-06-2004	441	64.0
Jul-07-2004	428	59.0
Jul-08-2004	410	53.0
Jul-09-2004	412	55.0
Jul-10-2004	399	54.0
Jul-11-2004	430	55.0
Jul-12-2004	436	59.0
Jul-13-2004	446	57.0
Jul-14-2004	418	51.0
Jul-15-2004	385	48.0
Jul-16-2004	387	48.0
Jul-17-2004	397	49.0
Jul-18-2004	409	46.0
Jul-19-2004	455	45.0
Jul-20-2004	440	49.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-21-2004	414	56.0
Jul-22-2004	421	53.0
Jul-23-2004	404	51.0
Jul-24-2004	410	47.0
Jul-25-2004	425	46.0
Jul-26-2004	404	50.0
Jul-27-2004	397	47.0
Jul-28-2004	350	42.0
Jul-29-2004	349	40.0
Jul-30-2004	338	39.0
Jul-31-2004	344	43.0
Aug-01-2004	361	45.0
Aug-02-2004	385	46.0
Aug-03-2004	429	47.0
Aug-04-2004	419	46.0
Aug-05-2004	408	45.0
Aug-06-2004	379	47.0
Aug-07-2004	374	52.0
Aug-08-2004	404	50.0
Aug-09-2004	402	46.0
Aug-10-2004	391	44.0
Aug-11-2004	368	42.0
Aug-12-2004	336	41.0
Aug-13-2004	339	43.0
Aug-14-2004	377	44.0
Aug-15-2004	405	41.0
Aug-16-2004	405	46 e
Aug-17-2004	418	56.0
Aug-18-2004	437	54.0
Aug-19-2004	404	46.0
Aug-20-2004	513	42.0
Aug-21-2004	593	43.0
Aug-22-2004	634	44.0
Aug-23-2004	662	48.0
Aug-24-2004	669	51.0
Aug-25-2004	664	53.0
Aug-26-2004	618	51.0
Aug-27-2004	631	45.0
Aug-28-2004	597	39.0
Aug-29-2004	589	38.0
Aug-30-2004	609	38.0
Aug-31-2004	564	35.0
Sep-01-2004	411	34.0
Sep-02-2004	318	42.0
Sep-03-2004	333	45.0
Sep-04-2004	344	37.0
Sep-05-2004	380	35.0
Sep-06-2004	398	28.0
Sep-07-2004	435	29.0
Sep-08-2004	403	33.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-09-2004	365	30.0
Sep-10-2004	380	31.0
Sep-11-2004	362	27.0
Sep-12-2004	346	24.0
Sep-13-2004	383	24.0
Sep-14-2004	416	28.0
Sep-15-2004	378	26.0
Sep-16-2004	358	23 e
Sep-17-2004	355	24.0
Sep-18-2004	316	22.0
Sep-19-2004	361	22.0
Sep-20-2004	447	24.0
Sep-21-2004	464	23.0
Sep-22-2004	432	20.0
Sep-23-2004	407	18.0
Sep-24-2004	383	17.0
Sep-25-2004	366	18.0
Sep-26-2004	360	18.0
Sep-27-2004	372	20.0
Sep-28-2004	374	20.0
Sep-29-2004	346	21.0
Sep-30-2004	293	21.0
Oct-01-2004	320	20.0
Oct-02-2004	327	18.0
Oct-03-2004	333	17.0
Oct-04-2004	373	18.0
Oct-05-2004	352	20.0
Oct-06-2004	373	19.0
Oct-07-2004	390	20.0
Oct-08-2004	392	22.0
Oct-09-2004	396	23.0
Oct-10-2004	388	22.0
Oct-11-2004	429	21.0
Oct-12-2004	440	21.0
Oct-13-2004	464	20.0
Oct-14-2004	472	21.0
Oct-15-2004	490	20.0
Oct-16-2004	503	17.0
Oct-17-2004	522	17.0
Oct-18-2004	593	19.0
Oct-19-2004	711	22.0
Oct-20-2004	1,000	29.0
Oct-21-2004	1,260	51.0
Oct-22-2004	1,320	41.0
Oct-23-2004	1,290	31.0
Oct-24-2004	1,300	30.0
Oct-25-2004	1,250	29.0
Oct-26-2004	1,190	30.0
Oct-27-2004	1,170	36.0
Oct-28-2004	1,160	43.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-29-2004	1,120	33.0
Oct-30-2004	1,070	29.0
Oct-31-2004	1,020	29.0
Nov-01-2004	948	24.0
Nov-02-2004	870	22.0
Nov-03-2004	824	22.0
Nov-04-2004	800	23.0
Nov-05-2004	809	25.0
Nov-06-2004	803	26.0
Nov-07-2004	821	25.0
Nov-08-2004	854	25.0
Nov-09-2004	857	25.0
Nov-10-2004	862	25.0
Nov-11-2004	826	25.0
Nov-12-2004	846	28.0
Nov-13-2004	858	28.0
Nov-14-2004	909	28.0
Nov-15-2004	935	27.0
Nov-16-2004	927	25.0
Nov-17-2004	907	24.0
Nov-18-2004	899	24.0
Nov-19-2004	899	24.0
Nov-20-2004	888	25.0
Nov-21-2004	850	30.0
Nov-22-2004	821	26.0
Nov-23-2004	832	25.0
Nov-24-2004	840	24.0
Nov-25-2004	829	23.0
Nov-26-2004	803	24.0
Nov-27-2004	770	27.0
Nov-28-2004	755	29.0
Nov-29-2004	738	24.0
Nov-30-2004	718	23.0
Dec-01-2004	706	22.0
Dec-02-2004	685	22.0
Dec-03-2004	659	22.0
Dec-04-2004	683	22.0
Dec-05-2004	686	23.0
Dec-06-2004	699	23.0
Dec-07-2004	720	21.0
Dec-08-2004	735	24.0
Dec-09-2004	749	27.0
Dec-10-2004	829	25.0
Dec-11-2004	906	24.0
Dec-12-2004	952	23.0
Dec-13-2004	1,010	23.0
Dec-14-2004	999	23.0
Dec-15-2004	959	24.0
Dec-16-2004	913	25.0
Dec-17-2004	878	25.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-18-2004	859	24.0
Dec-19-2004	843	24.0
Dec-20-2004	817	23.0
Dec-21-2004	801	24.0
Dec-22-2004	770	25.0
Dec-23-2004	748	26.0
Dec-24-2004	726	24.0
Dec-25-2004	717	24.0
Dec-26-2004	711	23.0
Dec-27-2004	712	23.0
Dec-28-2004	767	29.0
Dec-29-2004	844	34.0
Dec-30-2004	1,080	39.0
Dec-31-2004	1,590	37.0
Jan-01-2005	2,350	42.0
Jan-02-2005	2,760	45.0
Jan-03-2005	3,020	38.0
Jan-04-2005	3,220	36.0
Jan-05-2005	3,420	36.0
Jan-06-2005	3,370	34.0
Jan-07-2005	3,210	31.0
Jan-08-2005	3,060	41.0
Jan-09-2005	3,310	48.0
Jan-10-2005	3,830	46.0
Jan-11-2005	5,010	72.0
Jan-12-2005	5,710	68.0
Jan-13-2005	6,090	58.0
Jan-14-2005	6,190	48.0
Jan-15-2005	5,900	43.0
Jan-16-2005	5,220	41.0
Jan-17-2005	4,530	42.0
Jan-18-2005	3,950	43.0
Jan-19-2005	3,490	41.0
Jan-20-2005	3,100	39.0
Jan-21-2005	2,800	40.0
Jan-22-2005	2,580	43.0
Jan-23-2005	2,380	44.0
Jan-24-2005	2,080	44.0
Jan-25-2005	1,840	43.0
Jan-26-2005	1,690	45.0
Jan-27-2005	1,640	47.0
Jan-28-2005	2,030	51.0
Jan-29-2005	2,500	56.0
Jan-30-2005	3,060	61.0
Jan-31-2005	2,920	57.0
Feb-01-2005	2,720	54.0
Feb-02-2005	2,520	53.0
Feb-03-2005	2,170	51.0
Feb-04-2005	1,940	50.0
Feb-05-2005	1,770	50.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-06-2005	1,700	49.0
Feb-07-2005	1,630	46.0
Feb-08-2005	1,570	45.0
Feb-09-2005	1,500	47.0
Feb-10-2005	1,470	49.0
Feb-11-2005	1,410	50.0
Feb-12-2005	1,360	51.0
Feb-13-2005	1,320	51.0
Feb-14-2005	1,280	51.0
Feb-15-2005	1,270	55.0
Feb-16-2005	2,040	71.0
Feb-17-2005	2,260	123.0
Feb-18-2005	2,950	123.0
Feb-19-2005	3,560	94.0
Feb-20-2005	4,410	79.0
Feb-21-2005	4,800	63.0
Feb-22-2005	4,660	67.0
Feb-23-2005	4,230	78.0
Feb-24-2005	3,850	80.0
Feb-25-2005	3,510	80.0
Feb-26-2005	3,160	79.0
Feb-27-2005	2,850	78.0
Feb-28-2005	2,630	79.0
Mar-01-2005	2,620	77.0
Mar-02-2005	2,710	75.0
Mar-03-2005	2,710	76.0
Mar-04-2005	2,670	79.0
Mar-05-2005	2,580	80.0
Mar-06-2005	2,410	77.0
Mar-07-2005	2,290	72.0
Mar-08-2005	2,180	67.0
Mar-09-2005	2,100	63.0
Mar-10-2005	2,000	62.0
Mar-11-2005	1,920	62.0
Mar-12-2005	1,830	66.0
Mar-13-2005	1,750	64.0
Mar-14-2005	1,670	63.0
Mar-15-2005	1,590	61.0
Mar-16-2005	1,540	61.0
Mar-17-2005	1,480	59.0
Mar-18-2005	1,530	59.0
Mar-19-2005	1,540	59.0
Mar-20-2005	1,490	60.0
Mar-21-2005	1,540	58.0
Mar-22-2005	1,860	62.0
Mar-23-2005	2,410	66.0
Mar-24-2005	3,130	68.0
Mar-25-2005	4,170	63.0
Mar-26-2005	4,960	59.0
Mar-27-2005	5,650	53.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-28-2005	6,340	52.0
Mar-29-2005	7,050	51.0
Mar-30-2005	7,400	50.0
Mar-31-2005	7,370	47.0
Apr-01-2005	7,200	45.0
Apr-02-2005	6,810	43.0
Apr-03-2005	6,310	33.0
Apr-04-2005	5,780	35.0
Apr-05-2005	5,380	38.0
Apr-06-2005	5,000	36.0
Apr-07-2005	4,600	36.0
Apr-08-2005	4,330	36.0
Apr-09-2005	4,250	38.0
Apr-10-2005	4,260	37.0
Apr-11-2005	4,230	36.0
Apr-12-2005	4,130	35.0
Apr-13-2005	3,830	32.0
Apr-14-2005	3,610	31.0
Apr-15-2005	3,530	28.0
Apr-16-2005	3,430	27.0
Apr-17-2005	3,320	28.0
Apr-18-2005	3,260	30.0
Apr-19-2005	3,180	38.0
Apr-20-2005	3,070	34.0
Apr-21-2005	3,020	32.0
Apr-22-2005	2,950	32.0
Apr-23-2005	2,890	35.0
Apr-24-2005	2,870	42.0
Apr-25-2005	2,900	40.0
Apr-26-2005	2,810	40.0
Apr-27-2005	2,640	35.0
Apr-28-2005	2,520	38.0
Apr-29-2005	2,520	38.0
Apr-30-2005	2,480	44.0
May-01-2005	2,660	48.0
May-02-2005	2,790	48.0
May-03-2005	2,750	48.0
May-04-2005	2,450	40.0
May-05-2005	2,340	38.0
May-06-2005	2,590	43.0
May-07-2005	2,790	48.0
May-08-2005	2,890	45.0
May-09-2005	2,990	43.0
May-10-2005	3,010	46.0
May-11-2005	3,080	45.0
May-12-2005	3,150	39.0
May-13-2005	3,140	36.0
May-14-2005	3,070	35.0
May-15-2005	3,010	34.0
May-16-2005	2,960	36.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-17-2005	2,920	39.0
May-18-2005	3,350	39.0
May-19-2005	3,780	39.0
May-20-2005	4,130	36.0
May-21-2005	4,380	37.0
May-22-2005	4,680	39.0
May-23-2005	5,080	41.0
May-24-2005	5,400	43.0
May-25-2005	5,840	45.0
May-26-2005	6,330	42.0
May-27-2005	6,920	42.0
May-28-2005	7,540	45.0
May-29-2005	8,330	46.0
May-30-2005	9,070	46.0
May-31-2005	9,560	46.0
Jun-01-2005	9,940	50.0
Jun-02-2005	10,200	52.0
Jun-03-2005	10,300	48.0
Jun-04-2005	10,100	44.0
Jun-05-2005	9,670	42.0
Jun-06-2005	8,910	43.0
Jun-07-2005	8,010	42.0
Jun-08-2005	7,190	45.0
Jun-09-2005	6,480	46.0
Jun-10-2005	5,930	48.0
Jun-11-2005	5,380	52.0
Jun-12-2005	5,060	52.0
Jun-13-2005	4,820	50.0
Jun-14-2005	4,500	49.0
Jun-15-2005	3,840	44.0
Jun-16-2005	3,270	35.0
Jun-17-2005	2,870	32.0
Jun-18-2005	2,610	35.0
Jun-19-2005	2,450	38.0
Jun-20-2005	2,430	41.0
Jun-21-2005	2,400	44.0
Jun-22-2005	2,700	47.0
Jun-23-2005	2,790	47.0
Jun-24-2005	2,520	48.0
Jun-25-2005	2,310	51.0
Jun-26-2005	2,230	52.0
Jun-27-2005	2,140	55.0
Jun-28-2005	2,450	53.0
Jun-29-2005	2,590	51.0
Jun-30-2005	2,480	50.0
Jul-01-2005	2,490	53.0
Jul-02-2005	2,680	50.0
Jul-03-2005	2,550	46.0
Jul-04-2005	2,410	44.0
Jul-05-2005	2,230	47.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-06-2005	2,110	49.0
Jul-07-2005	2,080	49.0
Jul-08-2005	2,060	47.0
Jul-09-2005	2,080	45.0
Jul-10-2005	2,080	47.0
Jul-11-2005	2,000	50.0
Jul-12-2005	1,840	51.0
Jul-13-2005	1,670	48.0
Jul-14-2005	1,600	49.0
Jul-15-2005	1,480	46.0
Jul-16-2005	1,420	46.0
Jul-17-2005	1,430	49.0
Jul-18-2005	1,440	54.0
Jul-19-2005	1,380	52.0
Jul-20-2005	1,360	50.0
Jul-21-2005	1,320	44.0
Jul-22-2005	1,310	41.0
Jul-23-2005	1,290	43.0
Jul-24-2005	1,270	45.0
Jul-25-2005	1,260	44.0
Jul-26-2005	1,190	45.0
Jul-27-2005	1,160	40.0
Jul-28-2005	1,140	38.0
Jul-29-2005	1,080	40.0
Jul-30-2005	1,060	45.0
Jul-31-2005	1,070	47.0
Aug-01-2005	1,120	53.0
Aug-02-2005	1,100	51.0
Aug-03-2005	1,080	49.0
Aug-04-2005	1,070	47.0
Aug-05-2005	1,140	42.0
Aug-06-2005	1,180	39.0
Aug-07-2005	1,190	38.0
Aug-08-2005	1,200	38.0
Aug-09-2005	1,210	41.0
Aug-10-2005	1,220	42.0
Aug-11-2005	1,190	46.0
Aug-12-2005	1,190	47.0
Aug-13-2005	1,180	45.0
Aug-14-2005	1,150	46.0
Aug-15-2005	1,190	55.0
Aug-16-2005	1,240	58.0
Aug-17-2005	1,330	57.0
Aug-18-2005	1,340	57.0
Aug-19-2005	1,340	57.0
Aug-20-2005	1,370	54.0
Aug-21-2005	1,430	52.0
Aug-22-2005	1,420	55.0
Aug-23-2005	1,400	61.0
Aug-24-2005	1,420	55.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-25-2005	1,440	50.0
Aug-26-2005	1,470	47.0
Aug-27-2005	1,450	51.0
Aug-28-2005	1,250	54.0
Aug-29-2005	1,070	55.0
Aug-30-2005	989	56.0
Aug-31-2005	990	51.0
Sep-01-2005	1,020	47.0
Sep-02-2005	998	47.0
Sep-03-2005	1,030	48.0
Sep-04-2005	1,020	47.0
Sep-05-2005	1,010	35.0
Sep-06-2005	914	32.0
Sep-07-2005	926	34.0
Sep-08-2005	1,010	30.0
Sep-09-2005	1,080	31.0
Sep-10-2005	1,150	34.0
Sep-11-2005	1,160	37.0
Sep-12-2005	1,220	35.0
Sep-13-2005	1,240	32.0
Sep-14-2005	1,280	28.0
Sep-15-2005	1,290	26.0
Sep-16-2005	1,270	23.0
Sep-17-2005	1,320	26.0
Sep-18-2005	1,370	27.0
Sep-19-2005	1,400	21.0
Sep-20-2005	1,410	21.0
Sep-21-2005	1,310	27.0
Sep-22-2005	1,340	32.0
Sep-23-2005	1,350	34.0
Sep-24-2005	1,380	29.0
Sep-25-2005	1,370	24.0
Sep-26-2005	1,410	22.0
Sep-27-2005	1,380	21.0
Sep-28-2005	1,330	18.0
Sep-29-2005	1,290	17.0
Sep-30-2005	1,240	18.0
Oct-01-2005	1,100	18.0
Oct-02-2005	946	17.0
Oct-03-2005	850	17.0
Oct-04-2005	788	16.0
Oct-05-2005	734	17.0
Oct-06-2005	770	19.0
Oct-07-2005	757	20.0
Oct-08-2005	776	19.0
Oct-09-2005	816	19.0
Oct-10-2005	872	17.0
Oct-11-2005	804	17.0
Oct-12-2005	863	17.0
Oct-13-2005	929	18.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-14-2005	964	19.0
Oct-15-2005	940	21.0
Oct-16-2005	920	23.0
Oct-17-2005	1,030	23.0
Oct-18-2005	1,030	23.0
Oct-19-2005	994	23.0
Oct-20-2005	1,030	22.0
Oct-21-2005	1,050	22.0
Oct-22-2005	1,030	21.0
Oct-23-2005	1,050	21.0
Oct-24-2005	1,080	21.0
Oct-25-2005	1,040	20.0
Oct-26-2005	1,010	21.0
Oct-27-2005	1,040	21.0
Oct-28-2005	1,060	21.0
Oct-29-2005	1,070	21.0
Oct-30-2005	1,080	21.0
Oct-31-2005	1,110	21.0
Nov-01-2005	1,110	21.0
Nov-02-2005	1,060	20.0
Nov-03-2005	935	20.0
Nov-04-2005	937	21.0
Nov-05-2005	908	20.0
Nov-06-2005	861	21.0
Nov-07-2005	851	21.0
Nov-08-2005	856	20.0
Nov-09-2005	833	21.0
Nov-10-2005	797	21.0
Nov-11-2005	785	20.0
Nov-12-2005	758	19.0
Nov-13-2005	729	22.0
Nov-14-2005	754	22.0
Nov-15-2005	762	21.0
Nov-16-2005	777	21.0
Nov-17-2005	741	21.0
Nov-18-2005	715	21.0
Nov-19-2005	690	23.0
Nov-20-2005	724	23.0
Nov-21-2005	735	24.0
Nov-22-2005	755	27.0
Nov-23-2005	742	26.0
Nov-24-2005	752	25.0
Nov-25-2005	764	25.0
Nov-26-2005	794	23.0
Nov-27-2005	818	24.0
Nov-28-2005	822	24.0
Nov-29-2005	819	24.0
Nov-30-2005	793	21.0
Dec-01-2005	792	22.0
Dec-02-2005	840	24.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-03-2005	903	25.0
Dec-04-2005	949	25.0
Dec-05-2005	1,010	25.0
Dec-06-2005	995	25.0
Dec-07-2005	989	24.0
Dec-08-2005	976	25.0
Dec-09-2005	969	24.0
Dec-10-2005	937	21.0
Dec-11-2005	912	27.0
Dec-12-2005	895	28.0
Dec-13-2005	898	25.0
Dec-14-2005	860	23.0
Dec-15-2005	840	23.0
Dec-16-2005	821	25.0
Dec-17-2005	806	25.0
Dec-18-2005	837	25.0
Dec-19-2005	874	23.0
Dec-20-2005	980	22.0
Dec-21-2005	1,000	21.0
Dec-22-2005	1,020	25.0
Dec-23-2005	1,080	21.0
Dec-24-2005	1,170	21.0
Dec-25-2005	1,430	21.0
Dec-26-2005	1,810	26.0
Dec-27-2005	2,060	31.0
Dec-28-2005	2,460	30.0
Dec-29-2005	2,950	29.0
Dec-30-2005	3,190	28.0
Dec-31-2005	3,420	30.0
Jan-01-2006	3,850	36.0
Jan-02-2006	3,870	46.0
Jan-03-2006	4,600	81.0
Jan-04-2006	5,250	109.0
Jan-05-2006	5,860	114.0
Jan-06-2006	6,410	86.0
Jan-07-2006	6,650	75.0
Jan-08-2006	6,650	67.0
Jan-09-2006	6,470	56.0
Jan-10-2006	6,150	51.0
Jan-11-2006	5,860	51.0
Jan-12-2006	5,630	53.0
Jan-13-2006	5,330	52.0
Jan-14-2006	4,870	53.0
Jan-15-2006	4,570	52.0
Jan-16-2006	4,110	50.0
Jan-17-2006	3,850	47.0
Jan-18-2006	3,520	47.0
Jan-19-2006	3,090	48.0
Jan-20-2006	2,900	48.0
Jan-21-2006	2,860	48.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-22-2006	2,750	44.0
Jan-23-2006	2,710	41.0
Jan-24-2006	2,630	41.0
Jan-25-2006	2,480	44.0
Jan-26-2006	2,460	46.0
Jan-27-2006	2,280	45.0
Jan-28-2006	2,200	44.0
Jan-29-2006	2,200	42.0
Jan-30-2006	2,160	41.0
Jan-31-2006	2,140	42.0
Feb-01-2006	2,030	44.0
Feb-02-2006	1,860	43.0
Feb-03-2006	1,790	42.0
Feb-04-2006	1,800	44.0
Feb-05-2006	1,860	44.0
Feb-06-2006	1,870	45.0
Feb-07-2006	1,890	48.0
Feb-08-2006	1,870	51.0
Feb-09-2006	1,760	50.0
Feb-10-2006	1,700	55.0
Feb-11-2006	1,680	57.0
Feb-12-2006	1,650	54.0
Feb-13-2006	1,720	55.0
Feb-14-2006	2,080	56.0
Feb-15-2006	1,820	56.0
Feb-16-2006	1,700	57.0
Feb-17-2006	1,800	54.0
Feb-18-2006	1,890	45.0
Feb-19-2006	1,900	45.0
Feb-20-2006	1,840	43.0
Feb-21-2006	1,890	38.0
Feb-22-2006	1,910	38.0
Feb-23-2006	1,890	40.0
Feb-24-2006	1,870	43.0
Feb-25-2006	1,860	44.0
Feb-26-2006	1,880	54.0
Feb-27-2006	1,960	65.0
Feb-28-2006	2,030	66.0
Mar-01-2006	2,200	67.0
Mar-02-2006	2,730	62.0
Mar-03-2006	3,250	58.0
Mar-04-2006	3,620	60.0
Mar-05-2006	4,050	62.0
Mar-06-2006	4,180	60.0
Mar-07-2006	4,370	57.0
Mar-08-2006	4,390	55.0
Mar-09-2006	4,000	51.0
Mar-10-2006	4,020	48.0
Mar-11-2006	3,890	46.0
Mar-12-2006	3,770	39.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-13-2006	4,000	37.0
Mar-14-2006	4,130	36.0
Mar-15-2006	4,180	37.0
Mar-16-2006	4,300	40.0
Mar-17-2006	4,500	41.0
Mar-18-2006	4,690	43.0
Mar-19-2006	4,890	48.0
Mar-20-2006	4,640	50.0
Mar-21-2006	4,410	46.0
Mar-22-2006	4,290	40.0
Mar-23-2006	4,210	38.0
Mar-24-2006	4,270	36.0
Mar-25-2006	4,150	35.0
Mar-26-2006	4,020	34.0
Mar-27-2006	3,970	34.0
Mar-28-2006	4,010	36.0
Mar-29-2006	4,570	43.0
Mar-30-2006	4,970	43.0
Mar-31-2006	5,280	40.0
Apr-01-2006	5,570	38.0
Apr-02-2006	5,800	38.0
Apr-03-2006	6,050	38.0
Apr-04-2006	6,750	37.0
Apr-05-2006	8,400	40.0
Apr-06-2006	10,800	40.0
Apr-07-2006	16,500	39.0
Apr-08-2006	21,900	37.0
Apr-09-2006	23,600	35.0
Apr-10-2006	24,000	35.0
Apr-11-2006	23,400	37.0
Apr-12-2006	22,500	41.0
Apr-13-2006	21,400	42.0
Apr-14-2006	20,200	39.0
Apr-15-2006	19,100	35.0
Apr-16-2006	18,300	36.0
Apr-17-2006	17,900	32.0
Apr-18-2006	17,500	28.0
Apr-19-2006	17,000	28.0
Apr-20-2006	16,700	30.0
Apr-21-2006	16,600	30.0
Apr-22-2006	16,600	32.0
Apr-23-2006	16,500	36.0
Apr-24-2006	16,700	35.0
Apr-25-2006	16,900	36.0
Apr-26-2006	17,100	40.0
Apr-27-2006	17,000	44.0
Apr-28-2006	16,800	45.0
Apr-29-2006	16,600	42.0
Apr-30-2006	16,300	39.0
May-01-2006	16,200	37.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-02-2006	16,000	35.0
May-03-2006	15,600	34.0
May-04-2006	15,300	35.0
May-05-2006	14,900	37.0
May-06-2006	14,600	39.0
May-07-2006	14,300	40.0
May-08-2006	14,100	39.0
May-09-2006	13,900	36.0
May-10-2006	13,800	38.0
May-11-2006	13,800	38.0
May-12-2006	13,600	38.0
May-13-2006	13,400	35.0
May-14-2006	13,300	37.0
May-15-2006	13,300	32.0
May-16-2006	13,300	29.0
May-17-2006	13,200	27.0
May-18-2006	13,000	27.0
May-19-2006	12,600	27.0
May-20-2006	12,400	34.0
May-21-2006	12,400	38.0
May-22-2006	12,900	45.0
May-23-2006	13,500	53.0
May-24-2006	14,000	49.0
May-25-2006	14,400	41.0
May-26-2006	14,500	32.0
May-27-2006	14,100	30.0
May-28-2006	13,000	32.0
May-29-2006	12,100	32.0
May-30-2006	11,500	30.0
May-31-2006	11,100	31.0
Jun-01-2006	10,900	31.0
Jun-02-2006	10,700	30.0
Jun-03-2006	10,400	29.0
Jun-04-2006	10,200	30.0
Jun-05-2006	9,920	30.0
Jun-06-2006	9,710	31.0
Jun-07-2006	9,910	36.0
Jun-08-2006	10,200	39.0
Jun-09-2006	10,300	39.0
Jun-10-2006	10,300	43.0
Jun-11-2006	10,300	46.0
Jun-12-2006	10,400	50.0
Jun-13-2006	10,500	52.0
Jun-14-2006	10,300	53.0
Jun-15-2006	10,200	50.0
Jun-16-2006	10,000	47.0
Jun-17-2006	9,490	44.0
Jun-18-2006	8,780	48.0
Jun-19-2006	7,980	55.0
Jun-20-2006	7,310	49.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-21-2006	7,080	43.0
Jun-22-2006	7,080	41.0
Jun-23-2006	7,340	38.0
Jun-24-2006	7,750	37.0
Jun-25-2006	8,220	37.0
Jun-26-2006	8,520	35.0
Jun-27-2006	8,610	38.0
Jun-28-2006	8,570	41.0
Jun-29-2006	8,420	40.0
Jun-30-2006	7,810	40.0
Jul-01-2006	6,790	44.0
Jul-02-2006	5,530	46.0
Jul-03-2006	4,610	47.0
Jul-04-2006	4,150	45.0
Jul-05-2006	4,110	43.0
Jul-06-2006	4,100	43.0
Jul-07-2006	4,040	46.0
Jul-08-2006	3,590	45.0
Jul-09-2006	2,610	44.0
Jul-10-2006	1,970	47.0
Jul-11-2006	1,670	46.0
Jul-12-2006	1,680	40.0
Jul-13-2006	1,670	38.0
Jul-14-2006	1,630	35.0
Jul-15-2006	1,590	32.0
Jul-16-2006	1,550	33.0
Jul-17-2006	1,560	34.0
Jul-18-2006	1,490	37.0
Jul-19-2006	1,440	38.0
Jul-20-2006	1,350	38.0
Jul-21-2006	1,340	41.0
Jul-22-2006	1,320	40.0
Jul-23-2006	1,160	39.0
Jul-24-2006	1,080	40.0
Jul-25-2006	1,180	40.0
Jul-26-2006	1,250	40.0
Jul-27-2006	1,240	38.0
Jul-28-2006	1,230	37.0
Jul-29-2006	1,240	38.0
Jul-30-2006	1,290	34.0
Jul-31-2006	1,360	34.0
Aug-01-2006	1,320	36.0
Aug-02-2006	1,290	40.0
Aug-03-2006	1,330	41.0
Aug-04-2006	1,280	40.0
Aug-05-2006	1,260	39.0
Aug-06-2006	1,300	36.0
Aug-07-2006	1,350	31.0
Aug-08-2006	1,300	34.0
Aug-09-2006	1,270	36.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-10-2006	1,280	35.0
Aug-11-2006	1,290	32.0
Aug-12-2006	1,310	28.0
Aug-13-2006	1,280	31.0
Aug-14-2006	1,270	33.0
Aug-15-2006	1,220	35.0
Aug-16-2006	1,250	34.0
Aug-17-2006	1,340	33.0
Aug-18-2006	1,330	36.0
Aug-19-2006	1,320	34.0
Aug-20-2006	1,310	30.0
Aug-21-2006	1,310	30.0
Aug-22-2006	1,310	32.0
Aug-23-2006	1,260	32.0
Aug-24-2006	1,240	32.0
Aug-25-2006	1,320	31.0
Aug-26-2006	1,360	32.0
Aug-27-2006	1,380	35.0
Aug-28-2006	1,360	37.0
Aug-29-2006	1,280	40.0
Aug-30-2006	1,230	36.0
Aug-31-2006	1,160	40.0
Sep-01-2006	1,160	42.0
Sep-02-2006	1,180	42.0
Sep-03-2006	1,190	39.0
Sep-04-2006	1,240	31.0
Sep-05-2006	1,230	31.0
Sep-06-2006	1,220	31.0
Sep-07-2006	1,170	27.0
Sep-08-2006	1,230	25.0
Sep-09-2006	1,250	26.0
Sep-10-2006	1,300	27.0
Sep-11-2006	1,330	30.0
Sep-12-2006	1,300	31.0
Sep-13-2006	1,260	32.0
Sep-14-2006	1,290	33.0
Sep-15-2006	1,260	33.0
Sep-16-2006	1,240	28.0
Sep-17-2006	1,270	27.0
Sep-18-2006	1,270	26.0
Sep-19-2006	1,210	23.0
Sep-20-2006	1,170	19.0
Sep-21-2006	1,210	20.0
Sep-22-2006	1,210	19.0
Sep-23-2006	1,170	21.0
Sep-24-2006	1,150	21.0
Sep-25-2006	1,120	20.0
Sep-26-2006	1,060	21.0
Sep-27-2006	1,040	21.0
Sep-28-2006	1,030	22.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-29-2006	1,060	23.0
Sep-30-2006	1,040	21.0
Oct-01-2006	1,030	21.0
Oct-02-2006	1,060	23.0
Oct-03-2006	1,100	23.0
Oct-04-2006	1,090	20.0
Oct-05-2006	1,080	19.0
Oct-06-2006	1,110	19.0
Oct-07-2006	1,300	20.0
Oct-08-2006	1,460	21.0
Oct-09-2006	1,600	19.0
Oct-10-2006	1,510	14.0
Oct-11-2006	1,520	17.0
Oct-12-2006	1,530	20.0
Oct-13-2006	1,540	21.0
Oct-14-2006	1,560	23.0
Oct-15-2006	1,600	23.0
Oct-16-2006	1,710	22.0
Oct-17-2006	1,730	21.0
Oct-18-2006	1,790	21.0
Oct-19-2006	1,790	21.0
Oct-20-2006	1,820	20.0
Oct-21-2006	1,830	19.0
Oct-22-2006	1,810	20.0
Oct-23-2006	1,840	21.0
Oct-24-2006	1,830	21.0
Oct-25-2006	1,850	19.0
Oct-26-2006	1,860	22.0
Oct-27-2006	1,890	21.0
Oct-28-2006	1,880	21.0
Oct-29-2006	1,810	21.0
Oct-30-2006	1,810	21.0
Oct-31-2006	1,740	21.0
Nov-01-2006	1,620	21.0
Nov-02-2006	1,480	21.0
Nov-03-2006	1,410	21.0
Nov-04-2006	1,380	21.0
Nov-05-2006	1,260	22.0
Nov-06-2006	1,170	23.0
Nov-07-2006	1,130	22.0
Nov-08-2006	1,090	23.0
Nov-09-2006	1,060	22.0
Nov-10-2006	1,050	24.0
Nov-11-2006	1,050	24.0
Nov-12-2006	1,060	25.0
Nov-13-2006	1,070	25.0
Nov-14-2006	1,070	25.0
Nov-15-2006	1,070	24.0
Nov-16-2006	1,070	24.0
Nov-17-2006	1,060	23.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-18-2006	1,060	23.0
Nov-19-2006	1,070	24.0
Nov-20-2006	1,060	24.0
Nov-21-2006	1,040	26.0
Nov-22-2006	1,030	27.0
Nov-23-2006	992	26.0
Nov-24-2006	981	27.0
Nov-25-2006	986	27.0
Nov-26-2006	978	27.0
Nov-27-2006	957	25.0
Nov-28-2006	975	24.0
Nov-29-2006	1,010	22.0
Nov-30-2006	970	22.0
Dec-01-2006	946	21.0
Dec-02-2006	917	21.0
Dec-03-2006	915	21.0
Dec-04-2006	902	21.0
Dec-05-2006	860	20.0
Dec-06-2006	826	21.0
Dec-07-2006	797	21.0
Dec-08-2006	770	21.0
Dec-09-2006	755	22.0
Dec-10-2006	783	23.0
Dec-11-2006	811	22.0
Dec-12-2006	822	21.0
Dec-13-2006	808	22.0
Dec-14-2006	816	23.0
Dec-15-2006	832	22.0
Dec-16-2006	834	20.0
Dec-17-2006	828	18.0
Dec-18-2006	840	17.0
Dec-19-2006	860	17.0
Dec-20-2006	877	17.0
Dec-21-2006	899	17.0
Dec-22-2006	903	17.0
Dec-23-2006	926	18.0
Dec-24-2006	939	17.0
Dec-25-2006	935	17.0
Dec-26-2006	925	20.0
Dec-27-2006	942	19.0
Dec-28-2006	919	25.0
Dec-29-2006	948	32.0
Dec-30-2006	982	31.0
Dec-31-2006	960	31.0
Jan-01-2007	953	28.0
Jan-02-2007	929	26.0
Jan-03-2007	911	23.0
Jan-04-2007	892	22.0
Jan-05-2007	880	20.0
Jan-06-2007	871	24.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-07-2007	896	24.0
Jan-08-2007	922	30.0
Jan-09-2007	908	24.0
Jan-10-2007	894	24.0
Jan-11-2007	882	24.0
Jan-12-2007	871	24.0
Jan-13-2007	883	26.0
Jan-14-2007	890	27.0
Jan-15-2007	896	28.0
Jan-16-2007	896	30.0
Jan-17-2007	889	31.0
Jan-18-2007	857	35.0
Jan-19-2007	816	34.0
Jan-20-2007	793	36.0
Jan-21-2007	805	38.0
Jan-22-2007	802	40.0
Jan-23-2007	791	40.0
Jan-24-2007	784	40.0
Jan-25-2007	785	42.0
Jan-26-2007	781	43.0
Jan-27-2007	777	44.0
Jan-28-2007	786	44.0
Jan-29-2007	804	42.0
Jan-30-2007	786	43.0
Jan-31-2007	802	43.0
Feb-01-2007	791	44.0
Feb-02-2007	800	43.0
Feb-03-2007	792	45.0
Feb-04-2007	813	43.0
Feb-05-2007	812	44.0
Feb-06-2007	828	45.0
Feb-07-2007	843	45.0
Feb-08-2007	857	47.0
Feb-09-2007	886	49.0
Feb-10-2007	908	49.0
Feb-11-2007	1,000	48.0
Feb-12-2007	1,010	47.0
Feb-13-2007	1,070	43.0
Feb-14-2007	1,190	44.0
Feb-15-2007	1,200	42.0
Feb-16-2007	1,150	39.0
Feb-17-2007	1,020	39.0
Feb-18-2007	1,010	37.0
Feb-19-2007	951	36.0
Feb-20-2007	933	42.0
Feb-21-2007	884	42.0
Feb-22-2007	863	43.0
Feb-23-2007	849	47.0
Feb-24-2007	838	50.0
Feb-25-2007	861	43.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-26-2007	857	37.0
Feb-27-2007	876	34.0
Feb-28-2007	959	34.0
Mar-01-2007	1,190	32.0
Mar-02-2007	1,410	32.0
Mar-03-2007	1,390	34.0
Mar-04-2007	1,280	38.0
Mar-05-2007	1,190	35.0
Mar-06-2007	1,110	36.0
Mar-07-2007	1,080	32.0
Mar-08-2007	1,030	30.0
Mar-09-2007	982	30.0
Mar-10-2007	960	28.0
Mar-11-2007	1,010	27.0
Mar-12-2007	1,040	27.0
Mar-13-2007	1,000	30.0
Mar-14-2007	985	37.0
Mar-15-2007	1,010	40.0
Mar-16-2007	1,030	37.0
Mar-17-2007	1,000	38.0
Mar-18-2007	993	36.0
Mar-19-2007	1,010	35.0
Mar-20-2007	995	31.0
Mar-21-2007	976	25.0
Mar-22-2007	1,010	24.0
Mar-23-2007	1,010	23.0
Mar-24-2007	959	22.0
Mar-25-2007	889	24.0
Mar-26-2007	876	28.0
Mar-27-2007	885	33.0
Mar-28-2007	871	31.0
Mar-29-2007	812	34.0
Mar-30-2007	775	31.0
Mar-31-2007	769	27.0
Apr-01-2007	717	26.0
Apr-02-2007	716	30.0
Apr-03-2007	690	30.0
Apr-04-2007	665	25.0
Apr-05-2007	709	29.0
Apr-06-2007	685	31.0
Apr-07-2007	641	36.0
Apr-08-2007	672	38.0
Apr-09-2007	662	37.0
Apr-10-2007	653	34.0
Apr-11-2007	632	34.0
Apr-12-2007	609	34.0
Apr-13-2007	644	35.0
Apr-14-2007	643	35.0
Apr-15-2007	729	34.0
Apr-16-2007	802	36.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-17-2007	761	35.0
Apr-18-2007	762	36.0
Apr-19-2007	774	37.0
Apr-20-2007	788	35.0
Apr-21-2007	814	38.0
Apr-22-2007	842	35.0
Apr-23-2007	917	34.0
Apr-24-2007	902	36.0
Apr-25-2007	894	31.0
Apr-26-2007	863	27.0
Apr-27-2007	804	25.0
Apr-28-2007	877	23.0
Apr-29-2007	999	21.0
Apr-30-2007	1,100	20.0
May-01-2007	1,090	21.0
May-02-2007	1,030	20.0
May-03-2007	1,020	19.0
May-04-2007	1,060	19.0
May-05-2007	1,050	20.0
May-06-2007	1,040	30.0
May-07-2007	1,240	38.0
May-08-2007	1,330	36.0
May-09-2007	1,300	37.0
May-10-2007	1,310	30.0
May-11-2007	1,300	25.0
May-12-2007	1,220	31.0
May-13-2007	1,170	34.0
May-14-2007	1,160	32.0
May-15-2007	1,140	35.0
May-16-2007	1,090	35.0
May-17-2007	1,080	36.0
May-18-2007	1,100	35.0
May-19-2007	1,100	34.0
May-20-2007	1,080	35.0
May-21-2007	970	39.0
May-22-2007	893	42.0
May-23-2007	852	38.0
May-24-2007	779	36.0
May-25-2007	761	37.0
May-26-2007	707	39.0
May-27-2007	649	39.0
May-28-2007	611	39.0
May-29-2007	628	35.0
May-30-2007	615	31.0
May-31-2007	550	28.0
Jun-01-2007	563	26.0
Jun-02-2007	579	25.0
Jun-03-2007	587	24.0
Jun-04-2007	627	23.0
Jun-05-2007	602	23.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-06-2007	601	24.0
Jun-07-2007	597	24.0
Jun-08-2007	594	22.0
Jun-09-2007	604	21.0
Jun-10-2007	608	20.0
Jun-11-2007	886	20.0
Jun-12-2007	1,120	21.0
Jun-13-2007	1,100	21.0
Jun-14-2007	1,110	21.0
Jun-15-2007	1,120	23.0
Jun-16-2007	1,120	23.0
Jun-17-2007	1,130	22.0
Jun-18-2007	1,150	26.0
Jun-19-2007	1,120	27.0
Jun-20-2007	814	24.0
Jun-21-2007	655	25.0
Jun-22-2007	599	27.0
Jun-23-2007	544	25.0
Jun-24-2007	559	24.0
Jun-25-2007	562	24.0
Jun-26-2007	584	21.0
Jun-27-2007	537	20.0
Jun-28-2007	488	21.0
Jun-29-2007	463	23.0
Jun-30-2007	444	23.0
Jul-01-2007	478	20.0
Jul-02-2007	491	20.0
Jul-03-2007	456	21.0
Jul-04-2007	451	24.0
Jul-05-2007	434	27.0
Jul-06-2007	423	28.0
Jul-07-2007	427	28.0
Jul-08-2007	399	23.0
Jul-09-2007	389	21.0
Jul-10-2007	440	21.0
Jul-11-2007	457	23.0
Jul-12-2007	466	22.0
Jul-13-2007	451	20.0
Jul-14-2007	461	21.0
Jul-15-2007	480	22.0
Jul-16-2007	479	27.0
Jul-17-2007	478	29.0
Jul-18-2007	467	25.0
Jul-19-2007	484	25.0
Jul-20-2007	459	27.0
Jul-21-2007	437	25.0
Jul-22-2007	465	22.0
Jul-23-2007	503	14.0
Jul-24-2007	467	3.0
Jul-25-2007	428	2.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-26-2007	418	2.0
Jul-27-2007	406	15.0
Jul-28-2007	391	13.0
Jul-29-2007	401	12.0
Jul-30-2007	388	13.0
Jul-31-2007	398	24.0
Aug-01-2007	402	20.0
Aug-02-2007	387	17.0
Aug-03-2007	384	26.0
Aug-04-2007	402	21.0
Aug-05-2007	405	16.0
Aug-06-2007	401	15.0
Aug-07-2007	402	22.0
Aug-08-2007	433	22.0
Aug-09-2007	438	15.0
Aug-10-2007	368	15.0
Aug-11-2007	358	15.0
Aug-12-2007	384	19.0
Aug-13-2007	370	21.0
Aug-14-2007	348	17.0
Aug-15-2007	355	17.0
Aug-16-2007	351	20.0
Aug-17-2007	361	21.0
Aug-18-2007	354	20.0
Aug-19-2007	384	19.0
Aug-20-2007	436	18.0
Aug-21-2007	450	15.0
Aug-22-2007	411	14.0
Aug-23-2007	428	12.0
Aug-24-2007	411	14.0
Aug-25-2007	375	12.0
Aug-26-2007	352	10.0
Aug-27-2007	367	10.0
Aug-28-2007	364	9.0
Aug-29-2007	392	10.0
Aug-30-2007	383	11.0
Aug-31-2007	340	12.0
Sep-01-2007	338	12.0
Sep-02-2007	356	12.0
Sep-03-2007	362	13.0
Sep-04-2007	382	11.0
Sep-05-2007	461	10.0
Sep-06-2007	444	12.0
Sep-07-2007	391	13.0
Sep-08-2007	370	14.0
Sep-09-2007	367	12.0
Sep-10-2007	370	12.0
Sep-11-2007	366	13.0
Sep-12-2007	357	14.0
Sep-13-2007	360	13.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-14-2007	316	13.0
Sep-15-2007	311	14.0
Sep-16-2007	340	14.0
Sep-17-2007	356	14.0
Sep-18-2007	359	17.0
Sep-19-2007	367	17.0
Sep-20-2007	402	17.0
Sep-21-2007	360	16.0
Sep-22-2007	367	16.0
Sep-23-2007	392	16.0
Sep-24-2007	394	14.0
Sep-25-2007	390	13.0
Sep-26-2007	374	12.0
Sep-27-2007	379	12.0
Sep-28-2007	391	11.0
Sep-29-2007	373	11.0
Sep-30-2007	443	13.0
Oct-01-2007	462	12.0
Oct-02-2007	445	12.0
Oct-03-2007	422	12.0
Oct-04-2007	384	11.0
Oct-05-2007	368	11.0
Oct-06-2007	374	11.0
Oct-07-2007	358	12.0
Oct-08-2007	374	12.0
Oct-09-2007	378	12.0
Oct-10-2007	355	12.0
Oct-11-2007	354	13.0
Oct-12-2007	408	14.0
Oct-13-2007	437	15.0
Oct-14-2007	453	16.0
Oct-15-2007	461	17.0
Oct-16-2007	502	17.0
Oct-17-2007	510	18.0
Oct-18-2007	525	18.0
Oct-19-2007	514	18.0
Oct-20-2007	501	16.0
Oct-21-2007	517	18.0
Oct-22-2007	530	17.0
Oct-23-2007	532	15.0
Oct-24-2007	543	14.0
Oct-25-2007	648	14.0
Oct-26-2007	941	14.0
Oct-27-2007	1,100	14.0
Oct-28-2007	1,130	15.0
Oct-29-2007	1,160	19.0
Oct-30-2007	1,170	17.0
Oct-31-2007	1,200	16.0
Nov-01-2007	1,200	15.0
Nov-02-2007	1,270	15.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-03-2007	1,300	15.0
Nov-04-2007	1,290	15.0
Nov-05-2007	1,300	16.0
Nov-06-2007	1,330	18.0
Nov-07-2007	1,270	18.0
Nov-08-2007	1,190	18.0
Nov-09-2007	1,080	21.0
Nov-10-2007	949	23.0
Nov-11-2007	882	22.0
Nov-12-2007	860	20.0
Nov-13-2007	855	22.0
Nov-14-2007	824	20.0
Nov-15-2007	816	18.0
Nov-16-2007	832	16.0
Nov-17-2007	833	17.0
Nov-18-2007	855	17.0
Nov-19-2007	844	17.0
Nov-20-2007	822	16.0
Nov-21-2007	830	17.0
Nov-22-2007	832	17.0
Nov-23-2007	823	18.0
Nov-24-2007	803	20.0
Nov-25-2007	796	21.0
Nov-26-2007	794	21.0
Nov-27-2007	801	21.0
Nov-28-2007	804	19.0
Nov-29-2007	802	18.0
Nov-30-2007	820	17.0
Dec-01-2007	802	18.0
Dec-02-2007	812	17.0
Dec-03-2007	805	17.0
Dec-04-2007	796	17.0
Dec-05-2007	806	17.0
Dec-06-2007	803	18.0
Dec-07-2007	842	24.0
Dec-08-2007	893	25.0
Dec-09-2007	908	24.0
Dec-10-2007	936	22.0
Dec-11-2007	939	21.0
Dec-12-2007	945	21.0
Dec-13-2007	926	21.0
Dec-14-2007	879	23.0
Dec-15-2007	858	23.0
Dec-16-2007	847	31.0
Dec-17-2007	835	39.0
Dec-18-2007	847	33.0
Dec-19-2007	857	31.0
Dec-20-2007	877	29.0
Dec-21-2007	872	26.0
Dec-22-2007	876	25.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-23-2007	875	25.0
Dec-24-2007	863	23.0
Dec-25-2007	843	24.0
Dec-26-2007	840	22.0
Dec-27-2007	813	24.0
Dec-28-2007	804	23.0
Dec-29-2007	807	23.0
Dec-30-2007	789	23.0
Dec-31-2007	758	23.0
Jan-01-2008	732	21.0
Jan-02-2008	697	21.0
Jan-03-2008	674	22.0
Jan-04-2008	827	29.0
Jan-05-2008	1,130	30.0
Jan-06-2008	1,300	25.0
Jan-07-2008	1,600	20.0
Jan-08-2008	1,600	20.0
Jan-09-2008	1,480	23.0
Jan-10-2008	1,310	23.0
Jan-11-2008	1,170	22.0
Jan-12-2008	1,060	22.0
Jan-13-2008	969	21.0
Jan-14-2008	917	22.0
Jan-15-2008	872	25.0
Jan-16-2008	834	25.0
Jan-17-2008	800	25.0
Jan-18-2008	803	25.0
Jan-19-2008	792	25.0
Jan-20-2008	814	25.0
Jan-21-2008	792	27.0
Jan-22-2008	801	30.0
Jan-23-2008	827	33.0
Jan-24-2008	1,130	40.0
Jan-25-2008	2,430	53.0
Jan-26-2008	3,320	44.0
Jan-27-2008	2,980	28.0
Jan-28-2008	2,890	23.0
Jan-29-2008	2,790	23.0
Jan-30-2008	2,710	32.0
Jan-31-2008	2,530	35.0
Feb-01-2008	2,200	33.0
Feb-02-2008	1,820	35.0
Feb-03-2008	1,610	35.0
Feb-04-2008	1,670	34.0
Feb-05-2008	1,980	35.0
Feb-06-2008	2,240	32.0
Feb-07-2008	2,160	33.0
Feb-08-2008	1,820	32.0
Feb-09-2008	1,560	33.0
Feb-10-2008	1,420	33.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-11-2008	1,280	33.0
Feb-12-2008	1,180	33.0
Feb-13-2008	1,140	34.0
Feb-14-2008	1,070	30.0
Feb-15-2008	1,010	29.0
Feb-16-2008	961	25.0
Feb-17-2008	912	27.0
Feb-18-2008	873	28.0
Feb-19-2008	850	27.0
Feb-20-2008	885	32.0
Feb-21-2008	894	36.0
Feb-22-2008	1,060	36.0
Feb-23-2008	1,340	35.0
Feb-24-2008	1,360	34.0
Feb-25-2008	1,660	31.0
Feb-26-2008	2,180	30.0
Feb-27-2008	2,220	31.0
Feb-28-2008	2,080	34.0
Feb-29-2008	1,840	33.0
Mar-01-2008	1,600	32.0
Mar-02-2008	1,440	34.0
Mar-03-2008	1,390	34.0
Mar-04-2008	1,290	28.0
Mar-05-2008	1,270	29.0
Mar-06-2008	1,260	34.0
Mar-07-2008	1,220	37.0
Mar-08-2008	1,310	35.0
Mar-09-2008	1,240	36.0
Mar-10-2008	1,190	36.0
Mar-11-2008	1,080	37.0
Mar-12-2008	1,000	42.0
Mar-13-2008	1,010	46.0
Mar-14-2008	992	43.0
Mar-15-2008	960	34.0
Mar-16-2008	958	30.0
Mar-17-2008	939	31.0
Mar-18-2008	885	27.0
Mar-19-2008	865	25.0
Mar-20-2008	877	24.0
Mar-21-2008	899	21.0
Mar-22-2008	834	23.0
Mar-23-2008	864	21.0
Mar-24-2008	905	21.0
Mar-25-2008	893	20.0
Mar-26-2008	844	20.0
Mar-27-2008	820	19.0
Mar-28-2008	761	19.0
Mar-29-2008	738	21.0
Mar-30-2008	738	21.0
Mar-31-2008	727	19.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-01-2008	717	18.0
Apr-02-2008	709	20.0
Apr-03-2008	703	19.0
Apr-04-2008	694	17.0
Apr-05-2008	660	16.0
Apr-06-2008	670	18.0
Apr-07-2008	690	23.0
Apr-08-2008	656	22.0
Apr-09-2008	631	22.0
Apr-10-2008	615	19.0
Apr-11-2008	583	21.0
Apr-12-2008	579	21.0
Apr-13-2008	605	21.0
Apr-14-2008	607	22.0
Apr-15-2008	613	26.0
Apr-16-2008	608	31.0
Apr-17-2008	595	31.0
Apr-18-2008	574	27.0
Apr-19-2008	591	23.0
Apr-20-2008	560	27.0
Apr-21-2008	555	41.0
Apr-22-2008	591	50.0
Apr-23-2008	626	46.0
Apr-24-2008	812	38.0
Apr-25-2008	1,050	32.0
Apr-26-2008	1,300	29.0
Apr-27-2008	1,440	25.0
Apr-28-2008	1,530	25.0
Apr-29-2008	1,550	26.0
Apr-30-2008	1,530	21.0
May-01-2008	1,530	25.0
May-02-2008	1,590	32.0
May-03-2008	1,590	28.0
May-04-2008	1,540	23.0
May-05-2008	1,400	22.0
May-06-2008	1,290	24.0
May-07-2008	1,230	29.0
May-08-2008	1,240	28.0
May-09-2008	1,240	29.0
May-10-2008	1,300	30.0
May-11-2008	1,380	26.0
May-12-2008	1,420	26.0
May-13-2008	1,420	28.0
May-14-2008	1,390	27.0
May-15-2008	1,390	27.0
May-16-2008	1,400	24.0
May-17-2008	1,290	26.0
May-18-2008	1,160	26.0
May-19-2008	1,050	24.0
May-20-2008	895	23.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-21-2008	750	22.0
May-22-2008	687	33.0
May-23-2008	662	35.0
May-24-2008	655	28.0
May-25-2008	660	27.0
May-26-2008	664	29.0
May-27-2008	644	48.0
May-28-2008	624	37.0
May-29-2008	594	29.0
May-30-2008	569	40.0
May-31-2008	566	32.0
Jun-01-2008	552	26.0
Jun-02-2008	540	36.0
Jun-03-2008	500	35.0
Jun-04-2008	498	25.0
Jun-05-2008	488	26.0
Jun-06-2008	449	25.0
Jun-07-2008	446	24.0
Jun-08-2008	454	22.0
Jun-09-2008	478	21.0
Jun-10-2008	454	20.0
Jun-11-2008	407	20.0
Jun-12-2008	379	19.0
Jun-13-2008	400	18.0
Jun-14-2008	375	19.0
Jun-15-2008	358	21.0
Jun-16-2008	325	24.0
Jun-17-2008	332	22.0
Jun-18-2008	326	22.0
Jun-19-2008	318	20.0
Jun-20-2008	299	18.0
Jun-21-2008	305	17.0
Jun-22-2008	312	16.0
Jun-23-2008	321	16.0
Jun-24-2008	315	16.0
Jun-25-2008	312	17.0
Jun-26-2008	302	18.0
Jun-27-2008	282	19.0
Jun-28-2008	280	21.0
Jun-29-2008	300	18.0
Jun-30-2008	324	19.0
Jul-01-2008	304	19.0
Jul-02-2008	286	19.0
Jul-03-2008	297	22.0
Jul-04-2008	286	21.0
Jul-05-2008	307	22.0
Jul-06-2008	311	21.0
Jul-07-2008	321	18.0
Jul-08-2008	293	19.0
Jul-09-2008	275	20.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-10-2008	264	19.0
Jul-11-2008	259	20.0
Jul-12-2008	270	20.0
Jul-13-2008	312	21.0
Jul-14-2008	300	22.0
Jul-15-2008	306	19.0
Jul-16-2008	307	18.0
Jul-17-2008	309	18.0
Jul-18-2008	289	16.0
Jul-19-2008	297	16.0
Jul-20-2008	321	16.0
Jul-21-2008	312	16.0
Jul-22-2008	299	16.0
Jul-23-2008	257	16.0
Jul-24-2008	253	18.0
Jul-25-2008	265	18.0
Jul-26-2008	272	18.0
Jul-27-2008	300	17.0
Jul-28-2008	289	16.0
Jul-29-2008	276	18.0
Jul-30-2008	362	16.0
Jul-31-2008	426	16.0
Aug-01-2008	358	16.0
Aug-02-2008	354	19.0
Aug-03-2008	366	17.0
Aug-04-2008	384	12.0
Aug-05-2008	363	11.0
Aug-06-2008	330	12.0
Aug-07-2008	310	14.0
Aug-08-2008	355	14.0
Aug-09-2008	419	14.0
Aug-10-2008	421	12.0
Aug-11-2008	429	11.0
Aug-12-2008	412	10.0
Aug-13-2008	445	9.0
Aug-14-2008	403	10.0
Aug-15-2008	392	11.0
Aug-16-2008	396	11.0
Aug-17-2008	426	12.0
Aug-18-2008	468	9.0
Aug-19-2008	448	9.0
Aug-20-2008	425	8.0
Aug-21-2008	407	8.0
Aug-22-2008	395	9.0
Aug-23-2008	410	9.0
Aug-24-2008	440	10.0
Aug-25-2008	430	11.0
Aug-26-2008	435	10.0
Aug-27-2008	421	10.0
Aug-28-2008	394	10.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-29-2008	382	10.0
Aug-30-2008	390	11.0
Aug-31-2008	443	11.0
Sep-01-2008	438	16.0
Sep-02-2008	423	18.0
Sep-03-2008	416	20.0
Sep-04-2008	419	17.0
Sep-05-2008	409	12.0
Sep-06-2008	415	11.0
Sep-07-2008	401	10.0
Sep-08-2008	412	10.0
Sep-09-2008	419	9.0
Sep-10-2008	425	10.0
Sep-11-2008	415	9.0
Sep-12-2008	415	9.0
Sep-13-2008	404	8.0
Sep-14-2008	419	9.0
Sep-15-2008	454	7.0
Sep-16-2008	319	6.0
Sep-17-2008	256	6.0
Sep-18-2008	238	7.0
Sep-19-2008	227	13.0
Sep-20-2008	225	13.0
Sep-21-2008	272	12.0
Sep-22-2008	298	13.0
Sep-23-2008	306	14.0
Sep-24-2008	296	13.0
Sep-25-2008	280	12.0
Sep-26-2008	266	12.0
Sep-27-2008	267	12.0
Sep-28-2008	252	12.0
Sep-29-2008	263	13.0
Sep-30-2008	278	13.0
Oct-01-2008	265	14.0
Oct-02-2008	244	16.0
Oct-03-2008	260	19.0
Oct-04-2008	318	19.0
Oct-05-2008	341	19.0
Oct-06-2008	384	20.0
Oct-07-2008	405	19.0
Oct-08-2008	429	18.0
Oct-09-2008	466	16.0
Oct-10-2008	455	16.0
Oct-11-2008	494	18.0
Oct-12-2008	478	19.0
Oct-13-2008	470	17.0
Oct-14-2008	462	16.0
Oct-15-2008	456	15.0
Oct-16-2008	440	15.0
Oct-17-2008	418	15.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-18-2008	393	15.0
Oct-19-2008	427	15.0
Oct-20-2008	445	15.0
Oct-21-2008	461	15.0
Oct-22-2008	492	16.0
Oct-23-2008	494	17.0
Oct-24-2008	501	18.0
Oct-25-2008	506	17.0
Oct-26-2008	491	16.0
Oct-27-2008	472	16.0
Oct-28-2008	472	18.0
Oct-29-2008	468	15.0
Oct-30-2008	468	14.0
Oct-31-2008	476	18.0
Nov-01-2008	487	18.0
Nov-02-2008	501	18.0
Nov-03-2008	517	18.0
Nov-04-2008	521	19.0
Nov-05-2008	525	19.0
Nov-06-2008	520	12.0
Nov-07-2008	521	16.0
Nov-08-2008	520	20.0
Nov-09-2008	534	21.0
Nov-10-2008	540	26.0
Nov-11-2008	545	24.0
Nov-12-2008	548	20.0
Nov-13-2008	547	23.0
Nov-14-2008	530	25.0
Nov-15-2008	523	26.0
Nov-16-2008	531	26.0
Nov-17-2008	526	23.0
Nov-18-2008	519	25.0
Nov-19-2008	512	23.0
Nov-20-2008	510	22.0
Nov-21-2008	512	22.0
Nov-22-2008	515	21.0
Nov-23-2008	520	24.0
Nov-24-2008	512	27.0
Nov-25-2008	512	29.0
Nov-26-2008	517	28.0
Nov-27-2008	520	21.0
Nov-28-2008	512	16.0
Nov-29-2008	508	15.0
Nov-30-2008	496	15.0
Dec-01-2008	501	15.0
Dec-02-2008	499	16.0
Dec-03-2008	491	22.0
Dec-04-2008	479	23.0
Dec-05-2008	488	25.0
Dec-06-2008	489	21.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-07-2008	480	23.0
Dec-08-2008	459	24.0
Dec-09-2008	465	24.0
Dec-10-2008	470	24.0
Dec-11-2008	467	27.0
Dec-12-2008	447	26.0
Dec-13-2008	442	25.0
Dec-14-2008	437	25.0
Dec-15-2008	453	26.0
Dec-16-2008	473	26.0
Dec-17-2008	499	24.0
Dec-18-2008	504	23.0
Dec-19-2008	512	21.0
Dec-20-2008	517	21.0
Dec-21-2008	518	20.0
Dec-22-2008	544	20.0
Dec-23-2008	552	20.0
Dec-24-2008	554	21.0
Dec-25-2008	564	20.0
Dec-26-2008	556	19.0
Dec-27-2008	549	18.0
Dec-28-2008	529	18.0
Dec-29-2008	506	17.0
Dec-30-2008	490	17.0
Dec-31-2008	480	17.0
Jan-01-2009	472	16.0
Jan-02-2009	472	18.0
Jan-03-2009	468	17.0
Jan-04-2009	464	17.0
Jan-05-2009	454	17.0
Jan-06-2009	452	17.0
Jan-07-2009	443	17.0
Jan-08-2009	441	16.0
Jan-09-2009	427	17.0
Jan-10-2009	415	18.0
Jan-11-2009	412	19.0
Jan-12-2009	410	19.0
Jan-13-2009	404	18.0
Jan-14-2009	406	16.0
Jan-15-2009	408	14.0
Jan-16-2009	409	13.0
Jan-17-2009	413	13.0
Jan-18-2009	414	13.0
Jan-19-2009	418	13.0
Jan-20-2009	415	13.0
Jan-21-2009	410	13.0
Jan-22-2009	412	14.0
Jan-23-2009	429	20.0
Jan-24-2009	481	29.0
Jan-25-2009	599	44.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-26-2009	787	43.0
Jan-27-2009	844	33.0
Jan-28-2009	813	30.0
Jan-29-2009	741	34.0
Jan-30-2009	681	31.0
Jan-31-2009	620	27.0
Feb-01-2009	592	25.0
Feb-02-2009	592	24.0
Feb-03-2009	602	24.0
Feb-04-2009	608	26.0
Feb-05-2009	610	27.0
Feb-06-2009	616	30.0
Feb-07-2009	640	30.0
Feb-08-2009	662	34.0
Feb-09-2009	691	36.0
Feb-10-2009	714	34.0
Feb-11-2009	716	31.0
Feb-12-2009	695	27.0
Feb-13-2009	681	27.0
Feb-14-2009	678	28.0
Feb-15-2009	701	29.0
Feb-16-2009	780	29.0
Feb-17-2009	833	31.0
Feb-18-2009	906	34.0
Feb-19-2009	1,090	34.0
Feb-20-2009	1,050	34.0
Feb-21-2009	1,020	34.0
Feb-22-2009	973	37.0
Feb-23-2009	924	36.0
Feb-24-2009	894	37.0
Feb-25-2009	894	37.0
Feb-26-2009	896	39.0
Feb-27-2009	868	44.0
Feb-28-2009	815	47.0
Mar-01-2009	788	44.0
Mar-02-2009	775	43.0
Mar-03-2009	777	43.0
Mar-04-2009	805	41.0
Mar-05-2009	943	37.0
Mar-06-2009	1,140	35.0
Mar-07-2009	1,150	34.0
Mar-08-2009	1,130	34.0
Mar-09-2009	1,060	33.0
Mar-10-2009	986	32.0
Mar-11-2009	928	28.0
Mar-12-2009	890	22.0
Mar-13-2009	861	21.0
Mar-14-2009	837	21.0
Mar-15-2009	834	21.0
Mar-16-2009	841	22.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-17-2009	846	22.0
Mar-18-2009	830	21.0
Mar-19-2009	810	21.0
Mar-20-2009	805	30.0
Mar-21-2009	789	28.0
Mar-22-2009	812	24.0
Mar-23-2009	800	27.0
Mar-24-2009	746	25.0
Mar-25-2009	710	32.0
Mar-26-2009	704	31.0
Mar-27-2009	691	29.0
Mar-28-2009	682	24.0
Mar-29-2009	690	24.0
Mar-30-2009	670	24.0
Mar-31-2009	611	24.0
Apr-01-2009	570	20.0
Apr-02-2009	536	21.0
Apr-03-2009	513	19.0
Apr-04-2009	504	29.0
Apr-05-2009	494	30.0
Apr-06-2009	491	25.0
Apr-07-2009	500	20.0
Apr-08-2009	525	13.0
Apr-09-2009	525	15.0
Apr-10-2009	534	15.0
Apr-11-2009	545	17.0
Apr-12-2009	566	17.0
Apr-13-2009	570	19.0
Apr-14-2009	553	17.0
Apr-15-2009	561	17.0
Apr-16-2009	542	25.0
Apr-17-2009	550	21.0
Apr-18-2009	515	19.0
Apr-19-2009	495	17.0
Apr-20-2009	485	18.0
Apr-21-2009	446	17.0
Apr-22-2009	409	16.0
Apr-23-2009	392	18.0
Apr-24-2009	406	14.0
Apr-25-2009	407	13.0
Apr-26-2009	402	12.0
Apr-27-2009	431	12.0
Apr-28-2009	428	15.0
Apr-29-2009	387	23.0
Apr-30-2009	395	27.0
May-01-2009	405	15.0
May-02-2009	428	15.0
May-03-2009	508	19.0
May-04-2009	586	21.0
May-05-2009	585	18.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-06-2009	567	15.0
May-07-2009	581	12.0
May-08-2009	669	12.0
May-09-2009	740	13.0
May-10-2009	839	12.0
May-11-2009	894	9.0
May-12-2009	916	8.0
May-13-2009	723	8.0
May-14-2009	505	7.0
May-15-2009	412	5.0
May-16-2009	374	8.0
May-17-2009	346	7.0
May-18-2009	356	7.0
May-19-2009	366	8.0
May-20-2009	377	9.0
May-21-2009	364	10.0
May-22-2009	361	7.0
May-23-2009	356	8.0
May-24-2009	354	8.0
May-25-2009	353	8.0
May-26-2009	345	11.0
May-27-2009	347	13.0
May-28-2009	349	22.0
May-29-2009	314	19.0
May-30-2009	315	26.0
May-31-2009	335	28.0
Jun-01-2009	365	26.0
Jun-02-2009	380	26.0
Jun-03-2009	383	24.0
Jun-04-2009	371	16.0
Jun-05-2009	395	21.0
Jun-06-2009	398	22.0
Jun-07-2009	428	16.0
Jun-08-2009	424	14.0
Jun-09-2009	445	15.0
Jun-10-2009	427	15.0
Jun-11-2009	416	11.0
Jun-12-2009	399	9.0
Jun-13-2009	377	10.0
Jun-14-2009	370	13.0
Jun-15-2009	381	16.0
Jun-16-2009	400	13.0
Jun-17-2009	387	11.0
Jun-18-2009	339	10.0
Jun-19-2009	334	10.0
Jun-20-2009	336	11.0
Jun-21-2009	328	12.0
Jun-22-2009	351	13.0
Jun-23-2009	335	14.0
Jun-24-2009	321	13.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-25-2009	337	14.0
Jun-26-2009	306	14.0
Jun-27-2009	303	14.0
Jun-28-2009	301	17.0
Jun-29-2009	303	21.0
Jun-30-2009	270	17.0
Jul-01-2009	276	16.0
Jul-02-2009	274	15.0
Jul-03-2009	261	17.0
Jul-04-2009	255	16.0
Jul-05-2009	282	16.0
Jul-06-2009	276	14.0
Jul-07-2009	296	13.0
Jul-08-2009	296	12.0
Jul-09-2009	297	11.0
Jul-10-2009	273	10.0
Jul-11-2009	253	10.0
Jul-12-2009	263	10.0
Jul-13-2009	266	8.0
Jul-14-2009	273	7.0
Jul-15-2009	262	6.0
Jul-16-2009	243	6.0
Jul-17-2009	209	7.0
Jul-18-2009	201	8.0
Jul-19-2009	208	9.0
Jul-20-2009	214	8.0
Jul-21-2009	201	7.0
Jul-22-2009	223	8.0
Jul-23-2009	223	11.0
Jul-24-2009	207	12.0
Jul-25-2009	195	12.0
Jul-26-2009	201	15.0
Jul-27-2009	192	12.0
Jul-28-2009	188	11.0
Jul-29-2009	193	10.0
Jul-30-2009	208	8.0
Jul-31-2009	198	6.0
Aug-01-2009	218	7.0
Aug-02-2009	244	6.0
Aug-03-2009	265	8.0
Aug-04-2009	232	14.0
Aug-05-2009	259	16.0
Aug-06-2009	208	15.0
Aug-07-2009	224	12.0
Aug-08-2009	201	10.0
Aug-09-2009	195	11.0
Aug-10-2009	227	11.0
Aug-11-2009	217	11.0
Aug-12-2009	206	9.0
Aug-13-2009	191	8.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-14-2009	201	8.0
Aug-15-2009	216	6.0
Aug-16-2009	210	6.0
Aug-17-2009	192	5.0
Aug-18-2009	202	6.0
Aug-19-2009	190	10.0
Aug-20-2009	217	10.0
Aug-21-2009	210	11.0
Aug-22-2009	221	13.0
Aug-23-2009	239	16.0
Aug-24-2009	234	19.0
Aug-25-2009	227	20.0
Aug-26-2009	202	16.0
Aug-27-2009	217	13.0
Aug-28-2009	240	11.0
Aug-29-2009	204	9.0
Aug-30-2009	202	7.0
Aug-31-2009	213	7.0
Sep-01-2009	229	7.0
Sep-02-2009	222	6.0
Sep-03-2009	220	5.0
Sep-04-2009	200	6.0
Sep-05-2009	199	6.0
Sep-06-2009	200	6.0
Sep-07-2009	200	7.0
Sep-08-2009	206	8.0
Sep-09-2009	216	12.0
Sep-10-2009	217	15.0
Sep-11-2009	194	15.0
Sep-12-2009	217	12.0
Sep-13-2009	260	11.0
Sep-14-2009	270	10.0
Sep-15-2009	273	11.0
Sep-16-2009	252	11.0
Sep-17-2009	244	16.0
Sep-18-2009	253	16.0
Sep-19-2009	235	12.0
Sep-20-2009	250	12.0
Sep-21-2009	258	13.0
Sep-22-2009	231	12.0
Sep-23-2009	209	11.0
Sep-24-2009	212	7.0
Sep-25-2009	242	7.0
Sep-26-2009	249	6.0
Sep-27-2009	269	6.0
Sep-28-2009	264	11.0
Sep-29-2009	266	10.0
Sep-30-2009	290	10.0
Oct-01-2009	272	11.8
Oct-02-2009	282	10.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-03-2009	290	8.5
Oct-04-2009	291	7.6
Oct-05-2009	300	7.9
Oct-06-2009	310	7.1
Oct-07-2009	297	7.6
Oct-08-2009	305	7.9
Oct-09-2009	321	9.3
Oct-10-2009	326	12.9
Oct-11-2009	377	12.6
Oct-12-2009	395	12.7
Oct-13-2009	431	17.6
Oct-14-2009	600	16.0
Oct-15-2009	712	16.6
Oct-16-2009	828	15.1
Oct-17-2009	853	14.8
Oct-18-2009	879	14.8
Oct-19-2009	850	14.8
Oct-20-2009	844	15.5
Oct-21-2009	787	19.3
Oct-22-2009	737	22.1
Oct-23-2009	749	22.7
Oct-24-2009	866	23.7
Oct-25-2009	886	25.3
Oct-26-2009	988	26.5
Oct-27-2009	1,070	18.8
Oct-28-2009	1,020	19.6
Oct-29-2009	987	21.4
Oct-30-2009	992	18.1
Oct-31-2009	950	16.6
Nov-01-2009	867	17.1
Nov-02-2009	807	18.2
Nov-03-2009	766	22.0
Nov-04-2009	705	24.8
Nov-05-2009	709	22.3
Nov-06-2009	666	18.1
Nov-07-2009	612	15.4
Nov-08-2009	593	16.8
Nov-09-2009	570	19.3
Nov-10-2009	563	19.9
Nov-11-2009	542	20.4
Nov-12-2009	533	21.4
Nov-13-2009	527	23.1
Nov-14-2009	529	22.9
Nov-15-2009	533	22.5
Nov-16-2009	536	21.3
Nov-17-2009	533	20.0
Nov-18-2009	544	20.0
Nov-19-2009	543	19.1
Nov-20-2009	530	16.8
Nov-21-2009	524	16.2

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-22-2009	525	16.7
Nov-23-2009	528	17.0
Nov-24-2009	524	19.0
Nov-25-2009	521	18.4
Nov-26-2009	513	15.4
Nov-27-2009	511	15.8
Nov-28-2009	523	17.4
Nov-29-2009	520	21.6
Nov-30-2009	510	18.9
Dec-01-2009	517	19.0
Dec-02-2009	570	16.4
Dec-03-2009	594	17.7
Dec-04-2009	572	18.0
Dec-05-2009	539	17.0
Dec-06-2009	513	16.3
Dec-07-2009	498	16.5
Dec-08-2009	489	20.6
Dec-09-2009	494	21.9
Dec-10-2009	489	20.8
Dec-11-2009	484	20.0
Dec-12-2009	502	22.9
Dec-13-2009	551	28.8
Dec-14-2009	602	29.2
Dec-15-2009	664	27.0
Dec-16-2009	695	23.4
Dec-17-2009	695	21.1
Dec-18-2009	690	21.3
Dec-19-2009	651	21.0
Dec-20-2009	618	21.2
Dec-21-2009	589	20.3
Dec-22-2009	576	18.0
Dec-23-2009	555	18.5
Dec-24-2009	523	18.8
Dec-25-2009	504	24.5
Dec-26-2009	505	23.9
Dec-27-2009	504	23.9
Dec-28-2009	485	22.9
Dec-29-2009	477	21.6
Dec-30-2009	477	17.8
Dec-31-2009	474	16.4
Jan-01-2010	470	18.6
Jan-02-2010	470	20.1
Jan-03-2010	467	19.2
Jan-04-2010	459	20.3
Jan-05-2010	449	20.7
Jan-06-2010	442	21.1
Jan-07-2010	434	21.2
Jan-08-2010	434	20.4
Jan-09-2010	433	20.7
Jan-10-2010	450	21.2

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-11-2010	446	21.0
Jan-12-2010	444	20.6
Jan-13-2010	459	22.9
Jan-14-2010	463	23.8
Jan-15-2010	483	23.9
Jan-16-2010	492	23.5
Jan-17-2010	506	24.0
Jan-18-2010	534	26.9
Jan-19-2010	668	32.0
Jan-20-2010	1,440	34.6
Jan-21-2010	2,210	31.3
Jan-22-2010	2,510	32.9
Jan-23-2010	2,560	28.2
Jan-24-2010	2,540	25.9
Jan-25-2010	2,500	21.7
Jan-26-2010	2,280	19.7
Jan-27-2010	1,890	19.7
Jan-28-2010	1,550	22.8
Jan-29-2010	1,300	21.5
Jan-30-2010	1,130	19.4
Jan-31-2010	1,000	21.8
Feb-01-2010	915	21.1
Feb-02-2010	855	19.7
Feb-03-2010	798	21.3
Feb-04-2010	760	18.3
Feb-05-2010	736	17.2
Feb-06-2010	717	17.1
Feb-07-2010	735	20.8
Feb-08-2010	779	27.0
Feb-09-2010	956	26.0
Feb-10-2010	986	24.9
Feb-11-2010	1,050	25.4
Feb-12-2010	1,180	25.5
Feb-13-2010	1,160	25.0
Feb-14-2010	1,040	27.9
Feb-15-2010	946	28.3
Feb-16-2010	888	26.0
Feb-17-2010	843	22.4
Feb-18-2010	803	25.2
Feb-19-2010	760	26.0
Feb-20-2010	723	28.6
Feb-21-2010	732	32.0
Feb-22-2010	754	33.0
Feb-23-2010	760	34.2
Feb-24-2010	818	38.6
Feb-25-2010	949	50.9
Feb-26-2010	1,150	59.0
Feb-27-2010	1,420	40.3
Feb-28-2010	1,730	35.8
Mar-01-2010	2,000	35.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-02-2010	2,140	42.9
Mar-03-2010	2,270	46.1
Mar-04-2010	2,230	47.9
Mar-05-2010	2,360	53.0
Mar-06-2010	2,500	48.7
Mar-07-2010	2,500	45.2
Mar-08-2010	2,330	44.2
Mar-09-2010	2,110	41.2
Mar-10-2010	1,910	38.9
Mar-11-2010	1,760	40.1
Mar-12-2010	1,680	39.2
Mar-13-2010	1,600	35.7
Mar-14-2010	1,520	30.4
Mar-15-2010	1,480	30.2
Mar-16-2010	1,480	28.3
Mar-17-2010	1,430	25.8
Mar-18-2010	1,480	27.0
Mar-19-2010	1,530	31.5
Mar-20-2010	1,490	37.7
Mar-21-2010	1,490	29.0
Mar-22-2010	1,470	18.8
Mar-23-2010	1,430	17.6
Mar-24-2010	1,380	19.6
Mar-25-2010	1,370	14.0
Mar-26-2010	1,350	12.2
Mar-27-2010	1,310	12.2
Mar-28-2010	1,320	10.1
Mar-29-2010	1,290	10.6
Mar-30-2010	1,260	10.3
Mar-31-2010	1,230	9.6
Apr-01-2010	1,210	9.6
Apr-02-2010	1,170	9.3
Apr-03-2010	1,160	9.3
Apr-04-2010	1,160	13.6
Apr-05-2010	1,250	14.7
Apr-06-2010	1,380	16.3
Apr-07-2010	1,430	18.1
Apr-08-2010	1,460	13.7
Apr-09-2010	1,480	11.2
Apr-10-2010	1,440	21.5
Apr-11-2010	1,420	19.5
Apr-12-2010	1,430	14.5
Apr-13-2010	1,520	10.1
Apr-14-2010	1,640	11.5
Apr-15-2010	1,770	11.7
Apr-16-2010	1,800	9.0
Apr-17-2010	1,760	10.9
Apr-18-2010	1,640	13.7
Apr-19-2010	1,610	10.3
Apr-20-2010	1,600	12.6

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-21-2010	1,580	19.5
Apr-22-2010	1,710	24.0
Apr-23-2010	1,950	24.0
Apr-24-2010	2,260	20.6
Apr-25-2010	2,430	14.4
Apr-26-2010	2,490	13.7
Apr-27-2010	2,470	31.4
Apr-28-2010	2,450	28.4
Apr-29-2010	2,340	21.7
Apr-30-2010	2,150	20.3
May-01-2010	1,890	19.9
May-02-2010	1,690	13.0
May-03-2010	1,600	13.1
May-04-2010	1,600	16.4
May-05-2010	1,670	17.7
May-06-2010	1,830	19.2
May-07-2010	1,900	21.2
May-08-2010	1,870	18.7
May-09-2010	1,900	21.9
May-10-2010	1,840	22.1
May-11-2010	1,650	22.0
May-12-2010	1,500	24.0
May-13-2010	1,350	25.5
May-14-2010	1,230	28.2
May-15-2010	1,190	35.9
May-16-2010	1,240	37.8
May-17-2010	1,320	37.5
May-18-2010	1,310	36.8
May-19-2010	1,310	36.3
May-20-2010	1,390	33.3
May-21-2010	1,410	27.6
May-22-2010	1,380	27.9
May-23-2010	1,370	36.3
May-24-2010	1,320	34.9
May-25-2010	1,220	29.2
May-26-2010	1,250	26.8
May-27-2010	1,230	31.2
May-28-2010	1,320	27.8
May-29-2010	1,400	27.4
May-30-2010	1,450	28.9
May-31-2010	1,530	24.5
Jun-01-2010	1,500	26.3
Jun-02-2010	1,480	21.8
Jun-03-2010	1,480	19.0
Jun-04-2010	1,420	18.4
Jun-05-2010	1,370	19.3
Jun-06-2010	1,280	19.9
Jun-07-2010	1,360	19.4
Jun-08-2010	1,550	18.4
Jun-09-2010	1,530	13.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-10-2010	1,540	13.0
Jun-11-2010	1,500	12.2
Jun-12-2010	1,540	13.8
Jun-13-2010	1,420	13.4
Jun-14-2010	1,260	19.4
Jun-15-2010	1,150	18.9
Jun-16-2010	1,080	21.3
Jun-17-2010	1,010	25.6
Jun-18-2010	932	23.4
Jun-19-2010	904	21.0
Jun-20-2010	885	25.5
Jun-21-2010	893	24.2
Jun-22-2010	889	26.0
Jun-23-2010	835	27.7
Jun-24-2010	783	16.6
Jun-25-2010	712	14.5
Jun-26-2010	691	20.1
Jun-27-2010	727	29.6
Jun-28-2010	781	29.3
Jun-29-2010	761	22.4
Jun-30-2010	702	15.7
Jul-01-2010	638	12.7
Jul-02-2010	652	11.6
Jul-03-2010	641	11.6
Jul-04-2010	698	11.7
Jul-05-2010	675	13.9
Jul-06-2010	606	14.0
Jul-07-2010	642	12.2
Jul-08-2010	606	12.2
Jul-09-2010	563	11.3
Jul-10-2010	565	12.8
Jul-11-2010	574	13.5
Jul-12-2010	543	13.6
Jul-13-2010	513	14.3
Jul-14-2010	488	19.1
Jul-15-2010	518	22.9
Jul-16-2010	495	22.6
Jul-17-2010	539	22.4
Jul-18-2010	533	21.1
Jul-19-2010	521	14.2
Jul-20-2010	496	12.3
Jul-21-2010	499	11.9
Jul-22-2010	504	11.8
Jul-23-2010	507	13.1
Jul-24-2010	477	13.1
Jul-25-2010	524	13.4
Jul-26-2010	539	13.1
Jul-27-2010	540	13.5
Jul-28-2010	546	14.0
Jul-29-2010	506	12.7

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-30-2010	473	11.6
Jul-31-2010	474	11.4
Aug-01-2010	495	12.2
Aug-02-2010	542	12.7
Aug-03-2010	552	14.7
Aug-04-2010	559	14.9
Aug-05-2010	563	12.3
Aug-06-2010	559	12.2
Aug-07-2010	515	13.5
Aug-08-2010	545	18.4
Aug-09-2010	562	20.5
Aug-10-2010	526	18.5
Aug-11-2010	511	14.2
Aug-12-2010	506	14.4
Aug-13-2010	479	15.4
Aug-14-2010	449	15.1
Aug-15-2010	495	15.0
Aug-16-2010	579	15.5
Aug-17-2010	587	14.2
Aug-18-2010	560	13.7
Aug-19-2010	567	13.8
Aug-20-2010	517	15.4
Aug-21-2010	517	14.5
Aug-22-2010	550	16.5
Aug-23-2010	503	14.0
Aug-24-2010	439	12.8
Aug-25-2010	421	15.8
Aug-26-2010	443	15.1
Aug-27-2010	456	15.4
Aug-28-2010	464	15.2
Aug-29-2010	495	16.4
Aug-30-2010	596	17.2
Aug-31-2010	609	18.1
Sep-01-2010	696	14.0
Sep-02-2010	682	12.9
Sep-03-2010	630	12.6
Sep-04-2010	591	10.8
Sep-05-2010	597	9.8
Sep-06-2010	586	10.3
Sep-07-2010	588	11.8
Sep-08-2010	620	11.5
Sep-09-2010	738	12.2
Sep-10-2010	1,050	13.3
Sep-11-2010	1,450	13.9
Sep-12-2010	1,810	14.9
Sep-13-2010	1,970	15.9
Sep-14-2010	2,020	16.5
Sep-15-2010	1,760	15.5
Sep-16-2010	1,410	15.0
Sep-17-2010	1,230	16.7

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-18-2010	1,130	14.2
Sep-19-2010	1,020	12.6
Sep-20-2010	928	13.2
Sep-21-2010	818	12.4
Sep-22-2010	689	10.1
Sep-23-2010	687	9.6
Sep-24-2010	680	9.0
Sep-25-2010	625	8.1
Sep-26-2010	670	8.1
Sep-27-2010	673	7.3
Sep-28-2010	621	6.5
Sep-29-2010	615	7.3
Sep-30-2010	589	7.2
Oct-01-2010	598	6.8
Oct-02-2010	579	6.7
Oct-03-2010	568	6.8
Oct-04-2010	608	6.7
Oct-05-2010	615	6.5
Oct-06-2010	657	6.7
Oct-07-2010	678	8.0
Oct-08-2010	712	11.6
Oct-09-2010	715	11.5
Oct-10-2010	786	11.5
Oct-11-2010	807	10.3
Oct-12-2010	716	10.8
Oct-13-2010	672	12.0
Oct-14-2010	642	11.8
Oct-15-2010	610	11.1
Oct-16-2010	593	12.6
Oct-17-2010	626	12.5
Oct-18-2010	686	15.1
Oct-19-2010	693	16.8
Oct-20-2010	705	16.3
Oct-21-2010	698	13.8
Oct-22-2010	721	13.2
Oct-23-2010	751	13.3
Oct-24-2010	868	13.4
Oct-25-2010	1,100	10.9
Oct-26-2010	1,210	10.1
Oct-27-2010	1,310	11.1
Oct-28-2010	1,370	10.6
Oct-29-2010	1,430	10.0
Oct-30-2010	1,380	11.7
Oct-31-2010	1,290	12.4
Nov-01-2010	1,260	13.3
Nov-02-2010	1,180	12.7
Nov-03-2010	1,060	12.4
Nov-04-2010	938	13.2
Nov-05-2010	873	12.2
Nov-06-2010	840	12.9

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-07-2010	814	13.9
Nov-08-2010	813	13.7
Nov-09-2010	795	15.3
Nov-10-2010	784	15.2
Nov-11-2010	779	14.6
Nov-12-2010	761	13.6
Nov-13-2010	754	13.3
Nov-14-2010	742	13.8
Nov-15-2010	731	14.6
Nov-16-2010	704	15.4
Nov-17-2010	679	16.2
Nov-18-2010	669	14.3
Nov-19-2010	670	15.4
Nov-20-2010	692	18.8
Nov-21-2010	731	24.1
Nov-22-2010	774	32.2
Nov-23-2010	841	27.6
Nov-24-2010	890	17.1
Nov-25-2010	885	18.2
Nov-26-2010	888	28.3
Nov-27-2010	875	29.8
Nov-28-2010	844	26.3
Nov-29-2010	818	26.6
Nov-30-2010	812	24.0
Dec-01-2010	817	19.7
Dec-02-2010	825	22.9
Dec-03-2010	832	25.7
Dec-04-2010	832	26.3
Dec-05-2010	816	26.5
Dec-06-2010	789	28.9
Dec-07-2010	793	27.6
Dec-08-2010	798	26.4
Dec-09-2010	817	23.7
Dec-10-2010	850	22.9
Dec-11-2010	827	22.6
Dec-12-2010	805	23.8
Dec-13-2010	791	23.6
Dec-14-2010	772	24.8
Dec-15-2010	764	19.9
Dec-16-2010	812	25.0
Dec-17-2010	898	29.0
Dec-18-2010	1,170	27.8
Dec-19-2010	1,680	30.2
Dec-20-2010	2,180	31.0
Dec-21-2010	2,700	42.6
Dec-22-2010	3,350	42.9
Dec-23-2010	3,650	34.8
Dec-24-2010	3,760	35.5
Dec-25-2010	3,870	32.5
Dec-26-2010	3,980	29.6

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-27-2010	4,170	33.8
Dec-28-2010	4,330	33.4
Dec-29-2010	4,330	27.1
Dec-30-2010	4,720	42.7
Dec-31-2010	5,240	49.3
Jan-01-2011	5,490	33.5
Jan-02-2011	5,890	34.9
Jan-03-2011	6,670	50.8
Jan-04-2011	7,820	53.5
Jan-05-2011	9,100	41.4
Jan-06-2011	10,300	38.5
Jan-07-2011	10,400	31.8
Jan-08-2011	9,370	33.8
Jan-09-2011	8,810	32.6
Jan-10-2011	8,670	26.4
Jan-11-2011	8,580	26.9
Jan-12-2011	8,230	26.0
Jan-13-2011	7,830	25.7
Jan-14-2011	7,410	19.4
Jan-15-2011	7,060	19.5
Jan-16-2011	6,650	20.2
Jan-17-2011	6,190	22.2
Jan-18-2011	5,820	23.7
Jan-19-2011	5,420	22.3
Jan-20-2011	4,970	22.1
Jan-21-2011	4,540	22.8
Jan-22-2011	4,070	22.3
Jan-23-2011	3,500	21.7
Jan-24-2011	3,110	16.5
Jan-25-2011	2,900	16.0
Jan-26-2011	3,440	15.4
Jan-27-2011	4,170	17.2
Jan-28-2011	4,440	16.6
Jan-29-2011	4,410	15.8
Jan-30-2011	4,250	18.2
Jan-31-2011	4,210	19.1
Feb-01-2011	4,160	19.2
Feb-02-2011	4,060	17.8
Feb-03-2011	4,160	22.7
Feb-04-2011	4,220	25.1
Feb-05-2011	4,170	27.7
Feb-06-2011	4,110	30.2
Feb-07-2011	4,060	33.6
Feb-08-2011	4,050	30.8
Feb-09-2011	4,000	34.4
Feb-10-2011	3,970	31.1
Feb-11-2011	3,960	29.0
Feb-12-2011	3,950	27.9
Feb-13-2011	3,940	25.8
Feb-14-2011	3,920	29.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-15-2011	3,920	33.4
Feb-16-2011	3,980	31.7
Feb-17-2011	4,040	34.0
Feb-18-2011	4,180	35.4
Feb-19-2011	4,760	55.5
Feb-20-2011	5,490	84.1
Feb-21-2011	6,070	77.2
Feb-22-2011	6,350	62.0
Feb-23-2011	6,320	54.3
Feb-24-2011	6,040	50.1
Feb-25-2011	5,820	51.3
Feb-26-2011	6,080	49.1
Feb-27-2011	5,860	51.9
Feb-28-2011	5,820	50.7
Mar-01-2011	5,780	46.4
Mar-02-2011	5,650	47.2
Mar-03-2011	5,450	40.1
Mar-04-2011	5,220	39.4
Mar-05-2011	5,060	40.7
Mar-06-2011	5,010	45.1
Mar-07-2011	4,960	48.9
Mar-08-2011	4,930	51.5
Mar-09-2011	4,930	49.9
Mar-10-2011	4,940	46.7
Mar-11-2011	4,910	41.2
Mar-12-2011	4,800	44.1
Mar-13-2011	4,500	46.2
Mar-14-2011	4,360	42.7
Mar-15-2011	4,240	38.5
Mar-16-2011	4,210	33.9
Mar-17-2011	4,200	31.0
Mar-18-2011	4,210	32.2
Mar-19-2011	4,280	35.6
Mar-20-2011	4,820	50.0
Mar-21-2011	5,680	63.8
Mar-22-2011	6,590	100.0
Mar-23-2011	6,560	92.6
Mar-24-2011	7,350	66.3
Mar-25-2011	10,100	55.6
Mar-26-2011	12,700	55.5
Mar-27-2011	15,400	47.4
Mar-28-2011	17,600	48.7
Mar-29-2011	19,000	45.0
Mar-30-2011	19,600	45.0
Mar-31-2011	19,600	45.0
Apr-01-2011	19,300	45.4
Apr-02-2011	18,600	46.7
Apr-03-2011	17,900	46.5
Apr-04-2011	17,900	47.1
Apr-05-2011	17,900	31.3

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-06-2011	17,800	25.5
Apr-07-2011	17,600	31.3
Apr-08-2011	17,300	34.0
Apr-09-2011	17,100	36.3
Apr-10-2011	16,800	33.3
Apr-11-2011	16,600	34.1
Apr-12-2011	16,400	28.5
Apr-13-2011	16,200	24.9
Apr-14-2011	16,000	26.7
Apr-15-2011	15,800	34.1
Apr-16-2011	15,500	34.2
Apr-17-2011	15,000	34.5
Apr-18-2011	14,300	32.2
Apr-19-2011	13,800	32.2
Apr-20-2011	13,500	32.5
Apr-21-2011	13,300	30.2
Apr-22-2011	13,200	29.0
Apr-23-2011	13,000	28.9
Apr-24-2011	12,700	27.5
Apr-25-2011	12,400	27.4
Apr-26-2011	12,200	29.7
Apr-27-2011	11,800	38.2
Apr-28-2011	11,400	37.9
Apr-29-2011	11,100	35.3
Apr-30-2011	10,800	34.5
May-01-2011	10,400	34.2
May-02-2011	9,860	30.7
May-03-2011	9,370	27.6
May-04-2011	9,060	24.1
May-05-2011	8,870	22.9
May-06-2011	8,710	22.3
May-07-2011	8,500	21.5
May-08-2011	8,290	23.2
May-09-2011	8,110	26.7
May-10-2011	7,810	26.8
May-11-2011	7,480	19.0
May-12-2011	7,080	16.4
May-13-2011	6,920	14.3
May-14-2011	6,720	15.2
May-15-2011	6,340	19.8
May-16-2011	6,030	22.1
May-17-2011	5,990	24.3
May-18-2011	6,010	26.0
May-19-2011	5,980	29.6
May-20-2011	5,880	37.9
May-21-2011	5,850	36.5
May-22-2011	5,840	34.3
May-23-2011	5,790	32.6
May-24-2011	5,680	30.1
May-25-2011	5,850	25.3

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-26-2011	5,920	27.6
May-27-2011	5,770	44.1
May-28-2011	5,550	38.0
May-29-2011	5,470	33.4
May-30-2011	5,390	30.3
May-31-2011	5,310	29.8
Jun-01-2011	5,230	38.6
Jun-02-2011	4,800	38.6
Jun-03-2011	4,490	38.2
Jun-04-2011	4,400	40.4
Jun-05-2011	4,180	56.2
Jun-06-2011	3,890	65.1
Jun-07-2011	3,860	55.0
Jun-08-2011	3,890	39.5
Jun-09-2011	3,850	37.2
Jun-10-2011	3,860	39.7
Jun-11-2011	3,740	36.0
Jun-12-2011	3,510	24.0
Jun-13-2011	3,270	15.3
Jun-14-2011	3,110	16.6
Jun-15-2011	3,040	13.2
Jun-16-2011	3,030	11.6
Jun-17-2011	3,350	13.4
Jun-18-2011	3,490	10.3
Jun-19-2011	3,420	8.6
Jun-20-2011	3,580	14.1
Jun-21-2011	4,060	19.5
Jun-22-2011	4,600	11.6
Jun-23-2011	5,030	8.3
Jun-24-2011	5,360	16.7
Jun-25-2011	5,480	23.6
Jun-26-2011	5,950	22.2
Jun-27-2011	6,380	20.7
Jun-28-2011	6,610	22.5
Jun-29-2011	6,640	25.3
Jun-30-2011	6,630	29.2
Jul-01-2011	6,950	24.9
Jul-02-2011	7,330	24.7
Jul-03-2011	7,160	24.4
Jul-04-2011	6,720	26.6
Jul-05-2011	6,360	19.0
Jul-06-2011	6,240	18.3
Jul-07-2011	6,140	17.5
Jul-08-2011	6,000	19.6
Jul-09-2011	5,940	14.6
Jul-10-2011	6,140	16.8
Jul-11-2011	6,370	13.9
Jul-12-2011	6,590	12.7
Jul-13-2011	7,070	13.0
Jul-14-2011	7,380	14.7

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-15-2011	7,110	15.5
Jul-16-2011	5,740	15.9
Jul-17-2011	3,920	16.8
Jul-18-2011	3,210	15.8
Jul-19-2011	2,830	16.3
Jul-20-2011	2,470	12.6
Jul-21-2011	2,050	9.4
Jul-22-2011	1,720	9.9
Jul-23-2011	1,500	11.2
Jul-24-2011	1,340	15.9
Jul-25-2011	1,210	14.5
Jul-26-2011	1,240	12.7
Jul-27-2011	1,180	13.3
Jul-28-2011	1,090	13.0
Jul-29-2011	983	11.8
Jul-30-2011	925	13.2
Jul-31-2011	906	15.3
Aug-01-2011	916	19.4
Aug-02-2011	905	16.1
Aug-03-2011	933	15.1
Aug-04-2011	924	16.7
Aug-05-2011	945	18.8
Aug-06-2011	883	23.0
Aug-07-2011	962	24.2
Aug-08-2011	967	19.6
Aug-09-2011	973	20.3
Aug-10-2011	894	20.0
Aug-11-2011	872	13.2
Aug-12-2011	853	14.2
Aug-13-2011	844	16.1
Aug-14-2011	889	16.8
Aug-15-2011	970	18.3
Aug-16-2011	928	19.3
Aug-17-2011	932	15.6
Aug-18-2011	917	15.8
Aug-19-2011	873	15.2
Aug-20-2011	908	12.0
Aug-21-2011	906	9.7
Aug-22-2011	898	9.8
Aug-23-2011	949	9.9
Aug-24-2011	1,640	13.5
Aug-25-2011	2,190	19.9
Aug-26-2011	2,410	18.0
Aug-27-2011	2,460	22.9
Aug-28-2011	2,530	24.8
Aug-29-2011	2,330	22.3
Aug-30-2011	2,140	16.2
Aug-31-2011	2,450	14.3
Sep-01-2011	2,320	14.1
Sep-02-2011	1,480	12.2

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-03-2011	1,130	9.9
Sep-04-2011	1,040	9.8
Sep-05-2011	998	11.1
Sep-06-2011	946	11.1
Sep-07-2011	962	10.3
Sep-08-2011	867	11.4
Sep-09-2011	829	10.0
Sep-10-2011	793	10.0
Sep-11-2011	797	12.3
Sep-12-2011	844	17.4
Sep-13-2011	827	17.1
Sep-14-2011	942	13.3
Sep-15-2011	1,020	12.2
Sep-16-2011	1,040	13.8
Sep-17-2011	1,030	16.4
Sep-18-2011	1,110	16.2
Sep-19-2011	1,180	14.9
Sep-20-2011	1,140	14.2
Sep-21-2011	1,130	16.7
Sep-22-2011	1,080	12.8
Sep-23-2011	1,070	15.7
Sep-24-2011	1,120	20.3
Sep-25-2011	1,170	21.7
Sep-26-2011	1,260	17.1
Sep-27-2011	1,180	16.9
Sep-28-2011	1,150	16.6
Sep-29-2011	1,140	13.5
Sep-30-2011	1,120	9.2
Oct-01-2011	1,140	9.8
Oct-02-2011	1,200	10.9
Oct-03-2011	1,270	11.2
Oct-04-2011	1,290	12.3
Oct-05-2011	1,400	16.2
Oct-06-2011	1,550	18.2
Oct-07-2011	1,620	22.8
Oct-08-2011	1,690	20.8
Oct-09-2011	1,710	16.7
Oct-10-2011	1,740	14.9
Oct-11-2011	1,700	13.2
Oct-12-2011	1,720	14.4
Oct-13-2011	1,760	14.9
Oct-14-2011	1,730	13.6
Oct-15-2011	1,720	13.7
Oct-16-2011	1,710	15.1
Oct-17-2011	1,740	17.7
Oct-18-2011	1,660	19.1
Oct-19-2011	1,610	18.0
Oct-20-2011	1,640	20.5
Oct-21-2011	1,610	20.4
Oct-22-2011	1,640	21.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-23-2011	1,630	15.2
Oct-24-2011	1,690	12.9
Oct-25-2011	1,660	12.2
Oct-26-2011	1,660	13.7
Oct-27-2011	1,640	16.8
Oct-28-2011	1,710	22.1
Oct-29-2011	1,770	17.3
Oct-30-2011	1,750	15.3
Oct-31-2011	1,770	12.9
Nov-01-2011	1,760	11.1
Nov-02-2011	1,380	11.5
Nov-03-2011	1,220	10.1
Nov-04-2011	1,150	10.2
Nov-05-2011	1,100	12.7
Nov-06-2011	1,080	17.4
Nov-07-2011	1,030	16.0
Nov-08-2011	1,020	15.5
Nov-09-2011	1,000	16.1
Nov-10-2011	1,030	21.5
Nov-11-2011	1,050	25.1
Nov-12-2011	1,050	20.7
Nov-13-2011	1,050	18.2
Nov-14-2011	1,040	19.1
Nov-15-2011	1,030	14.8
Nov-16-2011	1,030	14.9
Nov-17-2011	1,030	15.9
Nov-18-2011	1,080	16.2
Nov-19-2011	1,190	15.0
Nov-20-2011	1,270	16.9
Nov-21-2011	1,210	18.7
Nov-22-2011	1,120	22.6
Nov-23-2011	1,080	19.2
Nov-24-2011	1,050	16.9
Nov-25-2011	1,030	15.2
Nov-26-2011	987	16.7
Nov-27-2011	975	15.6
Nov-28-2011	957	17.4
Nov-29-2011	933	18.3
Nov-30-2011	870	15.1
Dec-01-2011	795	12.0
Dec-02-2011	752	23.9
Dec-03-2011	744	21.6
Dec-04-2011	721	19.6
Dec-05-2011	690	16.9
Dec-06-2011	651	14.5
Dec-07-2011	639	13.3
Dec-08-2011	631	18.0
Dec-09-2011	627	21.7
Dec-10-2011	625	17.1
Dec-11-2011	636	17.1

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-12-2011	637	24.1
Dec-13-2011	624	26.5
Dec-14-2011	619	26.5
Dec-15-2011	621	19.9
Dec-16-2011	611	15.6
Dec-17-2011	609	22.7
Dec-18-2011	622	18.5
Dec-19-2011	633	22.5
Dec-20-2011	641	17.3
Dec-21-2011	640	15.5
Dec-22-2011	632	15.1
Dec-23-2011	612	15.7
Dec-24-2011	622	15.7
Dec-25-2011	635	14.4
Dec-26-2011	643	14.5
Dec-27-2011	630	18.3
Dec-28-2011	601	15.1
Dec-29-2011	614	14.4
Dec-30-2011	660	15.0
Dec-31-2011	680	16.5
Jan-01-2012	656	18.9
Jan-02-2012	638	17.6
Jan-03-2012	615	15.3
Jan-04-2012	597	16.2
Jan-05-2012	590	15.8
Jan-06-2012	578	16.2
Jan-07-2012	567	14.1
Jan-08-2012	580	13.8
Jan-09-2012	576	13.1
Jan-10-2012	555	13.3
Jan-11-2012	536	14.6
Jan-12-2012	534	14.3
Jan-13-2012	511	14.5
Jan-14-2012	506	16.3
Jan-15-2012	533	17.0
Jan-16-2012	546	17.2
Jan-17-2012	510	16.5
Jan-18-2012	507	14.9
Jan-19-2012	508	13.9
Jan-20-2012	527	11.5
Jan-21-2012	614	10.6
Jan-22-2012	675	15.6
Jan-23-2012	725	19.4
Jan-24-2012	686	21.2
Jan-25-2012	669	17.9
Jan-26-2012	652	15.1
Jan-27-2012	650	16.7
Jan-28-2012	623	15.1
Jan-29-2012	620	13.6
Jan-30-2012	590	13.3

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-31-2012	616	13.2
Feb-01-2012	664	13.2
Feb-02-2012	586	16.9
Feb-03-2012	571	23.6
Feb-04-2012	569	22.6
Feb-05-2012	571	20.0
Feb-06-2012	583	21.2
Feb-07-2012	600	21.2
Feb-08-2012	615	17.0
Feb-09-2012	612	14.8
Feb-10-2012	608	14.0
Feb-11-2012	607	14.4
Feb-12-2012	606	15.3
Feb-13-2012	631	13.9
Feb-14-2012	640	14.7
Feb-15-2012	650	18.9
Feb-16-2012	681	21.8
Feb-17-2012	700	24.9
Feb-18-2012	707	20.7
Feb-19-2012	721	17.3
Feb-20-2012	702	21.5
Feb-21-2012	662	26.6
Feb-22-2012	651	25.5
Feb-23-2012	669	16.0
Feb-24-2012	661	22.4
Feb-25-2012	650	19.7
Feb-26-2012	659	24.1
Feb-27-2012	661	24.1
Feb-28-2012	629	30.6
Feb-29-2012	638	26.9
Mar-01-2012	643	26.7
Mar-02-2012	657	26.3
Mar-03-2012	706	22.1
Mar-04-2012	776	21.8
Mar-05-2012	779	18.9
Mar-06-2012	729	15.2
Mar-07-2012	720	16.7
Mar-08-2012	724	18.9
Mar-09-2012	775	17.3
Mar-10-2012	804	17.4
Mar-11-2012	804	14.6
Mar-12-2012	777	14.3
Mar-13-2012	739	15.6
Mar-14-2012	723	15.6
Mar-15-2012	729	17.8
Mar-16-2012	707	23.5
Mar-17-2012	748	24.9
Mar-18-2012	799	52.9
Mar-19-2012	1,010	74.8
Mar-20-2012	1,180	60.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-21-2012	1,210	40.0
Mar-22-2012	1,130	27.1
Mar-23-2012	1,000	25.1
Mar-24-2012	931	23.3
Mar-25-2012	898	16.1
Mar-26-2012	885	14.7
Mar-27-2012	826	18.1
Mar-28-2012	803	17.1
Mar-29-2012	758	12.9
Mar-30-2012	733	13.8
Mar-31-2012	736	13.1
Apr-01-2012	736	10.7
Apr-02-2012	725	15.8
Apr-03-2012	693	18.1
Apr-04-2012	666	11.0
Apr-05-2012	663	8.3
Apr-06-2012	614	6.9
Apr-07-2012	601	7.0
Apr-08-2012	593	7.1
Apr-09-2012	615	7.2
Apr-10-2012	615	7.1
Apr-11-2012	612	6.8
Apr-12-2012	650	7.8
Apr-13-2012	692	11.7
Apr-14-2012	799	28.4
Apr-15-2012	1,320	32.6
Apr-16-2012	1,510	21.1
Apr-17-2012	1,340	12.6
Apr-18-2012	1,040	10.6
Apr-19-2012	877	11.9
Apr-20-2012	806	8.1
Apr-21-2012	706	8.1
Apr-22-2012	648	8.9
Apr-23-2012	616	7.2
Apr-24-2012	566	8.1
Apr-25-2012	524	10.1
Apr-26-2012	559	10.1
Apr-27-2012	550	8.6
Apr-28-2012	517	8.2
Apr-29-2012	497	7.1
Apr-30-2012	757	7.1
May-01-2012	1,010	12.4
May-02-2012	1,090	12.4
May-03-2012	1,150	11.1
May-04-2012	1,220	8.3
May-05-2012	1,240	6.2
May-06-2012	1,300	5.8
May-07-2012	1,340	6.9
May-08-2012	1,320	7.5
May-09-2012	1,330	7.1

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-10-2012	1,330	6.4
May-11-2012	1,200	9.2
May-12-2012	1,120	10.7
May-13-2012	1,010	9.4
May-14-2012	953	8.0
May-15-2012	836	8.5
May-16-2012	763	13.0
May-17-2012	727	14.4
May-18-2012	683	10.0
May-19-2012	632	11.0
May-20-2012	672	11.5
May-21-2012	701	12.5
May-22-2012	671	16.7
May-23-2012	624	13.6
May-24-2012	598	11.4
May-25-2012	555	9.7
May-26-2012	527	11.6
May-27-2012	565	11.7
May-28-2012	604	11.0
May-29-2012	566	13.9
May-30-2012	532	14.8
May-31-2012	519	14.4
Jun-01-2012	520	12.0
Jun-02-2012	528	10.2
Jun-03-2012	503	11.9
Jun-04-2012	565	11.2
Jun-05-2012	612	10.6
Jun-06-2012	663	11.1
Jun-07-2012	618	13.6
Jun-08-2012	574	14.2
Jun-09-2012	552	12.0
Jun-10-2012	580	12.5
Jun-11-2012	582	12.2
Jun-12-2012	559	13.6
Jun-13-2012	504	13.9
Jun-14-2012	481	15.0
Jun-15-2012	443	16.3
Jun-16-2012	447	18.4
Jun-17-2012	440	16.8
Jun-18-2012	461	19.4
Jun-19-2012	461	18.3
Jun-20-2012	470	14.1
Jun-21-2012	450	13.3
Jun-22-2012	431	11.4
Jun-23-2012	425	11.7
Jun-24-2012	440	18.2
Jun-25-2012	456	19.3
Jun-26-2012	424	13.2
Jun-27-2012	417	11.9
Jun-28-2012	422	10.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-29-2012	422	6.9
Jun-30-2012	402	6.4
Jul-01-2012	427	10.5
Jul-02-2012	442	17.7
Jul-03-2012	416	15.0
Jul-04-2012	365	14.6
Jul-05-2012	354	19.7
Jul-06-2012	351	18.2
Jul-07-2012	338	13.1
Jul-08-2012	374	14.2
Jul-09-2012	393	18.2
Jul-10-2012	344	13.6
Jul-11-2012	331	12.5
Jul-12-2012	380	15.1
Jul-13-2012	363	15.3
Jul-14-2012	344	14.4
Jul-15-2012	351	15.6
Jul-16-2012	372	17.9
Jul-17-2012	377	15.4
Jul-18-2012	386	13.6
Jul-19-2012	378	11.9
Jul-20-2012	340	10.0
Jul-21-2012	364	11.9
Jul-22-2012	383	13.3
Jul-23-2012	384	10.9
Jul-24-2012	347	8.9
Jul-25-2012	337	7.5
Jul-26-2012	332	6.5
Jul-27-2012	360	6.6
Jul-28-2012	337	8.1
Jul-29-2012	380	7.3
Jul-30-2012	388	7.7
Jul-31-2012	377	11.9
Aug-01-2012	335	10.3
Aug-02-2012	354	9.2
Aug-03-2012	345	7.1
Aug-04-2012	303	5.8
Aug-05-2012	309	5.7
Aug-06-2012	363	8.6
Aug-07-2012	359	10.0
Aug-08-2012	361	8.9
Aug-09-2012	355	12.4
Aug-10-2012	359	17.2
Aug-11-2012	342	12.4
Aug-12-2012	331	10.4
Aug-13-2012	339	8.1
Aug-14-2012	299	7.9
Aug-15-2012	327	7.7
Aug-16-2012	295	8.4
Aug-17-2012	292	9.3

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-18-2012	278	9.2
Aug-19-2012	320	9.9
Aug-20-2012	350	8.7
Aug-21-2012	357	10.1
Aug-22-2012	388	12.3
Aug-23-2012	341	10.0
Aug-24-2012	346	8.3
Aug-25-2012	337	8.9
Aug-26-2012	351	7.3
Aug-27-2012	351	6.8
Aug-28-2012	316	5.8
Aug-29-2012	324	5.6
Aug-30-2012	303	6.0
Aug-31-2012	290	5.8
Sep-01-2012	286	5.5
Sep-02-2012	319	5.9
Sep-03-2012	343	8.6
Sep-04-2012	341	8.0
Sep-05-2012	308	6.7
Sep-06-2012	320	5.7
Sep-07-2012	313	5.5
Sep-08-2012	278	5.5
Sep-09-2012	282	6.0
Sep-10-2012	306	9.0
Sep-11-2012	307	7.7
Sep-12-2012	297	6.1
Sep-13-2012	310	5.6
Sep-14-2012	269	5.5
Sep-15-2012	270	5.5
Sep-16-2012	256	5.8
Sep-17-2012	285	8.3
Sep-18-2012	290	9.0
Sep-19-2012	285	7.2
Sep-20-2012	320	6.2
Sep-21-2012	322	6.1
Sep-22-2012	325	5.7
Sep-23-2012	309	6.4
Sep-24-2012	323	6.8
Sep-25-2012	294	5.8
Sep-26-2012	277	6.3
Sep-27-2012	271	6.4
Sep-28-2012	275	7.6
Sep-29-2012	273	11.4
Sep-30-2012	267	10.0
Oct-01-2012	280	11.5
Oct-02-2012	286	12.1
Oct-03-2012	291	8.6
Oct-04-2012	300	6.6
Oct-05-2012	296	6.6
Oct-06-2012	304	7.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-07-2012	304	9.6
Oct-08-2012	308	10.0
Oct-09-2012	320	9.6
Oct-10-2012	339	9.9
Oct-11-2012	367	9.4
Oct-12-2012	375	9.0
Oct-13-2012	355	10.3
Oct-14-2012	364	11.2
Oct-15-2012	408	10.8
Oct-16-2012	406	10.3
Oct-17-2012	425	10.6
Oct-18-2012	485	12.1
Oct-19-2012	558	11.8
Oct-20-2012	911	13.3
Oct-21-2012	1,280	12.9
Oct-22-2012	1,180	12.5
Oct-23-2012	952	12.5
Oct-24-2012	834	13.0
Oct-25-2012	802	14.7
Oct-26-2012	737	12.9
Oct-27-2012	635	11.4
Oct-28-2012	555	10.5
Oct-29-2012	541	10.2
Oct-30-2012	535	10.5
Oct-31-2012	518	11.9
Nov-01-2012	506	12.3
Nov-02-2012	513	12.5
Nov-03-2012	518	12.7
Nov-04-2012	524	12.1
Nov-05-2012	532	10.3
Nov-06-2012	526	8.9
Nov-07-2012	531	8.6
Nov-08-2012	516	11.3
Nov-09-2012	505	13.8
Nov-10-2012	511	12.8
Nov-11-2012	516	15.5
Nov-12-2012	536	13.8
Nov-13-2012	548	12.7
Nov-14-2012	569	12.2
Nov-15-2012	575	11.9
Nov-16-2012	568	12.2
Nov-17-2012	572	12.9
Nov-18-2012	591	12.8
Nov-19-2012	610	15.8
Nov-20-2012	627	14.8
Nov-21-2012	634	13.0
Nov-22-2012	627	21.2
Nov-23-2012	620	31.8
Nov-24-2012	630	31.2
Nov-25-2012	622	23.5

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-26-2012	607	20.7
Nov-27-2012	602	18.7
Nov-28-2012	611	14.7
Nov-29-2012	626	12.1
Nov-30-2012	653	12.2
Dec-01-2012	691	13.4
Dec-02-2012	748	26.6
Dec-03-2012	807	32.4
Dec-04-2012	891	34.2
Dec-05-2012	934	29.2
Dec-06-2012	952	24.3
Dec-07-2012	935	23.7
Dec-08-2012	897	23.0
Dec-09-2012	856	22.4
Dec-10-2012	813	21.1
Dec-11-2012	770	18.5
Dec-12-2012	732	18.8
Dec-13-2012	712	18.5
Dec-14-2012	686	18.3
Dec-15-2012	654	15.6
Dec-16-2012	653	14.2
Dec-17-2012	656	14.4
Dec-18-2012	667	15.2
Dec-19-2012	656	18.9
Dec-20-2012	645	16.7
Dec-21-2012	635	14.2
Dec-22-2012	651	13.7
Dec-23-2012	671	17.1
Dec-24-2012	1,360	18.8
Dec-25-2012	1,560	22.0
Dec-26-2012	1,650	24.4
Dec-27-2012	1,740	25.7
Dec-28-2012	1,960	28.3
Dec-29-2012	1,960	22.6
Dec-30-2012	1,760	18.3
Dec-31-2012	1,500	20.1
Jan-01-2013	1,290	19.5
Jan-02-2013	1,150	18.3
Jan-03-2013	1,050	15.4
Jan-04-2013	969	13.8
Jan-05-2013	896	13.4
Jan-06-2013	892	16.2
Jan-07-2013	929	30.9
Jan-08-2013	1,200	48.2
Jan-09-2013	1,260	34.0
Jan-10-2013	1,210	26.6
Jan-11-2013	1,120	23.1
Jan-12-2013	1,020	18.6
Jan-13-2013	960	18.7
Jan-14-2013	924	16.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jan-15-2013	883	16.1
Jan-16-2013	848	14.6
Jan-17-2013	815	13.7
Jan-18-2013	792	12.7
Jan-19-2013	768	12.8
Jan-20-2013	747	15.9
Jan-21-2013	747	13.1
Jan-22-2013	733	12.7
Jan-23-2013	714	14.1
Jan-24-2013	702	14.7
Jan-25-2013	691	15.6
Jan-26-2013	690	14.5
Jan-27-2013	680	19.6
Jan-28-2013	683	21.2
Jan-29-2013	687	16.7
Jan-30-2013	670	16.7
Jan-31-2013	651	19.3
Feb-01-2013	647	18.3
Feb-02-2013	626	17.5
Feb-03-2013	616	17.9
Feb-04-2013	620	16.8
Feb-05-2013	613	16.2
Feb-06-2013	608	19.0
Feb-07-2013	609	18.1
Feb-08-2013	605	18.6
Feb-09-2013	600	17.7
Feb-10-2013	592	17.9
Feb-11-2013	582	17.3
Feb-12-2013	570	16.8
Feb-13-2013	551	15.6
Feb-14-2013	547	15.9
Feb-15-2013	558	15.9
Feb-16-2013	562	18.2
Feb-17-2013	576	19.0
Feb-18-2013	585	18.9
Feb-19-2013	588	19.6
Feb-20-2013	611	20.9
Feb-21-2013	627	20.1
Feb-22-2013	647	23.7
Feb-23-2013	662	19.3
Feb-24-2013	679	17.2
Feb-25-2013	674	23.2
Feb-26-2013	673	23.5
Feb-27-2013	682	27.2
Feb-28-2013	674	24.8
Mar-01-2013	681	23.8
Mar-02-2013	695	19.1
Mar-03-2013	712	24.5
Mar-04-2013	711	23.5
Mar-05-2013	720	19.5

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-06-2013	743	22.0
Mar-07-2013	768	24.4
Mar-08-2013	779	25.8
Mar-09-2013	805	21.1
Mar-10-2013	801	20.5
Mar-11-2013	759	15.5
Mar-12-2013	695	12.6
Mar-13-2013	677	12.4
Mar-14-2013	658	13.6
Mar-15-2013	676	12.4
Mar-16-2013	707	11.6
Mar-17-2013	750	13.0
Mar-18-2013	751	14.0
Mar-19-2013	769	13.4
Mar-20-2013	725	13.3
Mar-21-2013	704	9.9
Mar-22-2013	677	10.1
Mar-23-2013	670	14.0
Mar-24-2013	654	13.1
Mar-25-2013	649	14.1
Mar-26-2013	574	12.1
Mar-27-2013	535	11.6
Mar-28-2013	515	13.5
Mar-29-2013	511	11.8
Mar-30-2013	503	10.3
Mar-31-2013	510	12.7
Apr-01-2013	562	21.9
Apr-02-2013	575	25.5
Apr-03-2013	591	20.1
Apr-04-2013	616	12.4
Apr-05-2013	626	11.9
Apr-06-2013	618	9.4
Apr-07-2013	614	10.8
Apr-08-2013	623	10.5
Apr-09-2013	607	22.8
Apr-10-2013	580	31.2
Apr-11-2013	549	27.4
Apr-12-2013	495	24.2
Apr-13-2013	448	16.2
Apr-14-2013	416	8.8
Apr-15-2013	419	7.7
Apr-16-2013	434	10.1
Apr-17-2013	469	13.2
Apr-18-2013	424	13.7
Apr-19-2013	728	12.3
Apr-20-2013	924	11.7
Apr-21-2013	803	12.3
Apr-22-2013	775	10.7
Apr-23-2013	689	8.6
Apr-24-2013	591	7.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-25-2013	538	7.2
Apr-26-2013	516	9.7
Apr-27-2013	473	8.4
Apr-28-2013	466	7.6
Apr-29-2013	494	7.5
Apr-30-2013	487	6.1
May-01-2013	494	7.2
May-02-2013	471	7.3
May-03-2013	453	6.5
May-04-2013	415	5.8
May-05-2013	422	7.7
May-06-2013	442	15.6
May-07-2013	478	21.4
May-08-2013	515	18.0
May-09-2013	480	14.4
May-10-2013	441	12.8
May-11-2013	440	10.9
May-12-2013	441	8.1
May-13-2013	480	7.9
May-14-2013	470	9.5
May-15-2013	442	10.0
May-16-2013	417	10.7
May-17-2013	412	11.1
May-18-2013	421	12.8
May-19-2013	438	11.7
May-20-2013	458	12.3
May-21-2013	484	12.5
May-22-2013	467	11.3
May-23-2013	418	15.4
May-24-2013	397	21.6
May-25-2013	382	14.2
May-26-2013	420	10.4
May-27-2013	438	9.8
May-28-2013	425	11.6
May-29-2013	459	10.5
May-30-2013	453	9.8
May-31-2013	426	11.1
Jun-01-2013	420	12.9
Jun-02-2013	454	12.2
Jun-03-2013	476	10.3
Jun-04-2013	440	11.0
Jun-05-2013	432	11.0
Jun-06-2013	401	9.0
Jun-07-2013	398	9.7
Jun-08-2013	362	12.8
Jun-09-2013	362	13.0
Jun-10-2013	361	12.1
Jun-11-2013	340	16.1
Jun-12-2013	340	14.8
Jun-13-2013	342	9.2

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jun-14-2013	357	8.3
Jun-15-2013	343	7.2
Jun-16-2013	329	5.6
Jun-17-2013	329	5.8
Jun-18-2013	324	5.8
Jun-19-2013	305	5.4
Jun-20-2013	279	5.2
Jun-21-2013	289	5.0
Jun-22-2013	301	7.4
Jun-23-2013	302	6.8
Jun-24-2013	314	6.4
Jun-25-2013	326	7.3
Jun-26-2013	319	8.9
Jun-27-2013	299	11.3
Jun-28-2013	303	8.7
Jun-29-2013	296	7.8
Jun-30-2013	288	12.9
Jul-01-2013	291	13.4
Jul-02-2013	310	15.5
Jul-03-2013	270	12.5
Jul-04-2013	255	9.4
Jul-05-2013	265	6.7
Jul-06-2013	265	5.8
Jul-07-2013	267	9.2
Jul-08-2013	264	14.3
Jul-09-2013	250	16.5
Jul-10-2013	239	17.4
Jul-11-2013	237	13.1
Jul-12-2013	219	8.9
Jul-13-2013	194	10.4
Jul-14-2013	208	11.1
Jul-15-2013	239	10.7
Jul-16-2013	213	9.6
Jul-17-2013	241	9.0
Jul-18-2013	243	7.4
Jul-19-2013	250	7.6
Jul-20-2013	251	9.1
Jul-21-2013	255	13.2
Jul-22-2013	247	15.5
Jul-23-2013	231	20.6
Jul-24-2013	247	21.7
Jul-25-2013	251	17.3
Jul-26-2013	235	17.0
Jul-27-2013	253	15.3
Jul-28-2013	262	15.1
Jul-29-2013	279	13.4
Jul-30-2013	267	14.9
Jul-31-2013	254	15.2
Aug-01-2013	254	15.7
Aug-02-2013	250	12.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-03-2013	260	9.7
Aug-04-2013	257	9.8
Aug-05-2013	251	9.7
Aug-06-2013	237	9.9
Aug-07-2013	235	15.3
Aug-08-2013	248	15.8
Aug-09-2013	272	19.5
Aug-10-2013	254	15.3
Aug-11-2013	257	13.2
Aug-12-2013	256	12.7
Aug-13-2013	272	10.3
Aug-14-2013	263	10.3
Aug-15-2013	234	13.5
Aug-16-2013	217	15.0
Aug-17-2013	226	15.3
Aug-18-2013	250	14.6
Aug-19-2013	244	12.6
Aug-20-2013	232	13.1
Aug-21-2013	227	15.7
Aug-22-2013	234	14.1
Aug-23-2013	233	13.7
Aug-24-2013	235	13.7
Aug-25-2013	253	13.9
Aug-26-2013	247	10.8
Aug-27-2013	262	11.1
Aug-28-2013	259	10.9
Aug-29-2013	231	12.5
Aug-30-2013	238	13.1
Aug-31-2013	224	13.7
Sep-01-2013	238	9.2
Sep-02-2013	224	7.8
Sep-03-2013	230	11.4
Sep-04-2013	223	13.1
Sep-05-2013	248	13.0
Sep-06-2013	264	9.7
Sep-07-2013	254	8.3
Sep-08-2013	263	7.4
Sep-09-2013	265	7.0
Sep-10-2013	246	7.7
Sep-11-2013	236	8.7
Sep-12-2013	208	9.8
Sep-13-2013	226	10.7
Sep-14-2013	230	10.6
Sep-15-2013	223	9.5
Sep-16-2013	236	9.7
Sep-17-2013	258	9.1
Sep-18-2013	271	8.1
Sep-19-2013	297	9.0
Sep-20-2013	388	9.3
Sep-21-2013	594	10.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-22-2013	825	12.5
Sep-23-2013	1,020	11.9
Sep-24-2013	1,140	11.0
Sep-25-2013	1,160	8.8
Sep-26-2013	1,200	8.4
Sep-27-2013	1,210	9.0
Sep-28-2013	1,000	8.7
Sep-29-2013	665	9.7
Sep-30-2013	564	11.8
Oct-01-2013	508	12.5
Oct-02-2013	459	12.7
Oct-03-2013	453	11.2
Oct-04-2013	399	12.3
Oct-05-2013	377	10.2
Oct-06-2013	396	8.6
Oct-07-2013	389	10.7
Oct-08-2013	374	11.2
Oct-09-2013	383	10.5
Oct-10-2013	368	14.9
Oct-11-2013	351	15.3
Oct-12-2013	341	15.6
Oct-13-2013	369	14.8
Oct-14-2013	355	15.8
Oct-15-2013	355	14.2
Oct-16-2013	343	13.2
Oct-17-2013	358	13.1
Oct-18-2013	377	13.2
Oct-19-2013	415	12.3
Oct-20-2013	447	11.6
Oct-21-2013	490	11.6
Oct-22-2013	486	12.6
Oct-23-2013	473	14.3
Oct-24-2013	444	14.6
Oct-25-2013	453	15.0
Oct-26-2013	582	13.9
Oct-27-2013	772	12.1
Oct-28-2013	845	10.2
Oct-29-2013	793	12.3
Oct-30-2013	714	11.4
Oct-31-2013	641	9.9
Nov-01-2013	573	11.0
Nov-02-2013	542	13.2
Nov-03-2013	525	11.5
Nov-04-2013	508	13.1
Nov-05-2013	462	14.5
Nov-06-2013	445	13.2
Nov-07-2013	432	11.4
Nov-08-2013	421	10.8
Nov-09-2013	417	11.0
Nov-10-2013	420	11.1

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Nov-11-2013	426	11.7
Nov-12-2013	441	11.5
Nov-13-2013	448	12.0
Nov-14-2013	445	11.9
Nov-15-2013	443	11.6
Nov-16-2013	438	13.2
Nov-17-2013	445	12.4
Nov-18-2013	452	11.5
Nov-19-2013	447	11.5
Nov-20-2013	468	12.3
Nov-21-2013	485	11.2
Nov-22-2013	493	15.2
Nov-23-2013	496	16.2
Nov-24-2013	495	13.7
Nov-25-2013	495	12.8
Nov-26-2013	498	12.6
Nov-27-2013	492	12.1
Nov-28-2013	490	12.8
Nov-29-2013	489	12.7
Nov-30-2013	485	11.7
Dec-01-2013	481	11.6
Dec-02-2013	482	11.8
Dec-03-2013	484	12.3
Dec-04-2013	483	13.1
Dec-05-2013	471	13.3
Dec-06-2013	456	13.1
Dec-07-2013	465	13.3
Dec-08-2013	474	13.7
Dec-09-2013	473	19.5
Dec-10-2013	470	13.9
Dec-11-2013	470	11.9
Dec-12-2013	468	11.3
Dec-13-2013	467	11.0
Dec-14-2013	465	11.2
Dec-15-2013	466	11.4
Dec-16-2013	468	11.0
Dec-17-2013	458	11.0
Dec-18-2013	448	11.2
Dec-19-2013	449	10.8
Dec-20-2013	443	12.0
Dec-21-2013	428	12.2
Dec-22-2013	426	11.8
Dec-23-2013	420	13.8
Dec-24-2013	411	13.1
Dec-25-2013	414	11.8
Dec-26-2013	433	11.4
Dec-27-2013	422	10.9
Dec-28-2013	419	10.7
Dec-29-2013	409	10.9
Dec-30-2013	406	11.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-31-2013	400	10.8
Jan-01-2014	398	10.0
Jan-02-2014	405	9.9
Jan-03-2014	403	10.0
Jan-04-2014	395	10.0
Jan-05-2014	393	10.0
Jan-06-2014	389	10.0
Jan-07-2014	378	10.6
Jan-08-2014	365	11.1
Jan-09-2014	362	12.8
Jan-10-2014	366	12.6
Jan-11-2014	367	12.6
Jan-12-2014	365	10.8
Jan-13-2014	354	13.7
Jan-14-2014	350	15.1
Jan-15-2014	351	16.5
Jan-16-2014	343	16.6
Jan-17-2014	332	14.6
Jan-18-2014	327	15.5
Jan-19-2014	332	18.1
Jan-20-2014	336	17.4
Jan-21-2014	333	16.5
Jan-22-2014	335	17.0
Jan-23-2014	342	17.8
Jan-24-2014	346	18.4
Jan-25-2014	347	18.5
Jan-26-2014	350	22.0
Jan-27-2014	360	24.6
Jan-28-2014	353	27.6
Jan-29-2014	354	24.3
Jan-30-2014	369	23.5
Jan-31-2014	394	20.0
Feb-01-2014	406	21.6
Feb-02-2014	415	16.8
Feb-03-2014	422	13.3
Feb-04-2014	415	22.4
Feb-05-2014	403	26.5
Feb-06-2014	408	21.8
Feb-07-2014	414	23.3
Feb-08-2014	432	38.6
Feb-09-2014	455	41.6
Feb-10-2014	474	40.3
Feb-11-2014	482	28.1
Feb-12-2014	475	24.7
Feb-13-2014	459	21.8
Feb-14-2014	438	22.8
Feb-15-2014	426	23.5
Feb-16-2014	417	23.4
Feb-17-2014	400	24.3
Feb-18-2014	382	23.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-19-2014	377	31.5
Feb-20-2014	370	28.3
Feb-21-2014	366	17.5
Feb-22-2014	357	12.6
Feb-23-2014	349	10.2
Feb-24-2014	348	8.8
Feb-25-2014	341	8.6
Feb-26-2014	339	10.9
Feb-27-2014	357	13.5
Feb-28-2014	392	39.0
Mar-01-2014	423	50.6
Mar-02-2014	451	48.0
Mar-03-2014	460	34.6
Mar-04-2014	454	33.7
Mar-05-2014	434	35.0
Mar-06-2014	429	28.9
Mar-07-2014	417	20.3
Mar-08-2014	408	15.6
Mar-09-2014	403	14.0
Mar-10-2014	399	12.2
Mar-11-2014	389	12.9
Mar-12-2014	382	13.1
Mar-13-2014	382	10.8
Mar-14-2014	390	10.0
Mar-15-2014	401	8.6
Mar-16-2014	400	7.4
Mar-17-2014	380	6.2
Mar-18-2014	361	6.0
Mar-19-2014	349	6.4
Mar-20-2014	324	6.3
Mar-21-2014	304	6.1
Mar-22-2014	298	5.7
Mar-23-2014	293	5.6
Mar-24-2014	286	5.6
Mar-25-2014	278	5.6
Mar-26-2014	267	5.8
Mar-27-2014	260	6.0
Mar-28-2014	272	5.7
Mar-29-2014	314	5.8
Mar-30-2014	351	7.8
Mar-31-2014	373	11.3
Apr-01-2014	384	12.4
Apr-02-2014	421	10.2
Apr-03-2014	430	9.0
Apr-04-2014	417	10.1
Apr-05-2014	403	10.5
Apr-06-2014	413	9.9
Apr-07-2014	405	9.4
Apr-08-2014	394	9.2
Apr-09-2014	394	7.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Apr-10-2014	382	6.9
Apr-11-2014	365	6.7
Apr-12-2014	347	5.9
Apr-13-2014	341	5.6
Apr-14-2014	329	5.6
Apr-15-2014	312	5.6
Apr-16-2014	282	5.4
Apr-17-2014	249	5.6
Apr-18-2014	244	7.4
Apr-19-2014	243	7.0
Apr-20-2014	253	5.8
Apr-21-2014	253	5.5
Apr-22-2014	270	4.9
Apr-23-2014	262	3.5
Apr-24-2014	249	5.4
Apr-25-2014	323	5.8
Apr-26-2014	450	8.5
Apr-27-2014	518	14.0
Apr-28-2014	584	12.9
Apr-29-2014	571	12.8
Apr-30-2014	469	17.5
May-01-2014	365	13.7
May-02-2014	305	10.3
May-03-2014	268	9.3
May-04-2014	262	9.8
May-05-2014	272	9.3
May-06-2014	255	9.1
May-07-2014	226	8.3
May-08-2014	202	6.3
May-09-2014	183	5.7
May-10-2014	174	5.1
May-11-2014	183	4.5
May-12-2014	170	5.9
May-13-2014	164	6.5
May-14-2014	159	5.7
May-15-2014	153	5.4
May-16-2014	156	4.9
May-17-2014	153	4.3
May-18-2014	148	4.4
May-19-2014	151	4.7
May-20-2014	145	5.1
May-21-2014	138	5.6
May-22-2014	139	6.2
May-23-2014	135	6.0
May-24-2014	129	5.9
May-25-2014	132	6.1
May-26-2014	136	5.7
May-27-2014	148	6.5
May-28-2014	147	6.6
May-29-2014	139	5.8

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-30-2014	122	5.8
May-31-2014	116	5.5
Jun-01-2014	124	5.2
Jun-02-2014	142	4.5
Jun-03-2014	123	3.3
Jun-04-2014	105	3.3
Jun-05-2014	103	3.8
Jun-06-2014	86	2.2
Jun-07-2014	85	1.0
Jun-08-2014	107	2.9
Jun-09-2014	98	0.6
Jun-10-2014	98	0.0
Jun-11-2014	111	0.0
Jun-12-2014	105	0.8
Jun-13-2014	105	7.4
Jun-14-2014	115	6.4
Jun-15-2014	108	5.4
Jun-16-2014	94	5.5
Jun-17-2014	96	5.8
Jun-18-2014	109	8.3
Jun-19-2014	106	10.2
Jun-20-2014	104	9.2
Jun-21-2014	100	12.9
Jun-22-2014	100	19.0
Jun-23-2014	106	11.7
Jun-24-2014	96	12.4
Jun-25-2014	85	10.4
Jun-26-2014	86	9.7
Jun-27-2014	89	9.7
Jun-28-2014	88	14.1
Jun-29-2014	86	11.5
Jun-30-2014	87	7.4
Jul-01-2014	85	5.9
Jul-02-2014	80	6.1
Jul-03-2014	66	8.3
Jul-04-2014	62	6.3
Jul-05-2014	69	5.2
Jul-06-2014	74	4.4
Jul-07-2014	79	5.2
Jul-08-2014	83	5.5
Jul-09-2014	75	5.0
Jul-10-2014	78	5.5
Jul-11-2014	85	5.6
Jul-12-2014	87	5.5
Jul-13-2014	91	6.1
Jul-14-2014	77	5.6
Jul-15-2014	83	5.4
Jul-16-2014	82	5.5
Jul-17-2014	65	5.5
Jul-18-2014	58	5.5

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-19-2014	70	5.6
Jul-20-2014	67	5.5
Jul-21-2014	62	5.5
Jul-22-2014	62	5.5
Jul-23-2014	54	5.6
Jul-24-2014	58	6.8
Jul-25-2014	48	7.6
Jul-26-2014	58	6.0
Jul-27-2014	56	5.5
Jul-28-2014	57	5.3
Jul-29-2014	48	5.0
Jul-30-2014	52	5.1
Jul-31-2014	46	4.7
Aug-01-2014	62	3.9
Aug-02-2014	75	3.4
Aug-03-2014	71	2.6
Aug-04-2014	70	1.5
Aug-05-2014	62	0.8
Aug-06-2014	59	0.8
Aug-07-2014	60	1.3
Aug-08-2014	61	1.8
Aug-09-2014	54	1.5
Aug-10-2014	57	0.8
Aug-11-2014	45	0.4
Aug-12-2014	38	0.2
Aug-13-2014	48	0.1
Aug-14-2014	64	0.1
Aug-15-2014	72	0.1
Aug-16-2014	56	0.0
Aug-17-2014	57	0.0
Aug-18-2014	48	0.0
Aug-19-2014	57	0.0
Aug-20-2014	63	0.0
Aug-21-2014	77	0.0
Aug-22-2014	81	0.0
Aug-23-2014	74	0.0
Aug-24-2014	73	0.0
Aug-25-2014	77	0.0
Aug-26-2014	81	0.0
Aug-27-2014	83	0.0
Aug-28-2014	79	0.0
Aug-29-2014	84	0.0
Aug-30-2014	86	0.1
Aug-31-2014	85	1.4
Sep-01-2014	87	2.9
Sep-02-2014	67	3.2
Sep-03-2014	77	1.6
Sep-04-2014	94	1.0
Sep-05-2014	84	0.6
Sep-06-2014	95	0.4

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Sep-07-2014	91	0.3
Sep-08-2014	83	0.2
Sep-09-2014	81	0.1
Sep-10-2014	95	0.2
Sep-11-2014	79	0.2
Sep-12-2014	78	0.2
Sep-13-2014	103	0.2
Sep-14-2014	86	0.2
Sep-15-2014	77	0.1
Sep-16-2014	78	0.1
Sep-17-2014	75	0.2
Sep-18-2014	80	0.1
Sep-19-2014	96	0.1
Sep-20-2014	105	0.1
Sep-21-2014	112	0.1
Sep-22-2014	104	0.1
Sep-23-2014	97	0.1
Sep-24-2014	109	0.2
Sep-25-2014	115	0.2
Sep-26-2014	118	0.2
Sep-27-2014	114	0.1
Sep-28-2014	116	0.1
Sep-29-2014	108	0.0
Sep-30-2014	98	0.1
Oct-01-2014	95	0.0
Oct-02-2014	105	0.0
Oct-03-2014	93	0.0
Oct-04-2014	98	0.1
Oct-05-2014	114	0.1
Oct-06-2014	112	0.2
Oct-07-2014	110	0.2
Oct-08-2014	111	0.1
Oct-09-2014	132	0.0
Oct-10-2014	135	0.0
Oct-11-2014	117	0.1
Oct-12-2014	101	0.0
Oct-13-2014	103	0.1
Oct-14-2014	108	0.0
Oct-15-2014	109	0.1
Oct-16-2014	110	0.1
Oct-17-2014	118	0.2
Oct-18-2014	122	0.3
Oct-19-2014	127	0.4
Oct-20-2014	138	0.5
Oct-21-2014	142	1.2
Oct-22-2014	148	1.4
Oct-23-2014	184	1.7
Oct-24-2014	234	1.9
Oct-25-2014	277	2.1
Oct-26-2014	352	1.7

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-27-2014	525	1.8
Oct-28-2014	712	1.8
Oct-29-2014	850	1.9
Oct-30-2014	877	2.4
Oct-31-2014	798	3.2
Nov-01-2014	702	5.4
Nov-02-2014	570	27.0
Nov-03-2014	507	43.3
Nov-04-2014	470	29.8
Nov-05-2014	458	21.5
Nov-06-2014	455	16.8
Nov-07-2014	430	15.3
Nov-08-2014	408	12.8
Nov-09-2014	387	6.5
Nov-10-2014	370	5.5
Nov-11-2014	358	5.2
Nov-12-2014	342	5.1
Nov-13-2014	332	5.6
Nov-14-2014	326	5.6
Nov-15-2014	322	5.5
Nov-16-2014	317	5.5
Nov-17-2014	310	5.5
Nov-18-2014	309	5.5
Nov-19-2014	304	5.5
Nov-20-2014	301	5.5
Nov-21-2014	297	5.5
Nov-22-2014	292	5.4
Nov-23-2014	285	7.1
Nov-24-2014	276	6.9
Nov-25-2014	270	5.8
Nov-26-2014	279	5.8
Nov-27-2014	284	5.6
Nov-28-2014	282	5.7
Nov-29-2014	289	7.7
Nov-30-2014	308	9.2
Dec-01-2014	313	11.4
Dec-02-2014	332	21.5
Dec-03-2014	340	34.9
Dec-04-2014	349	62.1
Dec-05-2014	354	68.9
Dec-06-2014	357	40.2
Dec-07-2014	363	14.4
Dec-08-2014	381	10.9
Dec-09-2014	366	8.5
Dec-10-2014	346	6.8
Dec-11-2014	355	9.4
Dec-12-2014	571	42.2
Dec-13-2014	616	87.9
Dec-14-2014	690	101.4
Dec-15-2014	756	100.7

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-16-2014	956	82.1
Dec-17-2014	1,010	65.6
Dec-18-2014	955	77.9
Dec-19-2014	917	85.3
Dec-20-2014	863	69.3
Dec-21-2014	826	56.0
Dec-22-2014	792	49.1
Dec-23-2014	757	46.3
Dec-24-2014	719	44.7
Dec-25-2014	687	45.7
Dec-26-2014	650	51.9
Dec-27-2014	611	44.2
Dec-28-2014	579	37.6
Dec-29-2014	550	24.3
Dec-30-2014	526	15.9
Dec-31-2014	497	14.0
Jan-01-2015	482	24.4
Jan-02-2015	451	21.1
Jan-03-2015	429	19.8
Jan-04-2015	418	16.2
Jan-05-2015	425	14.9
Jan-06-2015	421	9.7
Jan-07-2015	425	5.7
Jan-08-2015	417	8.0
Jan-09-2015	401	6.4
Jan-10-2015	377	5.7
Jan-11-2015	364	5.6
Jan-12-2015	351	6.1
Jan-13-2015	349	7.0
Jan-14-2015	356	6.4
Jan-15-2015	377	7.8
Jan-16-2015	376	9.3
Jan-17-2015	373	9.4
Jan-18-2015	369	8.9
Jan-19-2015	364	9.8
Jan-20-2015	357	11.7
Jan-21-2015	351	13.7
Jan-22-2015	355	12.6
Jan-23-2015	353	12.1
Jan-24-2015	355	11.8
Jan-25-2015	361	29.0
Jan-26-2015	367	18.5
Jan-27-2015	371	20.1
Jan-28-2015	375	27.7
Jan-29-2015	380	36.1
Jan-30-2015	381	41.5
Jan-31-2015	380	21.3
Feb-01-2015	368	7.0
Feb-02-2015	354	5.7
Feb-03-2015	345	5.7

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Feb-04-2015	343	6.1
Feb-05-2015	338	5.9
Feb-06-2015	352	18.4
Feb-07-2015	363	43.8
Feb-08-2015	386	44.7
Feb-09-2015	414	36.0
Feb-10-2015	429	23.9
Feb-11-2015	408	8.7
Feb-12-2015	384	6.1
Feb-13-2015	361	5.7
Feb-14-2015	346	5.7
Feb-15-2015	337	5.6
Feb-16-2015	333	5.7
Feb-17-2015	328	5.7
Feb-18-2015	326	5.6
Feb-19-2015	321	5.6
Feb-20-2015	306	5.5
Feb-21-2015	305	5.5
Feb-22-2015	311	5.5
Feb-23-2015	323	5.5
Feb-24-2015	320	12.3
Feb-25-2015	328	29.4
Feb-26-2015	353	24.5
Feb-27-2015	376	26.4
Feb-28-2015	374	30.9
Mar-01-2015	351	14.8
Mar-02-2015	335	6.8
Mar-03-2015	318	5.9
Mar-04-2015	297	15.6
Mar-05-2015	286	29.0
Mar-06-2015	279	29.3
Mar-07-2015	283	26.3
Mar-08-2015	284	16.2
Mar-09-2015	293	7.4
Mar-10-2015	275	5.7
Mar-11-2015	264	5.6
Mar-12-2015	255	5.4
Mar-13-2015	257	5.5
Mar-14-2015	267	5.5
Mar-15-2015	273	5.4
Mar-16-2015	276	5.7
Mar-17-2015	267	7.5
Mar-18-2015	268	8.1
Mar-19-2015	267	7.6
Mar-20-2015	255	8.0
Mar-21-2015	244	11.8
Mar-22-2015	250	23.0
Mar-23-2015	239	27.6
Mar-24-2015	236	25.7
Mar-25-2015	227	20.1

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Mar-26-2015	224	17.1
Mar-27-2015	243	14.1
Mar-28-2015	263	7.2
Mar-29-2015	268	5.4
Mar-30-2015	252	4.9
Mar-31-2015	236	3.5
Apr-01-2015	227	2.0
Apr-02-2015	221	1.0
Apr-03-2015	221	1.4
Apr-04-2015	218	1.1
Apr-05-2015	212	1.1
Apr-06-2015	203	1.1
Apr-07-2015	191	1.6
Apr-08-2015	178	1.6
Apr-09-2015	197	1.5
Apr-10-2015	218	3.1
Apr-11-2015	220	6.6
Apr-12-2015	216	6.3
Apr-13-2015	215	6.2
Apr-14-2015	207	5.2
Apr-15-2015	199	5.6
Apr-16-2015	186	5.7
Apr-17-2015	179	5.5
Apr-18-2015	164	5.1
Apr-19-2015	154	3.9
Apr-20-2015	141	2.1
Apr-21-2015	138	1.2
Apr-22-2015	140	0.7
Apr-23-2015	141	0.2
Apr-24-2015	159	0.1
Apr-25-2015	153	0.1
Apr-26-2015	160	0.0
Apr-27-2015	192	0.0
Apr-28-2015	190	0.0
Apr-29-2015	178	0.0
Apr-30-2015	167	0.0
May-01-2015	134	0.0
May-02-2015	112	0.0
May-03-2015	143	0.0
May-04-2015	155	0.0
May-05-2015	134	0.0
May-06-2015	117	0.0
May-07-2015	114	0.0
May-08-2015	131	0.0
May-09-2015	123	0.0
May-10-2015	126	0.0
May-11-2015	139	0.0
May-12-2015	143	0.0
May-13-2015	152	0.0
May-14-2015	150	0.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
May-15-2015	134	0.0
May-16-2015	122	0.0
May-17-2015	133	0.0
May-18-2015	133	0.0
May-19-2015	120	0.0
May-20-2015	123	0.0
May-21-2015	119	0.0
May-22-2015	112	0.0
May-23-2015	102	0.0
May-24-2015	99	0.0
May-25-2015	110	0.0
May-26-2015	95	0.0
May-27-2015	86	0.0
May-28-2015	73	0.0
May-29-2015	69	0.0
May-30-2015	74	0.0
May-31-2015	81	0.0
Jun-01-2015	80	0.0
Jun-02-2015	86	0.0
Jun-03-2015	70	0.0
Jun-04-2015	68	0.0
Jun-05-2015	67	0.0
Jun-06-2015	65	0.0
Jun-07-2015	54	0.0
Jun-08-2015	46	0.0
Jun-09-2015	51	0.0
Jun-10-2015	65	0.0
Jun-11-2015	70	0.0
Jun-12-2015	58	0.0
Jun-13-2015	45	0.0
Jun-14-2015	51	0.0
Jun-15-2015	45	0.0
Jun-16-2015	51	0.0
Jun-17-2015	44	0.0
Jun-18-2015	57	0.0
Jun-19-2015	53	0.0
Jun-20-2015	48	0.0
Jun-21-2015	51	0.0
Jun-22-2015	41	0.0
Jun-23-2015	42	0.0
Jun-24-2015	42	0.0
Jun-25-2015	38	0.0
Jun-26-2015	41	0.0
Jun-27-2015	35	0.0
Jun-28-2015	31	0.0
Jun-29-2015	26	0.0
Jun-30-2015	31	0.0
Jul-01-2015	34	0.0
Jul-02-2015	37	0.0
Jul-03-2015	41	0.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Jul-04-2015	42	0.0
Jul-05-2015	47	0.0
Jul-06-2015	28	0.0
Jul-07-2015	30	0.0
Jul-08-2015	30	0.0
Jul-09-2015	28	0.0
Jul-10-2015	26	0.0
Jul-11-2015	23	0.0
Jul-12-2015	20	0.0
Jul-13-2015	30	0.0
Jul-14-2015	23	0.0
Jul-15-2015	30	0.0
Jul-16-2015	27	0.0
Jul-17-2015	21	0.0
Jul-18-2015	23	0.0
Jul-19-2015	28	0.0
Jul-20-2015	25	0.0
Jul-21-2015	25	0.0
Jul-22-2015	24	0.0
Jul-23-2015	22	0.0
Jul-24-2015	37	0.0
Jul-25-2015	23	0.0
Jul-26-2015	22	0.0
Jul-27-2015	19	0.0
Jul-28-2015	11	0.0
Jul-29-2015	14	0.0
Jul-30-2015	15	0.0
Jul-31-2015	12	0.0
Aug-01-2015	23	0.0
Aug-02-2015	33	0.0
Aug-03-2015	27	0.0
Aug-04-2015	30	0.0
Aug-05-2015	16	0.0
Aug-06-2015	8	0.0
Aug-07-2015	16	0.0
Aug-08-2015	14	0.0
Aug-09-2015	29	0.0
Aug-10-2015	33	0.0
Aug-11-2015	30	0.0
Aug-12-2015	32	0.0
Aug-13-2015	34	0.0
Aug-14-2015	30	0.0
Aug-15-2015	26	0.0
Aug-16-2015	38	0.0
Aug-17-2015	37	0.0
Aug-18-2015	34	0.0
Aug-19-2015	30	0.0
Aug-20-2015	29	0.0
Aug-21-2015	29	0.0
Aug-22-2015	36	0.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Aug-23-2015	35	0.0
Aug-24-2015	32	0.0
Aug-25-2015	30	0.0
Aug-26-2015	31	0.0
Aug-27-2015	39	0.0
Aug-28-2015	43	0.0
Aug-29-2015	37	0.0
Aug-30-2015	43	0.0
Aug-31-2015	39	0.0
Sep-01-2015	31	0.0
Sep-02-2015	27	0.0
Sep-03-2015	32	0.0
Sep-04-2015	27	0.0
Sep-05-2015	32	0.0
Sep-06-2015	35	0.0
Sep-07-2015	31	0.0
Sep-08-2015	21	0.0
Sep-09-2015	16	0.0
Sep-10-2015	15	0.0
Sep-11-2015	20	0.0
Sep-12-2015	14	0.0
Sep-13-2015	23	0.0
Sep-14-2015	23	0.0
Sep-15-2015	22	0.0
Sep-16-2015	25	0.0
Sep-17-2015	31	0.0
Sep-18-2015	41	0.0
Sep-19-2015	42	0.0
Sep-20-2015	42	0.0
Sep-21-2015	46	0.0
Sep-22-2015	42	0.0
Sep-23-2015	42	0.0
Sep-24-2015	35	0.0
Sep-25-2015	39	0.0
Sep-26-2015	42	0.0
Sep-27-2015	39	0.0
Sep-28-2015	35	0.0
Sep-29-2015	27	0.0
Sep-30-2015	37	0.0
Oct-01-2015	35	0.0
Oct-02-2015	33	0.0
Oct-03-2015	37	0.0
Oct-04-2015	41	0.0
Oct-05-2015	40	0.0
Oct-06-2015	36	0.0
Oct-07-2015	35	0.0
Oct-08-2015	51	0.0
Oct-09-2015	63	0.0
Oct-10-2015	70	0.0
Oct-11-2015	51	0.0

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Oct-12-2015	46	0.0
Oct-13-2015	46	0.0
Oct-14-2015	45	0.0
Oct-15-2015	43	0.0
Oct-16-2015	43	0.0
Oct-17-2015	44	0.0
Oct-18-2015	40	5.1
Oct-19-2015	40	5.4
Oct-20-2015	42	5.6
Oct-21-2015	45	
Oct-22-2015	49	
Oct-23-2015	77	0.0
Oct-24-2015	169	0.0
Oct-25-2015	321	0.0
Oct-26-2015	420	0.0
Oct-27-2015	488	0.0
Oct-28-2015	520	0.0
Oct-29-2015	542	0.0
Oct-30-2015	519	0.0
Oct-31-2015	482	0.0
Nov-01-2015	451	0.0
Nov-02-2015	457	0.0
Nov-03-2015	451	0.0
Nov-04-2015	417	0.0
Nov-05-2015	393	5.0
Nov-06-2015	373	3.2
Nov-07-2015	357	0.1
Nov-08-2015	353	0.0
Nov-09-2015	372	0.0
Nov-10-2015	374	0.0
Nov-11-2015	366	0.0
Nov-12-2015	366	0.0
Nov-13-2015	365	0.0
Nov-14-2015	358	0.0
Nov-15-2015	342	0.0
Nov-16-2015	330	0.0
Nov-17-2015	323	0.0
Nov-18-2015	321	0.1
Nov-19-2015	324	5.7
Nov-20-2015	319	5.7
Nov-21-2015	310	5.1
Nov-22-2015	312	4.2
Nov-23-2015	310	2.3
Nov-24-2015	306	1.7
Nov-25-2015	311	3.3
Nov-26-2015	313	18.0
Nov-27-2015	317	18.6
Nov-28-2015	318	18.6
Nov-29-2015	313	18.6
Nov-30-2015	318	18.6

Attachment A, Table 1. Daily Average Flow Data for Figures C-2, C-3, and C-8 (cfs)

Date	San Joaquin River at Crows Landing	San Luis Drain to Mud Slough
Dec-01-2015	320	11.7
Dec-02-2015	320	5.4
Dec-03-2015	325	4.7
Dec-04-2015	322	3.9
Dec-05-2015	320	4.1
Dec-06-2015	324	4.4
Dec-07-2015	327	4.2
Dec-08-2015	332	4.0
Dec-09-2015	329	4.9
Dec-10-2015	329	11.1
Dec-11-2015	331	29.7
Dec-12-2015	325	29.6
Dec-13-2015	332	19.4
Dec-14-2015	352	16.7
Dec-15-2015	363	25.5
Dec-16-2015	368	21.4
Dec-17-2015	368	24.7
Dec-18-2015	363	24.1
Dec-19-2015	364	25.8
Dec-20-2015	371	32.3
Dec-21-2015	382	22.2
Dec-22-2015	399	26.5
Dec-23-2015	412	22.4
Dec-24-2015	548	27.6
Dec-25-2015	698	25.5
Dec-26-2015	650	22.7
Dec-27-2015	679	21.5
Dec-28-2015	669	17.7
Dec-29-2015	617	16.9
Dec-30-2015	570	16.1
Dec-31-2015	534	13.7

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Jan-06-2005	0.4
Jan-13-2005	0.3
Jan-20-2005	0.5
Jan-27-2005	0.6
Feb-03-2005	0.8
Feb-10-2005	0.9
Feb-17-2005	0.8
Feb-24-2005	0.7
Mar-03-2005	0.8
Mar-10-2005	1.2
Mar-17-2005	1.5
Mar-24-2005	0.5
Mar-31-2005	0.3
Apr-07-2005	0.4
Apr-14-2005	0.5
Apr-21-2005	0.4
Apr-28-2005	
May-05-2005	0.4
May-12-2005	0.3
May-19-2005	
May-26-2005	
Jun-02-2005	0.1
Jun-09-2005	0.1
Jun-16-2005	0.4
Jun-23-2005	0.4
Jun-30-2005	0.4
Jul-07-2005	0.4
Jul-13-2005	0.6
Jul-21-2005	0.5
Jul-28-2005	0.6
Aug-04-2005	0.6
Aug-11-2005	0.5
Aug-18-2005	0.5
Aug-25-2005	0.5
Sep-01-2005	0.7
Sep-08-2005	0.4
Sep-15-2005	0.3
Sep-22-2005	0.3
Sep-29-2005	0.3
Oct-06-2005	0.5
Oct-13-2005	0.4
Oct-20-2005	0.4
Oct-27-2005	0.5
Nov-03-2005	0.5
Nov-10-2005	0.6
Nov-17-2005	0.6
Nov-22-2005	0.8
Dec-01-2005	0.7
Dec-08-2005	0.7
Dec-15-2005	0.8
Dec-22-2005	0.7

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Dec-29-2005	0.3
Jan-05-2006	0.3
Jan-12-2006	0.4
Jan-19-2006	0.5
Jan-26-2006	0.5
Feb-02-2006	0.7
Feb-09-2006	0.8
Feb-16-2006	0.7
Feb-23-2006	0.6
Mar-02-2006	0.5
Mar-09-2006	0.4
Mar-16-2006	0.3
Mar-23-2006	0.3
Mar-30-2006	0.4
Apr-06-2006	0.1
Apr-13-2006	0.1
Apr-20-2006	0.1
Apr-27-2006	<0.1
May-04-2006	0.1
May-11-2006	0.2
May-18-2006	0.1
May-25-2006	<0.1
Jun-01-2006	0.1
Jun-08-2006	0.1
Jun-15-2006	0.1
Jun-22-2006	0.1
Jun-29-2006	0.1
Jul-06-2006	0.2
Jul-13-2006	0.5
Jul-20-2006	0.5
Jul-27-2006	0.5
Aug-03-2006	0.4
Aug-10-2006	0.4
Aug-17-2006	0.4
Aug-24-2006	0.4
Aug-31-2006	0.5
Sep-07-2006	0.3
Sep-14-2006	0.4
Sep-21-2006	0.3
Sep-28-2006	0.4
Oct-05-2006	0.3
Oct-12-2006	0.2
Oct-19-2006	0.3
Oct-26-2006	0.3
Nov-02-2006	0.4
Nov-09-2006	0.6
Nov-16-2006	0.6
Nov-21-2006	0.7
Nov-30-2006	0.6
Dec-07-2006	0.8
Dec-14-2006	0.8

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Dec-21-2006	0.7
Dec-28-2006	0.8
Jan-04-2007	0.9
Jan-11-2007	0.8
Jan-18-2007	0.9
Jan-25-2007	0.9
Feb-01-2007	1.0
Feb-08-2007	1.0
Feb-15-2007	0.6
Feb-22-2007	0.9
Mar-01-2007	0.6
Mar-08-2007	0.8
Mar-15-2007	1.1
Mar-22-2007	0.9
Mar-29-2007	1.0
Apr-05-2007	1.0
Apr-12-2007	1.0
Apr-19-2007	0.8
Apr-26-2007	0.7
May-03-2007	0.5
May-10-2007	
May-17-2007	0.5
May-24-2007	0.8
May-31-2007	0.8
Jun-07-2007	0.7
Jun-13-2007	0.3
Jun-21-2007	0.5
Jun-28-2007	0.7
Jul-05-2007	0.8
Jul-12-2007	0.6
Jul-19-2007	0.8
Jul-26-2007	0.5
Aug-02-2007	0.8
Aug-09-2007	0.7
Aug-16-2007	0.8
Aug-23-2007	0.5
Aug-30-2007	0.5
Sep-06-2007	0.4
Sep-13-2007	0.6
Sep-20-2007	0.6
Sep-27-2007	0.7
Oct-04-2007	0.6
Oct-11-2007	0.7
Oct-18-2007	0.6
Oct-25-2007	0.6
Nov-01-2007	0.3
Nov-08-2007	0.3
Nov-15-2007	0.6
Nov-20-2007	0.6
Nov-29-2007	0.6
Dec-06-2007	0.6

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Dec-13-2007	0.7
Dec-20-2007	0.8
Dec-27-2007	0.7
Jan-03-2008	0.8
Jan-10-2008	0.7
Jan-17-2008	0.9
Jan-24-2008	0.9
Jan-31-2008	0.4
Feb-07-2008	0.4
Feb-14-2008	0.8
Feb-21-2008	0.9
Feb-28-2008	0.4
Mar-06-2008	0.9
Mar-13-2008	1.1
Mar-20-2008	1.1
Mar-27-2008	1.1
Apr-03-2008	1.2
Apr-10-2008	1.0
Apr-17-2008	1.0
Apr-24-2008	0.7
May-01-2008	0.3
May-08-2008	0.4
May-15-2008	0.4
May-22-2008	0.6
May-29-2008	0.8
Jun-05-2008	0.9
Jun-12-2008	0.9
Jun-19-2008	1.0
Jun-26-2008	0.8
Jul-02-2008	0.8
Jul-10-2008	0.8
Jul-17-2008	0.7
Jul-24-2008	0.6
Jul-31-2008	0.5
Aug-07-2008	0.5
Aug-14-2008	0.4
Aug-21-2008	0.4
Aug-28-2008	0.4
Sep-04-2008	0.5
Sep-11-2008	0.3
Sep-18-2008	0.5
Sep-25-2008	0.7
Oct-02-2008	0.7
Oct-09-2008	0.4
Oct-16-2008	0.5
Oct-23-2008	0.5
Oct-30-2008	0.5
Nov-06-2008	0.5
Nov-13-2008	0.5
Nov-20-2008	0.7
Nov-25-2008	0.7

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Dec-04-2008	1.0
Dec-11-2008	0.8
Dec-18-2008	0.8
Dec-23-2008	0.8
Dec-30-2008	0.9
Jan-08-2009	0.8
Jan-15-2009	0.9
Jan-22-2009	0.8
Jan-29-2009	0.9
Feb-05-2009	1.0
Feb-10-2009	1.1
Feb-19-2009	0.7
Feb-26-2009	0.9
Mar-05-2009	0.9
Mar-12-2009	1.0
Mar-19-2009	1.2
Mar-26-2009	1.1
Apr-02-2009	1.0
Apr-09-2009	1.0
Apr-16-2009	0.8
Apr-23-2009	1.0
Apr-30-2009	0.9
May-07-2009	0.7
May-14-2009	0.5
May-21-2009	0.7
May-28-2009	0.8
Jun-04-2009	1.0
Jun-11-2009	0.7
Jun-18-2009	0.7
Jun-25-2009	0.7
Jul-01-2009	0.8
Jul-07-2009	0.7
Jul-14-2009	0.8
Jul-21-2009	0.9
Jul-28-2009	1.1
Aug-04-2009	0.6
Aug-11-2009	0.8
Aug-18-2009	0.6
Aug-25-2009	0.9
Sep-01-2009	0.5
Sep-08-2009	0.5
Sep-15-2009	0.6
Sep-22-2009	0.8
Sep-29-2009	0.6
Oct-06-2009	0.5
Oct-13-2009	0.6
Oct-20-2009	0.6
Oct-27-2009	0.5
Nov-03-2009	0.5
Nov-10-2009	0.7
Nov-17-2009	0.8

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Nov-24-2009	0.8
Dec-01-2009	0.8
Dec-08-2009	0.8
Dec-15-2009	1.0
Dec-22-2009	1.0
Dec-29-2009	1.0
Jan-05-2010	1.1
Jan-12-2010	1.0
Jan-19-2010	1.1
Jan-26-2010	0.6
Feb-02-2010	1.0
Feb-09-2010	0.8
Feb-16-2010	0.9
Feb-23-2010	1.1
Mar-02-2010	0.4
Mar-09-2010	0.7
Mar-16-2010	0.8
Mar-23-2010	1.0
Mar-30-2010	0.8
Apr-06-2010	0.6
Apr-13-2010	0.5
Apr-20-2010	0.4
Apr-27-2010	0.3
May-04-2010	0.4
May-11-2010	0.4
May-18-2010	0.5
May-25-2010	0.5
Jun-01-2010	0.4
Jun-08-2010	0.3
Jun-15-2010	0.5
Jun-22-2010	0.5
Jun-29-2010	0.6
Jul-06-2010	0.6
Jul-13-2010	0.8
Jul-20-2010	0.9
Jul-27-2010	0.7
Aug-03-2010	0.7
Aug-10-2010	0.8
Aug-17-2010	0.6
Aug-24-2010	0.8
Aug-31-2010	0.6
Sep-07-2010	0.7
Sep-14-2010	0.4
Sep-21-2010	0.4
Sep-28-2010	0.6
Oct-05-2010	0.4
Oct-12-2010	0.4
Oct-19-2010	0.5
Oct-26-2010	0.3
Nov-02-2010	0.4
Nov-09-2010	0.6

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Nov-16-2010	0.7
Nov-23-2010	0.8
Nov-30-2010	0.9
Dec-07-2010	0.9
Dec-14-2010	0.9
Dec-21-2010	0.3
Dec-28-2010	0.3
Jan-04-2011	0.2
Jan-11-2011	0.2
Jan-18-2011	0.2
Jan-25-2011	0.4
Feb-01-2011	0.2
Feb-08-2011	0.2
Feb-15-2011	0.2
Feb-22-2011	0.3
Mar-01-2011	0.3
Mar-08-2011	0.3
Mar-15-2011	0.3
Mar-22-2011	0.2
Mar-29-2011	NA
Apr-05-2011	NA
Apr-12-2011	0.1
Apr-19-2011	0.1
Apr-26-2011	0.1
May-03-2011	0.1
May-10-2011	0.1
May-17-2011	0.1
May-24-2011	0.2
May-31-2011	0.2
Jun-07-2011	0.3
Jun-14-2011	0.2
Jun-21-2011	0.1
Jun-28-2011	0.1
Jul-06-2011	0.1
Jul-13-2011	0.1
Jul-19-2011	0.2
Jul-26-2011	0.4
Aug-03-2011	0.4
Aug-11-2011	0.5
Aug-16-2011	0.4
Aug-23-2011	0.3
Aug-30-2011	0.2
Sep-08-2011	0.3
Sep-15-2011	0.3
Sep-22-2011	0.3
Sep-29-2011	0.3
Oct-06-2011	0.2
Oct-13-2011	0.2
Oct-20-2011	0.2
Oct-27-2011	0.2
Nov-03-2011	0.4

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Nov-10-2011	0.4
Nov-15-2011	0.5
Nov-22-2011	0.5
Dec-01-2011	0.6
Dec-08-2011	0.7
Dec-13-2011	0.8
Dec-20-2011	0.9
Dec-29-2011	0.8
Jan-05-2012	0.8
Jan-12-2012	0.8
Jan-17-2012	0.9
Jan-24-2012	0.8
Jan-31-2012	0.8
Feb-07-2012	0.8
Feb-17-2012	0.8
Feb-21-2012	0.9
Feb-28-2012	1.0
Mar-06-2012	0.9
Mar-13-2012	1.0
Mar-21-2012	1.0
Mar-28-2012	0.9
Apr-03-2012	0.9
Apr-10-2012	0.9
Apr-17-2012	0.7
Apr-24-2012	0.7
May-01-2012	0.3
May-07-2012	0.3
May-15-2012	0.4
May-22-2012	0.5
May-29-2012	0.6
Jun-05-2012	0.6
Jun-06-2012	
Jun-13-2012	0.6
Jun-19-2012	0.7
Jun-25-2012	0.6
Jul-02-2012	0.6
Jul-10-2012	0.7
Jul-18-2012	0.8
Jul-24-2012	0.7
Aug-01-2012	0.6
Aug-09-2012	0.6
Aug-14-2012	0.7
Aug-21-2012	0.6
Aug-28-2012	0.5
Sep-06-2012	0.5
Sep-13-2012	0.4
Sep-18-2012	0.4
Sep-26-2012	0.6
Oct-02-2012	0.7
Oct-10-2012	0.6
Oct-16-2012	0.5

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Oct-23-2012	0.3
Oct-30-2012	0.5
Nov-07-2012	0.5
Nov-15-2012	0.5
Nov-20-2012	0.5
Nov-26-2012	0.7
Dec-06-2012	0.8
Dec-13-2012	0.9
Dec-20-2012	0.8
Dec-27-2012	0.4
Jan-03-2013	0.6
Jan-08-2013	0.5
Jan-15-2013	0.8
Jan-22-2013	0.8
Jan-29-2013	0.9
Feb-05-2013	0.9
Feb-12-2013	1.0
Feb-19-2013	0.9
Feb-26-2013	0.9
Mar-05-2013	1.0
Mar-12-2013	1.1
Mar-19-2013	1.2
Mar-29-2013	1.0
Apr-04-2013	1.0
Apr-11-2013	1.1
Apr-16-2013	0.9
Apr-23-2013	0.5
May-02-2013	0.7
May-09-2013	0.8
May-15-2013	0.7
May-20-2013	0.8
May-30-2013	0.7
Jun-04-2013	0.7
Jun-10-2013	0.9
Jun-18-2013	0.6
Jun-26-2013	0.7
Jul-02-2013	1.2
Jul-09-2013	1.2
Jul-17-2013	1.0
Jul-25-2013	2.0
Jul-29-2013	1.2
Aug-07-2013	1.1
Aug-15-2013	1.0
Aug-23-2013	1.5
Aug-28-2013	1.1
Sep-06-2013	1.2
Sep-09-2013	0.8
Sep-20-2013	0.8
Sep-25-2013	0.2
Oct-01-2013	
Oct-08-2013	

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Oct-15-2013	
Oct-21-2013	0.7
Oct-28-2013	0.3
Nov-04-2013	0.7
Nov-15-2013	0.7
Nov-22-2013	0.7
Nov-25-2013	0.8
Dec-06-2013	0.9
Dec-10-2013	1.0
Dec-17-2013	
Dec-27-2013	
Jan-03-2014	
Jan-09-2014	
Jan-14-2014	
Jan-23-2014	
Feb-07-2014	1.3
Feb-14-2014	1.3
Feb-21-2014	1.8
Feb-27-2014	1.1
Mar-06-2014	1.7
Mar-14-2014	1.5
Mar-21-2014	1.7
Mar-26-2014	
Apr-04-2014	1.3
Apr-11-2014	1.1
Apr-18-2014	1.2
Apr-30-2014	0.7
May-08-2014	1.2
May-16-2014	1.1
May-23-2014	0.8
May-30-2014	1.1
Jun-06-2014	0.8
Jun-13-2014	0.6
Jun-20-2014	1.1
Jun-26-2014	1.5
Jul-02-2014	
Jul-11-2014	1.0
Jul-18-2014	0.8
Jul-25-2014	0.8
Jul-31-2014	1.0
Aug-07-2014	0.9
Aug-15-2014	
Aug-22-2014	
Sep-04-2014	0.5
Sep-19-2014	0.5
Sep-26-2014	0.4
Oct-03-2014	0.5
Oct-10-2014	0.4
Oct-17-2014	0.5
Oct-24-2014	
Oct-31-2014	

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Nov-07-2014	0.8
Nov-14-2014	0.5
Nov-21-2014	0.6
Nov-28-2014	0.7
Dec-05-2014	0.9
Dec-12-2014	0.5
Dec-16-2014	
Dec-23-2014	1.8
Dec-30-2014	2.7
Jan-09-2015	1.1
Jan-13-2015	1.1
Jan-23-2015	1.4
Jan-30-2015	1.6
Feb-04-2015	1.4
Feb-13-2015	1.4
Feb-19-2015	1.2
Feb-27-2015	1.4
Mar-06-2015	1.8
Mar-13-2015	1.6
Mar-20-2015	1.6
Mar-27-2015	2.1
Apr-01-2015	1.3
Apr-10-2015	1.1
Apr-16-2015	1.4
Apr-24-2015	1.2
May-01-2015	1.0
May-08-2015	0.9
May-15-2015	0.7
May-21-2015	0.6
May-27-2015	0.7
Jun-04-2015	0.8
Jun-11-2015	0.6
Jun-17-2015	1.0
Jun-25-2015	0.8
Jun-29-2015	0.8
Jul-09-2015	0.7
Jul-15-2015	0.5
Jul-20-2015	0.6
Jul-27-2015	0.6
Aug-06-2015	0.7
Aug-11-2015	0.7
Aug-17-2015	0.6
Aug-24-2015	0.6
Sep-01-2015	0.5
Sep-08-2015	0.6
Sep-18-2015	0.4
Sep-21-2015	0.4
Sep-28-2015	0.6
Oct-05-2015	0.4
Oct-16-2015	0.5
Oct-19-2015	0.5

Attachment A, Table 2. Crows Landing Weekly Boron Data for Figures C-4, 5, 6, 7 and 8 (mg/L)

Date	Boron
Oct-26-2015	0.1
Nov-06-2015	0.1
Nov-09-2015	0.1
Nov-20-2015	0.3
Nov-23-2015	0.3
Nov-30-2015	0.5
Dec-07-2015	1.7
Dec-15-2015	1.1
Dec-21-2015	1.4
Dec-29-2015	1.0

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Jan-06-2005	450
Jan-13-2005	399
Jan-20-2005	719
Jan-27-2005	1,230
Feb-03-2005	1,060
Feb-10-2005	1,370
Feb-17-2005	1,140
Feb-24-2005	926
Mar-03-2005	1,040
Mar-10-2005	1,430
Mar-17-2005	1,800
Mar-24-2005	741
Mar-31-2005	393
Apr-07-2005	531
Apr-14-2005	553
Apr-21-2005	561
Apr-28-2005	579
May-05-2005	601
May-12-2005	378
May-19-2005	205
May-26-2005	100
Jun-02-2005	133
Jun-09-2005	182
Jun-16-2005	414
Jun-23-2005	403
Jun-30-2005	439
Jul-07-2005	559
Jul-13-2005	691
Jul-21-2005	787
Jul-28-2005	796
Aug-04-2005	778
Aug-11-2005	673
Aug-18-2005	621
Aug-25-2005	538
Sep-01-2005	822
Sep-08-2005	690
Sep-15-2005	474
Sep-22-2005	496
Sep-29-2005	479
Oct-06-2005	870
Oct-13-2005	692
Oct-20-2005	706
Oct-27-2005	751
Nov-03-2005	910
Nov-10-2005	1,030
Nov-17-2005	1,080
Nov-22-2005	1,130
Dec-01-2005	1,160
Dec-08-2005	1,040

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Dec-15-2005	1,230
Dec-22-2005	1,120
Dec-29-2005	440
Jan-05-2006	341
Jan-12-2006	449
Jan-19-2006	685
Jan-26-2006	755
Feb-02-2006	1,020
Feb-09-2006	1,080
Feb-16-2006	1,010
Feb-23-2006	892
Mar-02-2006	751
Mar-09-2006	555
Mar-16-2006	467
Mar-23-2006	477
Mar-30-2006	421
Apr-06-2006	301
Apr-13-2006	182
Apr-20-2006	177
Apr-27-2006	162
May-04-2006	149
May-11-2006	135
May-18-2006	124
May-25-2006	113
Jun-01-2006	140
Jun-08-2006	113
Jun-15-2006	121
Jun-22-2006	166
Jun-29-2006	131
Jul-06-2006	272
Jul-13-2006	783
Jul-20-2006	810
Jul-27-2006	802
Aug-03-2006	699
Aug-10-2006	621
Aug-17-2006	635
Aug-24-2006	608
Aug-31-2006	650
Sep-07-2006	547
Sep-14-2006	552
Sep-21-2006	511
Sep-28-2006	611
Oct-05-2006	591
Oct-12-2006	404
Oct-19-2006	456
Oct-26-2006	414
Nov-02-2006	696
Nov-09-2006	955
Nov-16-2006	993

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Nov-21-2006	1,080
Nov-30-2006	1,080
Dec-07-2006	1,300
Dec-14-2006	1,260
Dec-21-2006	1,120
Dec-28-2006	1,180
Jan-04-2007	1,230
Jan-11-2007	1,250
Jan-18-2007	1,290
Jan-25-2007	1,380
Feb-01-2007	1,470
Feb-08-2007	1,410
Feb-15-2007	1,100
Feb-22-2007	1,460
Mar-01-2007	1,150
Mar-08-2007	1,410
Mar-15-2007	1,630
Mar-22-2007	1,490
Mar-29-2007	1,570
Apr-05-2007	1,560
Apr-12-2007	1,630
Apr-19-2007	1,310
Apr-26-2007	1,100
May-03-2007	805
May-10-2007	604
May-17-2007	732
May-24-2007	1,110
May-31-2007	1,300
Jun-07-2007	1,130
Jun-13-2007	480
Jun-21-2007	947
Jun-28-2007	1,280
Jul-05-2007	1,370
Jul-12-2007	1,090
Jul-19-2007	1,110
Jul-26-2007	1,090
Aug-02-2007	1,230
Aug-09-2007	1,060
Aug-16-2007	1,220
Aug-23-2007	1,040
Aug-30-2007	1,030
Sep-06-2007	935
Sep-13-2007	1,130
Sep-20-2007	1,070
Sep-27-2007	1,180
Oct-04-2007	1,200
Oct-11-2007	1,290
Oct-18-2007	993
Oct-25-2007	1,030

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Nov-01-2007	480
Nov-08-2007	510
Nov-15-2007	900
Nov-20-2007	920
Nov-29-2007	950
Dec-06-2007	980
Dec-13-2007	990
Dec-20-2007	1,120
Dec-27-2007	1,130
Jan-03-2008	1,350
Jan-10-2008	970
Jan-17-2008	1,370
Jan-24-2008	1,350
Jan-31-2008	590
Feb-07-2008	650
Feb-14-2008	1,220
Feb-21-2008	1,450
Feb-28-2008	700
Mar-06-2008	1,230
Mar-13-2008	1,560
Mar-20-2008	1,560
Mar-27-2008	1,590
Apr-03-2008	1,670
Apr-10-2008	1,570
Apr-17-2008	1,570
Apr-24-2008	1,020
May-01-2008	500
May-08-2008	660
May-15-2008	560
May-22-2008	1,040
May-29-2008	1,220
Jun-05-2008	1,330
Jun-12-2008	1,500
Jun-19-2008	1,580
Jun-26-2008	1,480
Jul-02-2008	1,460
Jul-10-2008	1,420
Jul-17-2008	1,210
Jul-24-2008	1,330
Jul-31-2008	870
Aug-07-2008	1,110
Aug-14-2008	900
Aug-21-2008	900
Aug-28-2008	950
Sep-04-2008	990
Sep-11-2008	890
Sep-18-2008	1,300
Sep-25-2008	1,100
Oct-02-2008	1,210

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Oct-09-2008	790
Oct-16-2008	930
Oct-23-2008	840
Oct-30-2008	950
Nov-06-2008	940
Nov-13-2008	1,000
Nov-20-2008	1,130
Nov-25-2008	1,210
Dec-04-2008	1,220
Dec-11-2008	1,300
Dec-18-2008	1,320
Dec-23-2008	1,270
Dec-30-2008	1,390
Jan-08-2009	1,460
Jan-15-2009	1,480
Jan-22-2009	1,460
Jan-29-2009	1,220
Feb-05-2009	1,460
Feb-10-2009	1,480
Feb-19-2009	910
Feb-26-2009	1,250
Mar-05-2009	1,320
Mar-12-2009	1,390
Mar-19-2009	1,630
Mar-26-2009	1,680
Apr-02-2009	1,760
Apr-09-2009	1,640
Apr-16-2009	1,370
Apr-23-2009	1,840
Apr-30-2009	1,610
May-07-2009	1,230
May-14-2009	1,020
May-21-2009	1,340
May-28-2009	1,390
Jun-04-2009	1,400
Jun-11-2009	1,070
Jun-18-2009	1,250
Jun-25-2009	1,240
Jul-01-2009	1,370
Jul-07-2009	1,290
Jul-14-2009	1,310
Jul-21-2009	1,550
Jul-28-2009	1,590
Aug-04-2009	1,180
Aug-11-2009	1,320
Aug-18-2009	1,230
Aug-25-2009	1,330
Sep-01-2009	1,150
Sep-08-2009	1,230

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Sep-15-2009	1,070
Sep-22-2009	1,310
Sep-29-2009	1,170
Oct-06-2009	1,040
Oct-13-2009	1,000
Oct-20-2009	910
Oct-27-2009	740
Nov-03-2009	790
Nov-10-2009	1,050
Nov-17-2009	1,180
Nov-24-2009	1,210
Dec-01-2009	1,280
Dec-08-2009	1,360
Dec-15-2009	1,300
Dec-22-2009	1,420
Dec-29-2009	1,570
Jan-05-2010	1,620
Jan-12-2010	1,600
Jan-19-2010	1,550
Jan-26-2010	790
Feb-02-2010	1,390
Feb-09-2010	1,270
Feb-16-2010	1,390
Feb-23-2010	1,620
Mar-02-2010	670
Mar-09-2010	1,000
Mar-16-2010	1,150
Mar-23-2010	1,350
Mar-30-2010	1,180
Apr-06-2010	980
Apr-13-2010	840
Apr-20-2010	760
Apr-27-2010	500
May-04-2010	610
May-11-2010	540
May-18-2010	700
May-25-2010	750
Jun-01-2010	600
Jun-08-2010	530
Jun-15-2010	730
Jun-22-2010	820
Jun-29-2010	900
Jul-06-2010	1,090
Jul-13-2010	1,130
Jul-20-2010	1,220
Jul-27-2010	1,000
Aug-03-2010	1,050
Aug-10-2010	950
Aug-17-2010	860

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Aug-24-2010	1,050
Aug-31-2010	860
Sep-07-2010	780
Sep-14-2010	300
Sep-21-2010	600
Sep-28-2010	880
Oct-05-2010	830
Oct-12-2010	680
Oct-19-2010	880
Oct-26-2010	590
Nov-02-2010	660
Nov-09-2010	960
Nov-16-2010	1,100
Nov-23-2010	1,090
Nov-30-2010	1,210
Dec-07-2010	1,220
Dec-14-2010	1,350
Dec-21-2010	480
Dec-28-2010	410
Jan-04-2011	390
Jan-11-2011	360
Jan-18-2011	390
Jan-25-2011	660
Feb-01-2011	450
Feb-08-2011	450
Feb-15-2011	460
Feb-22-2011	430
Mar-01-2011	460
Mar-08-2011	550
Mar-15-2011	580
Mar-22-2011	350
Mar-29-2011	
Apr-05-2011	
Apr-12-2011	290
Apr-19-2011	240
Apr-26-2011	250
May-03-2011	250
May-10-2011	250
May-17-2011	320
May-24-2011	300
May-31-2011	320
Jun-07-2011	470
Jun-14-2011	480
Jun-21-2011	310
Jun-28-2011	200
Jul-06-2011	181
Jul-13-2011	114
Jul-19-2011	388
Jul-26-2011	908

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Aug-03-2011	929
Aug-11-2011	935
Aug-16-2011	776
Aug-23-2011	668
Aug-30-2011	294
Sep-08-2011	728
Sep-15-2011	558
Sep-22-2011	550
Sep-29-2011	541
Oct-06-2011	351
Oct-13-2011	346
Oct-20-2011	405
Oct-27-2011	410
Nov-03-2011	656
Nov-10-2011	753
Nov-15-2011	826
Nov-22-2011	781
Dec-01-2011	1,150
Dec-08-2011	1,280
Dec-13-2011	1,320
Dec-20-2011	1,330
Dec-29-2011	1,400
Jan-05-2012	1,380
Jan-12-2012	1,550
Jan-17-2012	1,540
Jan-24-2012	1,350
Jan-31-2012	1,480
Feb-07-2012	1,570
Feb-17-2012	1,430
Feb-21-2012	1,590
Feb-28-2012	1,750
Mar-06-2012	1,640
Mar-13-2012	1,660
Mar-21-2012	1,340
Mar-28-2012	1,680
Apr-03-2012	1,720
Apr-10-2012	1,660
Apr-17-2012	1,020
Apr-24-2012	1,560
May-01-2012	704
May-07-2012	583
May-15-2012	890
May-22-2012	939
May-29-2012	1,050
Jun-05-2012	1,025
Jun-13-2012	1,198
Jun-19-2012	1,244
Jun-25-2012	1,152
Jul-02-2012	1,060

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Jul-10-2012	1,300
Jul-18-2012	1,290
Jul-24-2012	1,220
Aug-01-2012	1,130
Aug-09-2012	1,180
Aug-14-2012	1,160
Aug-21-2012	1,100
Aug-28-2012	1,160
Sep-06-2012	1,120
Sep-13-2012	1,070
Sep-18-2012	1,040
Sep-26-2012	1,210
Oct-02-2012	1,280
Oct-10-2012	1,220
Oct-16-2012	1,100
Oct-23-2012	556
Oct-30-2012	939
Nov-07-2012	1,040
Nov-15-2012	900
Nov-20-2012	885
Nov-26-2012	1,070
Dec-06-2012	1,010
Dec-13-2012	1,170
Dec-20-2012	
Dec-27-2012	585
Jan-03-2013	1,020
Jan-08-2013	863
Jan-15-2013	1,290
Jan-22-2013	1,400
Jan-29-2013	1,480
Feb-05-2013	1,560
Feb-12-2013	1,620
Feb-19-2013	1,420
Feb-26-2013	1,440
Mar-05-2013	1,510
Mar-12-2013	1,610
Mar-19-2013	1,680
Mar-29-2013	1,760
Apr-04-2013	1,590
Apr-11-2013	1,620
Apr-16-2013	1,630
Apr-23-2013	960
May-02-2013	1,280
May-09-2013	1,230
May-15-2013	1,260
May-20-2013	1,270
May-30-2013	1,250
Jun-04-2013	1,260
Jun-10-2013	1,420

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Jun-18-2013	1,310
Jun-26-2013	1,330
Jul-02-2013	1,510
Jul-09-2013	1,480
Jul-17-2013	1,540
Jul-25-2013	1,780
Jul-29-2013	1,600
Aug-07-2013	1,580
Aug-15-2013	1,670
Aug-23-2013	1,780
Aug-28-2013	1,500
Sep-06-2013	1,600
Sep-09-2013	1,260
Sep-20-2013	1,070
Sep-25-2013	360
Oct-01-2013	
Oct-08-2013	
Oct-15-2013	
Oct-21-2013	940
Oct-28-2013	517
Nov-04-2013	1,040
Nov-15-2013	1,100
Nov-22-2013	1,060
Nov-25-2013	1,180
Dec-06-2013	1,340
Dec-10-2013	1,400
Dec-17-2013	1,440
Dec-27-2013	1,450
Jan-03-2014	1,500
Jan-09-2014	1,610
Jan-14-2014	1,640
Jan-23-2014	1,840
Feb-07-2014	1,180
Feb-14-2014	1,730
Feb-21-2014	2,210
Feb-27-2014	1,900
Mar-06-2014	2,200
Mar-14-2014	2,160
Mar-21-2014	2,480
Apr-04-2014	2,010
Apr-11-2014	1,820
Apr-18-2014	2,220
Apr-30-2014	1,030
May-08-2014	2,030
May-16-2014	2,110
May-23-2014	1,800
May-30-2014	1,740
Jun-06-2014	1,780
Jun-13-2014	1,570

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Jun-20-2014	2,020
Jun-26-2014	2,120
Jul-11-2014	1,730
Jul-18-2014	1,620
Jul-25-2014	1,560
Jul-31-2014	1,850
Aug-07-2014	1,700
Sep-04-2014	1,310
Sep-19-2014	1,870
Sep-26-2014	1,090
Oct-03-2014	1,360
Oct-10-2014	1,110
Oct-17-2014	1,540
Nov-07-2014	818
Nov-14-2014	796
Nov-21-2014	859
Nov-28-2014	926
Dec-05-2014	1,060
Dec-12-2014	833
Dec-23-2014	1,660
Dec-30-2014	1,710
Jan-09-2015	1448
Jan-13-2015	1473
Jan-23-2015	1506
Jan-26-2015	1602
Feb-04-2015	1624
Feb-13-2015	1754
Feb-19-2015	1654
Feb-27-2015	1630
Mar-06-2015	2017
Mar-13-2015	2176
Mar-20-2015	1984
Mar-27-2015	2239
Apr-01-2015	1909
Apr-10-2015	1770
Apr-16-2015	2061
Apr-24-2015	1892
May-01-2015	2006
May-15-2015	1672
May-21-2015	1495
May-27-2015	1645
Jun-04-2015	1844
Jun-11-2015	1618
Jun-17-2015	2094
Jun-25-2015	1869
Jun-29-2015	1786
Jul-09-2015	1793
Jul-15-2015	1585
Jul-20-2015	1345

Attachment A, Table 3. Average Weekly Crows EC for Figures C-5, 6, and 7 (µS/cm)

Date	San Joaquin River at Crows Landing
Jul-27-2015	1525
Aug-06-2015	1785
Aug-11-2015	1773
Aug-17-2015	1642
Aug-24-2015	1516
Sep-01-2015	1396
Sep-08-2015	1483
Sep-18-2015	1249
Sep-21-2015	1113
Sep-28-2015	1496
Oct-05-2015	
Oct-16-2015	1299
Oct-19-2015	1251
Oct-26-2015	187
Nov-06-2015	396
Nov-09-2015	434
Nov-20-2015	602
Nov-23-2015	659
Nov-30-2015	785
Dec-07-2015	851
Dec-15-2015	1112
Dec-21-2015	1281
Dec-29-2015	997

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jan-01-2005	7.4
Jan-02-2005	6.8
Jan-03-2005	7.3
Jan-04-2005	7.2
Jan-05-2005	7.1
Jan-06-2005	7.2
Jan-07-2005	7.4
Jan-08-2005	7.9
Jan-09-2005	7.9
Jan-10-2005	8.2
Jan-11-2005	8
Jan-12-2005	7.7
Jan-13-2005	5.9
Jan-14-2005	7.2
Jan-15-2005	7.1
Jan-16-2005	8
Jan-17-2005	8.9
Jan-18-2005	8.8
Jan-19-2005	8.8
Jan-20-2005	9.1
Jan-21-2005	9.2
Jan-22-2005	9.2
Jan-23-2005	9.1
Jan-24-2005	8.5
Jan-25-2005	8.4
Jan-26-2005	8.2
Jan-27-2005	8
Jan-28-2005	7.7
Jan-29-2005	8.1
Jan-30-2005	8
Jan-31-2005	8
Feb-01-2005	7.4
Feb-02-2005	7.1
Feb-03-2005	7.6
Feb-04-2005	7.8
Feb-05-2005	7.5
Feb-06-2005	7.7
Feb-07-2005	7.8
Feb-08-2005	8.4
Feb-09-2005	8.1
Feb-10-2005	8.5
Feb-11-2005	8.1
Feb-12-2005	7.7
Feb-13-2005	8
Feb-14-2005	8.3
Feb-15-2005	7.8
Feb-16-2005	7.8
Feb-17-2005	7.7

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Feb-18-2005	4.8
Feb-19-2005	5.3
Feb-20-2005	6.7
Feb-21-2005	5.8
Feb-22-2005	6.1
Feb-23-2005	7.3
Feb-24-2005	7.2
Feb-25-2005	8.7
Feb-26-2005	9.2
Feb-27-2005	9.3
Feb-28-2005	9.1
Mar-01-2005	8.8
Mar-02-2005	9
Mar-03-2005	9.3
Mar-04-2005	8.6
Mar-05-2005	8.7
Mar-06-2005	8.5
Mar-07-2005	7.8
Mar-08-2005	9
Mar-09-2005	9.1
Mar-10-2005	9.8
Mar-11-2005	9.7
Mar-12-2005	9.8
Mar-13-2005	9.5
Mar-14-2005	9.8
Mar-15-2005	10
Mar-16-2005	9.7
Mar-17-2005	10
Mar-18-2005	9.8
Mar-19-2005	9.6
Mar-20-2005	9.2
Mar-21-2005	9.1
Mar-22-2005	9.1
Mar-23-2005	9
Mar-24-2005	8.8
Mar-25-2005	7.3
Mar-26-2005	7.8
Mar-27-2005	8.4
Mar-28-2005	8.1
Mar-29-2005	8.5
Mar-30-2005	8.6
Mar-31-2005	8.6
Apr-01-2005	9.2
Apr-02-2005	9.1
Apr-03-2005	9.2
Apr-04-2005	9.4
Apr-05-2005	9.4
Apr-06-2005	9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Apr-07-2005	9.4
Apr-08-2005	9.9
Apr-09-2005	9.8
Apr-10-2005	9.7
Apr-11-2005	11
Apr-12-2005	10
Apr-13-2005	10
Apr-14-2005	11
Apr-15-2005	12
Apr-16-2005	8.7
Apr-17-2005	8.6
Apr-18-2005	9
Apr-19-2005	12
Apr-20-2005	12
Apr-22-2005	10
Apr-23-2005	8.6
Apr-24-2005	8.2
Apr-25-2005	9.4
Apr-26-2005	9.3
Apr-27-2005	8.6
Apr-28-2005	7.9
Apr-29-2005	7.4
Apr-30-2005	8.1
May-01-2005	7.5
May-02-2005	7.2
May-03-2005	7.1
May-04-2005	7
May-05-2005	7
May-06-2005	7.4
May-07-2005	8.1
May-08-2005	8.2
May-09-2005	8.1
May-10-2005	8.2
May-11-2005	8.5
May-12-2005	8.8
May-13-2005	8.7
May-14-2005	8.6
May-15-2005	8.7
May-16-2005	8.9
May-17-2005	8.3
May-18-2005	8.8
May-19-2005	9.2
May-20-2005	9.1
May-21-2005	8.7
May-22-2005	9
May-23-2005	9.1
May-24-2005	9.2
May-25-2005	8.7

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
May-26-2005	8
May-27-2005	7.5
May-28-2005	8.3
May-29-2005	9.3
May-30-2005	8.8
May-31-2005	9
Jun-01-2005	8.5
Jun-02-2005	9
Jun-03-2005	9
Jun-04-2005	9.2
Jun-05-2005	8.3
Jun-06-2005	8.2
Jun-07-2005	8.6
Jun-08-2005	8.4
Jun-09-2005	7.8
Jun-10-2005	8.7
Jun-11-2005	7.8
Jun-12-2005	8.3
Jun-13-2005	7.3
Jun-14-2005	7.4
Jun-15-2005	8.8
Jun-16-2005	8.9
Jun-17-2005	9
Jun-18-2005	9.1
Jun-19-2005	9.2
Jun-20-2005	9.7
Jun-21-2005	9.3
Jun-22-2005	9.3
Jun-23-2005	9
Jun-24-2005	8.6
Jun-25-2005	8.7
Jun-26-2005	8.7
Jun-27-2005	7.6
Jun-28-2005	7.6
Jun-29-2005	7.5
Jun-30-2005	7.6
Jul-01-2005	10
Jul-02-2005	10
Jul-03-2005	11
Jul-04-2005	9.3
Jul-05-2005	9
Jul-06-2005	11
Jul-07-2005	11
Jul-08-2005	10
Jul-09-2005	11
Jul-10-2005	9.5
Jul-11-2005	10
Jul-12-2005	9.4

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jul-13-2005	9.2
Jul-16-2005	8.4
Jul-17-2005	9.1
Jul-18-2005	9.2
Jul-19-2005	8.6
Jul-20-2005	7.8
Jul-21-2005	7.9
Jul-22-2005	8.1
Jul-23-2005	8.2
Jul-24-2005	8.6
Jul-25-2005	8
Jul-26-2005	7.7
Jul-27-2005	7.6
Jul-28-2005	7.9
Jul-29-2005	7.8
Jul-30-2005	8.3
Jul-31-2005	8.9
Aug-01-2005	8.3
Aug-02-2005	7.8
Aug-03-2005	7.6
Aug-04-2005	8.2
Aug-05-2005	8.4
Aug-06-2005	8.5
Aug-07-2005	8.6
Aug-08-2005	8.9
Aug-09-2005	9.2
Aug-10-2005	8.6
Aug-11-2005	8.8
Aug-12-2005	9.1
Aug-13-2005	8.8
Aug-14-2005	7.8
Aug-15-2005	8.2
Aug-16-2005	7.5
Aug-17-2005	7.3
Aug-18-2005	7
Aug-19-2005	7.2
Aug-20-2005	6.6
Aug-21-2005	6.5
Aug-22-2005	6.9
Aug-23-2005	6.9
Aug-24-2005	6.8
Aug-25-2005	6
Aug-26-2005	6.4
Aug-27-2005	7.6
Aug-28-2005	7.4
Aug-29-2005	8.5
Aug-30-2005	8.3
Aug-31-2005	8.3

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Sep-01-2005	7.4
Sep-02-2005	7.5
Sep-03-2005	6.8
Sep-04-2005	6.8
Sep-05-2005	6.8
Sep-06-2005	6.8
Sep-07-2005	6.7
Sep-08-2005	8.1
Sep-09-2005	7.9
Sep-10-2005	7.9
Sep-11-2005	7.5
Sep-12-2005	6.7
Sep-13-2005	5.9
Sep-14-2005	5.3
Sep-15-2005	5.9
Sep-16-2005	5.7
Sep-17-2005	5.4
Sep-18-2005	5.9
Sep-19-2005	5.3
Sep-20-2005	5.5
Sep-21-2005	6.1
Sep-22-2005	6.1
Sep-23-2005	7
Sep-24-2005	6.5
Sep-25-2005	6.6
Sep-26-2005	6.1
Sep-27-2005	6.7
Sep-28-2005	6.9
Sep-29-2005	6.6
Sep-30-2005	6.5
Oct-01-2005	7.3
Oct-02-2005	6.9
Oct-03-2005	7.2
Oct-04-2005	7.6
Oct-05-2005	7.5
Oct-06-2005	7.4
Oct-07-2005	7.2
Oct-08-2005	7.5
Oct-09-2005	7.4
Oct-10-2005	8
Oct-11-2005	8.5
Oct-12-2005	8.3
Oct-13-2005	7.5
Oct-14-2005	7.6
Oct-15-2005	6.8
Oct-16-2005	6.3
Oct-17-2005	5.9
Oct-18-2005	6

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Oct-19-2005	6.5
Oct-20-2005	5.4
Oct-21-2005	5.9
Oct-22-2005	5.9
Oct-23-2005	5.4
Oct-24-2005	5.3
Oct-25-2005	5.8
Oct-26-2005	5
Oct-27-2005	5.7
Oct-28-2005	6.4
Oct-29-2005	6.4
Oct-30-2005	6.6
Oct-31-2005	7
Nov-01-2005	6.8
Nov-02-2005	7.3
Nov-03-2005	7.2
Nov-04-2005	6.4
Nov-05-2005	6.6
Nov-06-2005	6.7
Nov-07-2005	6.4
Nov-08-2005	6.4
Nov-09-2005	6.7
Nov-10-2005	6.3
Nov-11-2005	6.4
Nov-12-2005	6.7
Nov-13-2005	6.4
Nov-14-2005	6.8
Nov-15-2005	7.1
Nov-16-2005	5.6
Nov-17-2005	5.6
Nov-18-2005	6.9
Nov-19-2005	6
Nov-20-2005	6.4
Nov-21-2005	7
Nov-22-2005	6.9
Nov-23-2005	6.8
Nov-24-2005	6.4
Nov-25-2005	6.5
Nov-26-2005	6.6
Nov-27-2005	6
Nov-28-2005	6.5
Nov-29-2005	7.3
Nov-30-2005	7.4
Dec-01-2005	7.3
Dec-02-2005	7.6
Dec-03-2005	7.4
Dec-04-2005	6.9
Dec-05-2005	6.9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Dec-06-2005	7.6
Dec-07-2005	7.9
Dec-08-2005	7.3
Dec-09-2005	8
Dec-10-2005	8
Dec-11-2005	8
Dec-12-2005	7.7
Dec-13-2005	7.9
Dec-14-2005	8.4
Dec-15-2005	6.8
Dec-16-2005	4.6
Dec-17-2005	5.2
Dec-18-2005	5.4
Dec-19-2005	5.7
Dec-20-2005	5
Dec-21-2005	4.8
Dec-22-2005	5.2
Dec-23-2005	5.6
Dec-24-2005	5.6
Dec-25-2005	6.1
Dec-26-2005	6.1
Dec-27-2005	6.7
Dec-28-2005	7.1
Dec-29-2005	6.9
Dec-30-2005	7.2
Dec-31-2005	7
Jan-01-2006	7.3
Jan-02-2006	6.6
Jan-03-2006	6.4
Jan-04-2006	2.8
Jan-05-2006	3.2
Jan-06-2006	4
Jan-07-2006	6.2
Jan-08-2006	6.5
Jan-09-2006	7.1
Jan-10-2006	8.2
Jan-11-2006	8.2
Jan-12-2006	5.4
Jan-13-2006	8.1
Jan-14-2006	8.1
Jan-15-2006	8.1
Jan-16-2006	9.6
Jan-17-2006	8
Jan-18-2006	8.5
Jan-19-2006	8.5
Jan-20-2006	7.8
Jan-21-2006	8.7
Jan-22-2006	8.7

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jan-23-2006	8.7
Jan-24-2006	9
Jan-25-2006	8.3
Jan-26-2006	8.5
Jan-27-2006	7.8
Jan-28-2006	7.8
Jan-29-2006	8
Jan-30-2006	8
Jan-31-2006	7.4
Feb-01-2006	7.8
Feb-02-2006	7.7
Feb-03-2006	7.8
Feb-04-2006	7.4
Feb-05-2006	7.6
Feb-06-2006	8
Feb-07-2006	7.5
Feb-08-2006	7.4
Feb-09-2006	7.6
Feb-10-2006	7
Feb-11-2006	6.9
Feb-12-2006	7
Feb-13-2006	6.7
Feb-14-2006	7.3
Feb-15-2006	6.7
Feb-16-2006	6.7
Feb-17-2006	6
Feb-18-2006	6.3
Feb-19-2006	6.4
Feb-20-2006	6.1
Feb-21-2006	6.2
Feb-22-2006	6
Feb-23-2006	6.4
Feb-24-2006	8.8
Feb-25-2006	9
Feb-26-2006	8.8
Feb-27-2006	8.5
Feb-28-2006	8.3
Mar-01-2006	8.8
Mar-02-2006	8.1
Mar-03-2006	8.6
Mar-04-2006	9
Mar-05-2006	9.1
Mar-06-2006	8.9
Mar-07-2006	8.6
Mar-08-2006	8.1
Mar-09-2006	8.4
Mar-10-2006	8.1
Mar-11-2006	7.1

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Mar-12-2006	8.3
Mar-13-2006	9.1
Mar-14-2006	8.8
Mar-15-2006	9.2
Mar-16-2006	8.6
Mar-17-2006	8.4
Mar-18-2006	7.6
Mar-19-2006	7.9
Mar-20-2006	7.4
Mar-21-2006	7.5
Mar-22-2006	7.4
Mar-23-2006	7.1
Mar-24-2006	8.5
Mar-25-2006	9.5
Mar-26-2006	10
Mar-27-2006	11
Mar-28-2006	12
Mar-29-2006	11
Mar-30-2006	11
Mar-31-2006	10
Apr-01-2006	10
Apr-02-2006	10
Apr-03-2006	11
Apr-06-2006	10
Apr-07-2006	10
Apr-08-2006	10
Apr-09-2006	10
Apr-10-2006	11
Apr-11-2006	10
Apr-12-2006	10
Apr-13-2006	9.4
Apr-14-2006	10
Apr-15-2006	9.2
Apr-16-2006	9.2
Apr-17-2006	8.9
Apr-18-2006	8.8
Apr-19-2006	8.9
Apr-20-2006	9.3
Apr-21-2006	8.8
Apr-22-2006	9.5
Apr-23-2006	10
Apr-24-2006	11
Apr-25-2006	11
Apr-26-2006	11
Apr-27-2006	10
Apr-28-2006	10
Apr-29-2006	9.9
Apr-30-2006	9.7

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
May-01-2006	9.7
May-02-2006	10
May-03-2006	10
May-04-2006	9.3
May-05-2006	9.1
May-06-2006	9
May-07-2006	8.7
May-08-2006	8.6
May-09-2006	8.1
May-10-2006	8.2
May-11-2006	8.1
May-12-2006	8.2
May-13-2006	8.2
May-14-2006	8.6
May-15-2006	7.4
May-16-2006	6.1
May-17-2006	5.9
May-18-2006	6.1
May-19-2006	6.2
May-20-2006	7.4
May-21-2006	8
May-22-2006	7.7
May-23-2006	6.9
May-24-2006	7.6
May-25-2006	6.5
May-26-2006	7.3
May-27-2006	7.3
May-28-2006	6.9
May-29-2006	6.6
May-30-2006	6.9
May-31-2006	7.8
Jun-01-2006	7.3
Jun-02-2006	8.1
Jun-03-2006	8.1
Jun-04-2006	8.5
Jun-05-2006	8.4
Jun-06-2006	7.9
Jun-07-2006	8.1
Jun-08-2006	7.4
Jun-09-2006	7.7
Jun-10-2006	7.2
Jun-11-2006	7
Jun-12-2006	6.3
Jun-13-2006	6.1
Jun-14-2006	6.1
Jun-15-2006	6.6
Jun-16-2006	7.3
Jun-17-2006	7.6

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jun-18-2006	8.5
Jun-19-2006	8.6
Jun-20-2006	8.4
Jun-21-2006	7.3
Jun-22-2006	8
Jun-23-2006	8.1
Jun-24-2006	8.8
Jun-25-2006	8.8
Jun-26-2006	9.5
Jun-27-2006	9.9
Jun-28-2006	9.1
Jun-29-2006	9.4
Jun-30-2006	8.9
Jul-01-2006	8.4
Jul-02-2006	8.5
Jul-03-2006	7.8
Jul-04-2006	8
Jul-05-2006	7.8
Jul-06-2006	7.6
Jul-07-2006	7.5
Jul-08-2006	7.2
Jul-09-2006	7
Jul-10-2006	6.8
Jul-11-2006	7.4
Jul-12-2006	7.4
Jul-13-2006	6.9
Jul-14-2006	7.3
Jul-15-2006	7.8
Jul-16-2006	8.2
Jul-17-2006	8.4
Jul-18-2006	8.9
Jul-19-2006	8.8
Jul-20-2006	8.6
Jul-21-2006	7.7
Jul-22-2006	8
Jul-23-2006	7.9
Jul-24-2006	7.6
Jul-25-2006	7.2
Jul-26-2006	7.3
Jul-27-2006	7.1
Jul-28-2006	7.5
Jul-29-2006	7.4
Jul-30-2006	7.5
Jul-31-2006	8
Aug-01-2006	7.6
Aug-02-2006	7.7
Aug-03-2006	7.9
Aug-04-2006	6.8

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Aug-05-2006	6.4
Aug-06-2006	6.2
Aug-07-2006	6.2
Aug-08-2006	6.3
Aug-09-2006	6.8
Aug-10-2006	7.8
Aug-12-2006	7.6
Aug-13-2006	8.3
Aug-14-2006	8.1
Aug-15-2006	8.3
Aug-16-2006	8.7
Aug-17-2006	8.1
Aug-18-2006	7.6
Aug-19-2006	6.9
Aug-20-2006	6.6
Aug-21-2006	6.2
Aug-22-2006	6.3
Aug-23-2006	6.8
Aug-24-2006	7.1
Aug-25-2006	7.3
Aug-26-2006	7.8
Aug-27-2006	8.1
Aug-28-2006	8.2
Aug-29-2006	8.3
Aug-30-2006	8
Aug-31-2006	7.4
Sep-01-2006	6.9
Sep-02-2006	6.8
Sep-03-2006	5.7
Sep-04-2006	6.1
Sep-05-2006	5.5
Sep-06-2006	5.4
Sep-07-2006	6.1
Sep-10-2006	7.1
Sep-11-2006	7.7
Sep-12-2006	7.8
Sep-13-2006	8.1
Sep-14-2006	7.8
Sep-15-2006	7.2
Sep-16-2006	7.4
Sep-17-2006	7
Sep-18-2006	6.9
Sep-19-2006	6.9
Sep-20-2006	8
Sep-21-2006	8.8
Sep-22-2006	8.3
Sep-23-2006	7.4
Sep-24-2006	7.3

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Sep-25-2006	8.3
Sep-26-2006	8.7
Sep-27-2006	7.7
Sep-28-2006	7.6
Sep-29-2006	7.1
Sep-30-2006	7
Oct-01-2006	9.2
Oct-02-2006	6.5
Oct-03-2006	6.1
Oct-04-2006	6.1
Oct-05-2006	5.4
Oct-06-2006	6.7
Oct-07-2006	6.7
Oct-08-2006	6.7
Oct-09-2006	6.6
Oct-10-2006	5.7
Oct-11-2006	5.6
Oct-12-2006	5.9
Oct-13-2006	5
Oct-14-2006	5.4
Oct-15-2006	6.4
Oct-16-2006	6.5
Oct-17-2006	7.2
Oct-18-2006	7.6
Oct-19-2006	7.6
Oct-20-2006	7.3
Oct-21-2006	6.6
Oct-22-2006	7.1
Oct-23-2006	7.5
Oct-24-2006	6.9
Oct-25-2006	6.8
Oct-26-2006	6.9
Oct-27-2006	7.2
Oct-28-2006	7.2
Oct-29-2006	7.3
Oct-30-2006	7.5
Oct-31-2006	8.7
Nov-01-2006	8.9
Nov-02-2006	8.4
Nov-03-2006	6.6
Nov-04-2006	6.3
Nov-05-2006	6.2
Nov-06-2006	6.3
Nov-07-2006	6.4
Nov-08-2006	6.4
Nov-09-2006	6.6
Nov-10-2006	6.6
Nov-11-2006	6.4

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Nov-12-2006	6
Nov-13-2006	6.4
Nov-14-2006	6.9
Nov-15-2006	6.3
Nov-16-2006	6
Nov-17-2006	6.3
Nov-18-2006	5.8
Nov-19-2006	6.5
Nov-20-2006	6.6
Nov-21-2006	6.7
Nov-22-2006	6.1
Nov-23-2006	6.1
Nov-24-2006	6
Nov-25-2006	6.6
Nov-26-2006	5.7
Nov-27-2006	5.5
Nov-28-2006	5.6
Nov-29-2006	5.5
Nov-30-2006	5.4
Dec-01-2006	5
Dec-02-2006	5.4
Dec-03-2006	5.8
Dec-04-2006	5.9
Dec-05-2006	6
Dec-06-2006	5.7
Dec-07-2006	5.9
Dec-08-2006	6
Dec-09-2006	5.8
Dec-10-2006	5.8
Dec-11-2006	6.2
Dec-12-2006	5.8
Dec-13-2006	5.7
Dec-14-2006	6
Dec-15-2006	5.9
Dec-16-2006	6.3
Dec-17-2006	6.4
Dec-18-2006	6.3
Dec-19-2006	6
Dec-20-2006	5.9
Dec-21-2006	5.9
Dec-22-2006	5.7
Dec-23-2006	5.3
Dec-24-2006	5.3
Dec-25-2006	5.5
Dec-26-2006	5.7
Dec-27-2006	5.6
Dec-28-2006	5.5
Dec-29-2006	5.5

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Dec-30-2006	6.2
Dec-31-2006	4.9
Jan-01-2007	5.2
Jan-02-2007	5.3
Jan-03-2007	5.3
Jan-04-2007	4.9
Jan-05-2007	5.1
Jan-06-2007	5.2
Jan-07-2007	5.5
Jan-08-2007	5.6
Jan-09-2007	6.1
Jan-10-2007	6.5
Jan-11-2007	6.5
Jan-12-2007	5.5
Jan-13-2007	5.6
Jan-14-2007	5.9
Jan-15-2007	5.8
Jan-16-2007	5.9
Jan-17-2007	6
Jan-18-2007	5.6
Jan-19-2007	5.2
Jan-20-2007	5.1
Jan-21-2007	5
Jan-22-2007	5.4
Jan-23-2007	5.2
Jan-24-2007	4.9
Jan-25-2007	5
Jan-26-2007	5
Jan-27-2007	5.2
Jan-28-2007	4.7
Jan-29-2007	5
Jan-30-2007	4.9
Jan-31-2007	5.2
Feb-01-2007	5.3
Feb-02-2007	5.3
Feb-03-2007	5.2
Feb-04-2007	5.2
Feb-05-2007	5.1
Feb-06-2007	5.4
Feb-07-2007	5.2
Feb-08-2007	5.3
Feb-09-2007	5.3
Feb-10-2007	4.9
Feb-11-2007	5.2
Feb-12-2007	5.9
Feb-13-2007	5.5
Feb-14-2007	5.7
Feb-15-2007	5.9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Feb-16-2007	6.4
Feb-17-2007	5.9
Feb-18-2007	6.6
Feb-19-2007	6.8
Feb-20-2007	6.2
Feb-21-2007	6.2
Feb-22-2007	5.9
Feb-23-2007	5.9
Feb-24-2007	5.7
Feb-25-2007	5.4
Feb-26-2007	5.2
Feb-27-2007	4.5
Feb-28-2007	4.7
Mar-01-2007	4.8
Mar-02-2007	5.2
Mar-03-2007	4.9
Mar-04-2007	5.4
Mar-05-2007	5.5
Mar-06-2007	6
Mar-07-2007	5.3
Mar-08-2007	6
Mar-09-2007	6.2
Mar-10-2007	6.8
Mar-11-2007	7.4
Mar-12-2007	7.4
Mar-13-2007	7.6
Mar-14-2007	8
Mar-15-2007	8.2
Mar-16-2007	8.1
Mar-17-2007	7.9
Mar-18-2007	7.4
Mar-19-2007	7.3
Mar-20-2007	7.1
Mar-21-2007	7.5
Mar-22-2007	7.2
Mar-23-2007	7.4
Mar-24-2007	8.1
Mar-25-2007	8.3
Mar-26-2007	8.1
Mar-27-2007	8.2
Mar-28-2007	8.8
Mar-29-2007	8.9
Mar-30-2007	9.6
Mar-31-2007	9.1
Apr-01-2007	8.5
Apr-02-2007	8.7
Apr-03-2007	9
Apr-04-2007	8.6

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Apr-05-2007	8.4
Apr-06-2007	7.2
Apr-07-2007	6.5
Apr-08-2007	5.8
Apr-09-2007	6
Apr-10-2007	6.8
Apr-11-2007	6.8
Apr-12-2007	7.1
Apr-13-2007	7.1
Apr-14-2007	7.7
Apr-15-2007	7.5
Apr-16-2007	7.6
Apr-17-2007	6.8
Apr-18-2007	6.5
Apr-19-2007	6.7
Apr-20-2007	7.7
Apr-21-2007	7.4
Apr-22-2007	7.4
Apr-23-2007	7
Apr-24-2007	5.4
Apr-25-2007	6.2
Apr-26-2007	6.4
Apr-27-2007	6.4
Apr-28-2007	6.4
Apr-29-2007	6.6
Apr-30-2007	6.8
May-01-2007	7.1
May-02-2007	7.4
May-03-2007	7.3
May-04-2007	7.9
May-05-2007	8.1
May-06-2007	8.2
May-07-2007	7.4
May-08-2007	7
May-09-2007	6.8
May-10-2007	7
May-11-2007	7.9
May-12-2007	8.5
May-13-2007	7.9
May-14-2007	8.6
May-15-2007	8.6
May-16-2007	7.8
May-17-2007	8.6
May-18-2007	8.5
May-19-2007	8.7
May-20-2007	8.8
May-21-2007	9.2
May-22-2007	9.2

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
May-23-2007	8.5
May-24-2007	7.8
May-25-2007	7
May-26-2007	6.7
May-27-2007	6.7
May-28-2007	6.7
May-29-2007	6.7
May-30-2007	6.6
May-31-2007	7
Jun-01-2007	7.3
Jun-02-2007	7.3
Jun-03-2007	7.4
Jun-04-2007	7.2
Jun-05-2007	6.8
Jun-06-2007	6.6
Jun-07-2007	6.9
Jun-08-2007	6.4
Jun-09-2007	6.5
Jun-10-2007	6.5
Jun-11-2007	6.3
Jun-12-2007	6.6
Jun-13-2007	6.6
Jun-14-2007	8.9
Jun-15-2007	8.5
Jun-16-2007	8.1
Jun-17-2007	8.1
Jun-18-2007	7.9
Jun-19-2007	7.4
Jun-20-2007	7.2
Jun-21-2007	6.9
Jun-22-2007	6.7
Jun-23-2007	6.6
Jun-24-2007	6.8
Jun-25-2007	7
Jun-26-2007	7
Jun-27-2007	7.5
Jun-28-2007	6.8
Jun-29-2007	5.9
Jun-30-2007	6.7
Jul-01-2007	7.1
Jul-02-2007	6.6
Jul-03-2007	6.6
Jul-04-2007	5.9
Jul-05-2007	6.1
Jul-06-2007	6.2
Jul-07-2007	6.2
Jul-08-2007	5.8
Jul-09-2007	5.5

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jul-10-2007	6
Jul-11-2007	5.2
Jul-12-2007	5.2
Jul-13-2007	7.2
Jul-14-2007	7.3
Jul-15-2007	7.7
Jul-16-2007	7.4
Jul-17-2007	6.8
Jul-18-2007	6.4
Jul-19-2007	6
Jul-20-2007	5.9
Jul-21-2007	5.3
Jul-22-2007	5.6
Jul-23-2007	5.2
Jul-24-2007	5.7
Jul-25-2007	5.6
Jul-26-2007	5.8
Jul-27-2007	5.4
Jul-28-2007	5.6
Jul-29-2007	6.3
Jul-30-2007	6.2
Jul-31-2007	5.6
Aug-01-2007	5.4
Aug-02-2007	5.8
Aug-03-2007	5.9
Aug-04-2007	6.3
Aug-05-2007	6.4
Aug-06-2007	6.1
Aug-07-2007	5.7
Aug-08-2007	6.4
Aug-09-2007	5.2
Aug-10-2007	6.1
Aug-11-2007	6.5
Aug-12-2007	6.8
Aug-13-2007	7.3
Aug-14-2007	7.5
Aug-15-2007	7.5
Aug-16-2007	7.2
Aug-17-2007	7.3
Aug-18-2007	7.2
Aug-19-2007	7.1
Aug-20-2007	6.7
Aug-21-2007	6.4
Aug-22-2007	6.1
Aug-23-2007	6.4
Aug-24-2007	6.5
Aug-25-2007	5.7
Aug-26-2007	5.6

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Aug-27-2007	5.5
Aug-28-2007	5.9
Aug-29-2007	6.5
Aug-30-2007	6.5
Aug-31-2007	7.6
Sep-01-2007	7.5
Sep-02-2007	7.4
Sep-03-2007	8.8
Sep-04-2007	8.5
Sep-05-2007	8.4
Sep-06-2007	8.4
Sep-07-2007	8.2
Sep-08-2007	8.2
Sep-09-2007	7.3
Sep-10-2007	7.1
Sep-11-2007	7.1
Sep-12-2007	7
Sep-13-2007	7.8
Sep-14-2007	7.4
Sep-15-2007	7
Sep-16-2007	7.6
Sep-17-2007	7.6
Sep-18-2007	7.2
Sep-19-2007	6.7
Sep-20-2007	7.4
Sep-22-2007	7.3
Sep-23-2007	7.7
Sep-24-2007	7.5
Sep-25-2007	7.6
Sep-26-2007	7.3
Sep-27-2007	6.6
Sep-28-2007	6
Sep-29-2007	5.9
Sep-30-2007	5.8
Oct-01-2007	6
Oct-02-2007	5.4
Oct-03-2007	5.4
Oct-04-2007	6.2
Oct-05-2007	6.1
Oct-06-2007	5.9
Oct-07-2007	6.1
Oct-08-2007	6
Oct-09-2007	5.9
Oct-10-2007	5.8
Oct-11-2007	5.9
Oct-12-2007	5.6
Oct-13-2007	6.1
Oct-14-2007	5.5

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Oct-15-2007	5.2
Oct-16-2007	5.7
Oct-17-2007	5.6
Oct-18-2007	5.1
Oct-19-2007	5.9
Oct-20-2007	5.8
Oct-21-2007	5.1
Oct-22-2007	5.2
Oct-23-2007	4.8
Oct-24-2007	5.3
Oct-25-2007	4.9
Oct-26-2007	4.7
Oct-27-2007	6
Oct-28-2007	4.4
Oct-29-2007	7.1
Oct-30-2007	4.7
Oct-31-2007	6.3
Nov-01-2007	6.3
Nov-02-2007	6.3
Nov-03-2007	7
Nov-04-2007	7.6
Nov-05-2007	6
Nov-06-2007	5.3
Nov-07-2007	6.4
Nov-08-2007	6
Nov-09-2007	6.1
Nov-10-2007	6.4
Nov-11-2007	7.8
Nov-12-2007	8.2
Nov-13-2007	8.1
Nov-14-2007	7.5
Nov-15-2007	7.5
Nov-16-2007	6.8
Nov-17-2007	6.7
Nov-18-2007	6.6
Nov-19-2007	6.5
Nov-20-2007	5.7
Nov-21-2007	4.7
Nov-22-2007	4.8
Nov-23-2007	5.1
Nov-24-2007	4.8
Nov-25-2007	5.2
Nov-26-2007	5.7
Nov-27-2007	4.5
Nov-28-2007	6.6
Nov-29-2007	4.3
Nov-30-2007	7.2
Dec-01-2007	6.9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Dec-02-2007	6.8
Dec-03-2007	6.7
Dec-04-2007	6.8
Dec-05-2007	6.7
Dec-06-2007	6.8
Dec-07-2007	6.6
Dec-08-2007	6.6
Dec-09-2007	6.6
Dec-10-2007	6.8
Dec-11-2007	7.2
Dec-12-2007	6.7
Dec-13-2007	6.6
Dec-14-2007	6.9
Dec-15-2007	6.6
Dec-16-2007	6.8
Dec-17-2007	6.9
Dec-18-2007	7.1
Dec-19-2007	4.6
Dec-20-2007	4.1
Dec-21-2007	5.1
Dec-22-2007	5.5
Dec-23-2007	5.4
Dec-24-2007	5.9
Dec-25-2007	6.3
Dec-26-2007	6.5
Dec-27-2007	6.1
Dec-28-2007	6.4
Dec-29-2007	6.7
Dec-30-2007	6.9
Dec-31-2007	6.4
Jan-01-2008	6.5
Jan-02-2008	7.2
Jan-03-2008	6.5
Jan-04-2008	7
Jan-05-2008	7.4
Jan-06-2008	7.5
Jan-07-2008	7.7
Jan-08-2008	7.7
Jan-09-2008	7.6
Jan-10-2008	8
Jan-11-2008	7.2
Jan-12-2008	7
Jan-13-2008	7.5
Jan-14-2008	7.3
Jan-15-2008	8.1
Jan-16-2008	7.5
Jan-17-2008	7.8
Jan-18-2008	8

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jan-19-2008	8.1
Jan-20-2008	8.1
Jan-21-2008	8.4
Jan-22-2008	7.8
Jan-23-2008	7.7
Jan-24-2008	7.7
Jan-25-2008	7.1
Jan-26-2008	7.3
Jan-27-2008	7.2
Jan-28-2008	6.2
Jan-29-2008	6
Jan-30-2008	6.8
Jan-31-2008	6.9
Feb-01-2008	8.2
Feb-02-2008	8.4
Feb-03-2008	8.2
Feb-04-2008	8.2
Feb-05-2008	8.3
Feb-06-2008	8.4
Feb-07-2008	8.2
Feb-08-2008	8.1
Feb-09-2008	8.2
Feb-10-2008	7.8
Feb-11-2008	7.9
Feb-12-2008	8.2
Feb-13-2008	7.8
Feb-14-2008	8
Feb-15-2008	7.7
Feb-16-2008	8.4
Feb-17-2008	7.9
Feb-18-2008	7.6
Feb-19-2008	7.9
Feb-20-2008	7.1
Feb-21-2008	6.5
Feb-22-2008	6.9
Feb-23-2008	6.3
Feb-24-2008	6.3
Feb-25-2008	6.3
Feb-26-2008	6.3
Feb-27-2008	6.1
Feb-28-2008	6.2
Feb-29-2008	6.8
Mar-01-2008	6.9
Mar-02-2008	6.6
Mar-03-2008	7.1
Mar-04-2008	7.1
Mar-05-2008	6.9
Mar-06-2008	6.3

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Mar-07-2008	7.5
Mar-08-2008	7.2
Mar-09-2008	6.6
Mar-10-2008	6.3
Mar-11-2008	6.1
Mar-12-2008	5.8
Mar-13-2008	5.6
Mar-14-2008	4.6
Mar-15-2008	4.3
Mar-16-2008	3.9
Mar-17-2008	4.5
Mar-18-2008	5.8
Mar-19-2008	5.9
Mar-20-2008	6.9
Mar-21-2008	8.1
Mar-22-2008	8.1
Mar-23-2008	7.9
Mar-24-2008	7.7
Mar-25-2008	8
Mar-26-2008	8.2
Mar-27-2008	8.7
Mar-28-2008	8.9
Mar-29-2008	9
Mar-30-2008	9.2
Mar-31-2008	9.4
Apr-01-2008	9.1
Apr-02-2008	9.3
Apr-03-2008	7.9
Apr-04-2008	8.1
Apr-05-2008	8.5
Apr-06-2008	8.2
Apr-07-2008	8.2
Apr-08-2008	8.1
Apr-09-2008	8.4
Apr-10-2008	8.2
Apr-11-2008	7.4
Apr-12-2008	5.9
Apr-13-2008	6.7
Apr-14-2008	7.1
Apr-15-2008	6.1
Apr-16-2008	8.5
Apr-17-2008	8.7
Apr-18-2008	8.5
Apr-19-2008	7.6
Apr-20-2008	7.5
Apr-21-2008	7.4
Apr-22-2008	7
Apr-23-2008	6.7

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Apr-24-2008	6.9
Apr-25-2008	5.8
Apr-26-2008	6.4
Apr-27-2008	7.1
Apr-28-2008	7.3
Apr-29-2008	7.3
Apr-30-2008	8
May-01-2008	8.3
May-02-2008	8.6
May-03-2008	8.4
May-04-2008	9.3
May-05-2008	9.5
May-06-2008	9.5
May-07-2008	8.7
May-08-2008	8.7
May-09-2008	8.5
May-10-2008	8.1
May-11-2008	8.7
May-12-2008	8.1
May-13-2008	8.7
May-14-2008	8.9
May-15-2008	8.7
May-16-2008	6.9
May-17-2008	7.1
May-18-2008	7.6
May-19-2008	7.1
May-20-2008	7.1
May-21-2008	6.7
May-22-2008	6.3
May-23-2008	7
May-24-2008	7.6
May-25-2008	7.9
May-26-2008	8.1
May-27-2008	6.9
May-28-2008	6.5
May-29-2008	7.2
May-30-2008	8.2
May-31-2008	8.9
Jun-01-2008	8.6
Jun-02-2008	9.1
Jun-03-2008	9.2
Jun-04-2008	9
Jun-05-2008	9.4
Jun-06-2008	9.2
Jun-07-2008	8.5
Jun-08-2008	8.1
Jun-09-2008	7.9
Jun-10-2008	7.9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jun-11-2008	8
Jun-12-2008	7.4
Jun-13-2008	8.4
Jun-14-2008	8.2
Jun-15-2008	8.1
Jun-16-2008	8.3
Jun-17-2008	8.8
Jun-18-2008	7.6
Jun-19-2008	7.1
Jun-20-2008	6.9
Jun-21-2008	6.2
Jun-22-2008	7.2
Jun-23-2008	7.3
Jun-24-2008	7.4
Jun-25-2008	7.4
Jun-26-2008	8
Jul-25-2008	7.6
Jul-26-2008	7.9
Jul-27-2008	7.8
Jul-28-2008	7.6
Jul-29-2008	7.3
Jul-30-2008	7.1
Jul-31-2008	7.4
Aug-01-2008	7.3
Aug-02-2008	7.7
Aug-03-2008	7.3
Aug-04-2008	7.6
Aug-05-2008	7.7
Aug-06-2008	6.8
Aug-07-2008	6.9
Aug-08-2008	7.2
Aug-09-2008	6.4
Aug-10-2008	8
Aug-11-2008	7.8
Aug-12-2008	7.6
Aug-13-2008	7.7
Aug-14-2008	6.9
Aug-15-2008	7.1
Aug-16-2008	6.3
Aug-17-2008	6.3
Aug-18-2008	5.4
Aug-19-2008	4.8
Aug-20-2008	5.2
Aug-21-2008	5.4
Aug-22-2008	5
Aug-23-2008	4.4
Aug-24-2008	4.5
Aug-25-2008	5.4

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Aug-26-2008	5.8
Aug-27-2008	6
Aug-28-2008	6.1
Aug-29-2008	6.2
Aug-30-2008	5.9
Aug-31-2008	6.1
Sep-01-2008	6.6
Sep-02-2008	6.3
Sep-03-2008	5.5
Sep-04-2008	4.7
Sep-05-2008	4.8
Sep-06-2008	4.9
Sep-07-2008	4.3
Sep-08-2008	4.2
Sep-09-2008	4.5
Sep-10-2008	4.2
Sep-11-2008	4.5
Sep-12-2008	4.8
Sep-13-2008	5
Sep-14-2008	4.8
Sep-15-2008	4.8
Sep-16-2008	5.6
Sep-17-2008	6
Sep-18-2008	5.5
Sep-19-2008	5.9
Sep-20-2008	7.7
Sep-21-2008	8.3
Sep-22-2008	8.6
Sep-23-2008	9.9
Sep-24-2008	10
Sep-25-2008	9.4
Sep-26-2008	7.5
Sep-27-2008	7.1
Sep-28-2008	6.2
Sep-29-2008	6.1
Sep-30-2008	5.9
Oct-01-2008	5.6
Oct-02-2008	6.4
Oct-03-2008	6.5
Oct-04-2008	6.9
Oct-05-2008	6.7
Oct-06-2008	6.5
Oct-07-2008	4.9
Oct-08-2008	3.9
Oct-09-2008	4
Oct-10-2008	4.6
Oct-11-2008	4.2
Oct-12-2008	4.8

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Oct-13-2008	4.5
Oct-14-2008	5.2
Oct-15-2008	5.3
Oct-16-2008	5.4
Oct-17-2008	5.2
Oct-18-2008	5.2
Oct-19-2008	5.1
Oct-20-2008	5.5
Oct-21-2008	5.6
Oct-22-2008	5
Oct-23-2008	5.1
Oct-24-2008	5.2
Oct-25-2008	5.5
Oct-26-2008	5
Oct-27-2008	5
Oct-28-2008	4.9
Oct-29-2008	4.7
Oct-30-2008	4.8
Oct-31-2008	4.8
Nov-01-2008	5.7
Nov-02-2008	5.4
Nov-03-2008	4.4
Nov-04-2008	4.4
Nov-05-2008	4.9
Nov-06-2008	4.7
Nov-07-2008	4.3
Nov-08-2008	4.1
Nov-09-2008	4
Nov-10-2008	3.7
Nov-11-2008	4
Nov-12-2008	4.1
Nov-13-2008	4.2
Nov-14-2008	5.1
Nov-15-2008	5.5
Nov-16-2008	5.6
Nov-17-2008	6.6
Nov-18-2008	6.1
Nov-19-2008	5.6
Nov-20-2008	6
Nov-21-2008	5.8
Nov-22-2008	5.7
Nov-23-2008	6.2
Nov-24-2008	6.3
Nov-25-2008	6.2
Nov-26-2008	6.2
Nov-27-2008	5.9
Nov-28-2008	5.4
Nov-29-2008	5.2

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Nov-30-2008	4.5
Dec-01-2008	4.6
Dec-02-2008	4.5
Dec-03-2008	4.1
Dec-04-2008	5
Dec-05-2008	5.7
Dec-06-2008	6.1
Dec-07-2008	6.1
Dec-08-2008	5.9
Dec-09-2008	6.2
Dec-10-2008	5.5
Dec-11-2008	5.6
Dec-12-2008	6.5
Dec-13-2008	7
Dec-14-2008	6.7
Dec-15-2008	5.6
Dec-16-2008	5.6
Dec-17-2008	5.7
Dec-18-2008	5.9
Dec-19-2008	5.8
Dec-20-2008	5.8
Dec-21-2008	6.1
Dec-22-2008	6
Dec-23-2008	6.1
Dec-24-2008	6.2
Dec-25-2008	6
Dec-26-2008	6.4
Dec-27-2008	6.5
Dec-28-2008	6.1
Dec-29-2008	6.3
Dec-30-2008	6.4
Dec-31-2008	6.2
Jan-01-2009	6.1
Jan-02-2009	6
Jan-03-2009	6.4
Jan-04-2009	6
Jan-05-2009	6
Jan-06-2009	6.1
Jan-07-2009	6
Jan-08-2009	6
Jan-09-2009	5.5
Jan-10-2009	5.4
Jan-11-2009	5.5
Jan-12-2009	5.5
Jan-13-2009	5.6
Jan-14-2009	5.7
Jan-15-2009	5.8
Jan-16-2009	5.8

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jan-17-2009	6.1
Jan-18-2009	6.1
Jan-19-2009	5.8
Jan-20-2009	5.3
Jan-21-2009	5.4
Jan-22-2009	4.9
Jan-23-2009	5.7
Jan-24-2009	5.7
Jan-25-2009	6.4
Jan-26-2009	8.6
Jan-27-2009	6.5
Jan-28-2009	5.5
Jan-29-2009	6.5
Jan-30-2009	7.1
Jan-31-2009	7.1
Feb-01-2009	6
Feb-02-2009	5.9
Feb-03-2009	6.7
Feb-04-2009	7.3
Feb-05-2009	7.6
Feb-06-2009	6.9
Feb-07-2009	7
Feb-08-2009	7.2
Feb-09-2009	7.3
Feb-10-2009	6.8
Feb-11-2009	7.3
Feb-12-2009	6.7
Feb-13-2009	6.5
Feb-14-2009	6.3
Feb-15-2009	6.7
Feb-16-2009	7.1
Feb-17-2009	7.2
Feb-18-2009	7
Feb-19-2009	6.8
Feb-20-2009	6.8
Feb-21-2009	6.2
Feb-22-2009	6.2
Feb-23-2009	6
Feb-24-2009	5.9
Feb-25-2009	5.6
Feb-26-2009	6
Feb-27-2009	6.3
Feb-28-2009	6.4
Mar-01-2009	6.1
Mar-02-2009	6.1
Mar-03-2009	5.9
Mar-04-2009	5.7
Mar-05-2009	5.9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Mar-06-2009	5.8
Mar-07-2009	6.6
Mar-08-2009	6.8
Mar-09-2009	7.1
Mar-10-2009	7
Mar-11-2009	6.9
Mar-12-2009	7.3
Mar-13-2009	7
Mar-14-2009	7.4
Mar-15-2009	6.9
Mar-16-2009	6.9
Mar-17-2009	7
Mar-18-2009	6.9
Mar-19-2009	7.9
Mar-20-2009	7
Mar-21-2009	7
Mar-22-2009	6.7
Mar-23-2009	7.4
Mar-24-2009	6.8
Mar-25-2009	6.6
Mar-26-2009	6.1
Mar-27-2009	6.4
Mar-28-2009	6.2
Mar-29-2009	6.4
Mar-30-2009	7.6
Mar-31-2009	7.2
Apr-01-2009	7
Apr-02-2009	7.1
Apr-03-2009	7.6
Apr-04-2009	7.3
Apr-05-2009	7.9
Apr-06-2009	7.5
Apr-07-2009	7.9
Apr-08-2009	7.5
Apr-09-2009	7.6
Apr-10-2009	8.1
Apr-11-2009	8
Apr-12-2009	8.5
Apr-13-2009	9.4
Apr-14-2009	7.6
Apr-15-2009	6.8
Apr-16-2009	6.8
Apr-17-2009	6.1
Apr-18-2009	5.6
Apr-19-2009	5.9
Apr-20-2009	7.8
Apr-21-2009	7.8
Apr-22-2009	7.7

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Apr-23-2009	7.9
Apr-24-2009	8.3
Apr-25-2009	8.6
Apr-26-2009	8.9
Apr-27-2009	9.5
Apr-28-2009	9.4
Apr-29-2009	9.2
Apr-30-2009	9.8
May-01-2009	11.7
May-02-2009	10.4
May-03-2009	8.47
May-04-2009	7.06
May-05-2009	6.62
May-06-2009	7.64
May-07-2009	6.71
May-08-2009	6.84
May-09-2009	5.82
May-10-2009	6.09
May-11-2009	6.67
May-12-2009	6.93
May-13-2009	7.34
May-14-2009	6.27
May-15-2009	7.39
May-16-2009	6.95
May-17-2009	7.36
May-18-2009	7.23
May-19-2009	7.08
May-20-2009	8.32
May-21-2009	8.64
May-22-2009	9.18
May-23-2009	9.49
May-24-2009	9.37
May-25-2009	9.47
May-26-2009	10.3
May-27-2009	9.47
May-28-2009	9.07
May-29-2009	7.99
May-30-2009	7.53
May-31-2009	8.66
Jun-01-2009	7.89
Jun-02-2009	7.54
Jun-03-2009	7.07
Jun-04-2009	6.64
Jun-05-2009	6.52
Jun-06-2009	5.69
Jun-07-2009	6.31
Jun-08-2009	5.8
Jun-09-2009	7.45

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jun-10-2009	8.79
Jun-11-2009	8.06
Jun-12-2009	7.29
Jun-13-2009	7.34
Jun-14-2009	8.8
Jun-15-2009	8.72
Jun-16-2009	8.1
Jun-17-2009	8.41
Jun-18-2009	7.86
Jun-19-2009	7.32
Jun-20-2009	7.35
Jun-21-2009	7.83
Jun-22-2009	7.89
Jun-23-2009	8.61
Jun-24-2009	8.33
Jun-25-2009	8.32
Jun-26-2009	9.03
Jun-27-2009	9.19
Jun-28-2009	7.2
Jun-29-2009	7.15
Jun-30-2009	7.51
Jul-01-2009	7.77
Jul-02-2009	7.41
Jul-03-2009	8.09
Jul-04-2009	7.24
Jul-05-2009	6.7
Jul-06-2009	6.88
Jul-07-2009	6.79
Jul-08-2009	6.84
Jul-09-2009	8.04
Jul-10-2009	8.88
Jul-11-2009	9.85
Jul-12-2009	9.87
Jul-13-2009	8.58
Jul-14-2009	8.41
Jul-15-2009	9.47
Jul-16-2009	9.71
Jul-17-2009	10.6
Jul-18-2009	11
Jul-19-2009	9.29
Jul-20-2009	8.6
Jul-21-2009	8
Jul-22-2009	8.71
Jul-23-2009	10.3
Jul-24-2009	10.7
Jul-25-2009	10.1
Jul-26-2009	8.56
Jul-27-2009	6.07

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jul-28-2009	4.94
Jul-29-2009	5.13
Jul-30-2009	5.17
Jul-31-2009	4.84
Aug-01-2009	4.64
Aug-02-2009	5.07
Aug-03-2009	6.18
Aug-04-2009	6.41
Aug-19-2009	10.6
Aug-20-2009	11.3
Aug-21-2009	11.1
Aug-22-2009	8.39
Aug-23-2009	8.42
Aug-24-2009	9.45
Aug-25-2009	6.48
Aug-26-2009	5
Aug-27-2009	5.56
Aug-28-2009	4.76
Aug-29-2009	4.46
Aug-30-2009	5.01
Aug-31-2009	6.22
Sep-01-2009	6.8
Sep-02-2009	6.28
Sep-03-2009	6.22
Sep-04-2009	6.65
Sep-05-2009	6.46
Sep-06-2009	6.94
Sep-07-2009	7.5
Sep-08-2009	7.35
Sep-09-2009	7.79
Sep-10-2009	8.49
Sep-11-2009	7.78
Sep-12-2009	8.3
Sep-13-2009	10.5
Sep-14-2009	11.1
Sep-15-2009	9.87
Sep-16-2009	6.6
Sep-17-2009	7.74
Sep-18-2009	8.18
Sep-19-2009	8.96
Sep-20-2009	7.84
Sep-21-2009	7.37
Sep-22-2009	5.97
Sep-23-2009	7.85
Sep-24-2009	7.43
Sep-25-2009	7.9
Sep-26-2009	7.39
Sep-27-2009	7.07

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Sep-28-2009	5.96
Sep-29-2009	6.3
Sep-30-2009	7.31
Oct-01-2009	6.87
Oct-02-2009	6.63
Oct-03-2009	6.09
Oct-04-2009	6.55
Oct-05-2009	7.18
Oct-06-2009	6.91
Oct-07-2009	7.01
Oct-08-2009	6.56
Oct-09-2009	6.77
Oct-10-2009	6.75
Oct-11-2009	6.98
Oct-12-2009	6.98
Oct-13-2009	6.56
Oct-14-2009	6.56
Oct-15-2009	7.37
Oct-16-2009	5.63
Oct-17-2009	4.25
Oct-18-2009	4.59
Oct-19-2009	5.03
Oct-20-2009	5.65
Oct-21-2009	6.43
Oct-22-2009	6.74
Oct-23-2009	6.8
Oct-24-2009	6.85
Oct-25-2009	6.92
Oct-26-2009	6.87
Oct-27-2009	6.52
Oct-28-2009	6.75
Oct-29-2009	6.61
Oct-30-2009	6.69
Oct-31-2009	6.58
Nov-01-2009	6.91
Nov-02-2009	7.03
Nov-03-2009	6.87
Nov-04-2009	6.95
Nov-05-2009	6.64
Nov-06-2009	6.65
Nov-07-2009	7.52
Nov-08-2009	6.56
Nov-09-2009	5.79
Nov-10-2009	5.85
Nov-11-2009	5.6
Nov-12-2009	6.21
Nov-13-2009	6.19
Nov-14-2009	5.5

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Nov-15-2009	5.61
Nov-16-2009	6.02
Nov-17-2009	5.38
Nov-18-2009	5.67
Nov-19-2009	5.64
Nov-20-2009	5.5
Nov-21-2009	5.63
Nov-22-2009	6.21
Nov-23-2009	5.99
Nov-24-2009	6.02
Nov-25-2009	6.08
Nov-26-2009	5.94
Nov-27-2009	5.75
Nov-28-2009	5.66
Nov-29-2009	5.97
Nov-30-2009	5.79
Dec-01-2009	5.44
Dec-02-2009	6.17
Dec-03-2009	6.45
Dec-04-2009	6.68
Dec-05-2009	5.78
Dec-06-2009	5.83
Dec-07-2009	5.94
Dec-08-2009	7.2
Dec-09-2009	6.09
Dec-10-2009	5.93
Dec-11-2009	6.54
Dec-12-2009	6.99
Dec-13-2009	7.43
Dec-14-2009	7.08
Dec-15-2009	7
Dec-16-2009	7.41
Dec-17-2009	7.32
Dec-18-2009	7.3
Dec-19-2009	7.33
Dec-20-2009	7.72
Dec-21-2009	7.28
Dec-22-2009	7.46
Dec-23-2009	7.47
Dec-24-2009	7.78
Dec-25-2009	7.94
Dec-26-2009	7.93
Dec-27-2009	7.58
Dec-28-2009	8.35
Dec-29-2009	8.23
Dec-30-2009	7.73
Dec-31-2009	8.06
Jan-01-2010	8.33

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jan-02-2010	8.82
Jan-03-2010	8.61
Jan-04-2010	7.96
Jan-05-2010	7.31
Jan-06-2010	7.38
Jan-07-2010	7.17
Jan-08-2010	7.52
Jan-09-2010	7.38
Jan-10-2010	7.46
Jan-11-2010	7.5
Jan-12-2010	7.51
Jan-13-2010	7.41
Jan-14-2010	7.35
Jan-15-2010	7.21
Jan-16-2010	7.4
Jan-17-2010	7.88
Jan-18-2010	7.24
Jan-19-2010	6.8
Jan-20-2010	7.04
Jan-21-2010	7.03
Jan-22-2010	7.16
Jan-23-2010	8.22
Jan-24-2010	7.91
Jan-25-2010	8.14
Jan-26-2010	8.69
Jan-27-2010	8.43
Jan-28-2010	8.66
Jan-29-2010	8.13
Jan-30-2010	7.74
Jan-31-2010	7.27
Feb-01-2010	8.04
Feb-02-2010	8.1
Feb-03-2010	8.14
Feb-04-2010	9.36
Feb-05-2010	8.96
Feb-06-2010	8.63
Feb-07-2010	8.45
Feb-08-2010	7.77
Feb-09-2010	7.88
Feb-10-2010	7.61
Feb-11-2010	6.84
Feb-12-2010	7.21
Feb-13-2010	6.94
Feb-14-2010	7.34
Feb-15-2010	8.22
Feb-16-2010	8.36
Feb-17-2010	8.77
Feb-18-2010	8.28

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Feb-19-2010	7.84
Feb-20-2010	7.94
Feb-21-2010	8.14
Feb-22-2010	8.41
Feb-23-2010	8.44
Feb-24-2010	8.3
Feb-25-2010	8.32
Feb-26-2010	8.29
Feb-27-2010	8.64
Feb-28-2010	8.65
Mar-01-2010	8.54
Mar-02-2010	8.58
Mar-03-2010	7.96
Mar-04-2010	8.59
Mar-05-2010	8.07
Mar-06-2010	8
Mar-07-2010	8.11
Mar-08-2010	8.25
Mar-09-2010	8.46
Mar-10-2010	8.51
Mar-11-2010	8.53
Mar-12-2010	7.99
Mar-13-2010	8.54
Mar-14-2010	8.73
Mar-15-2010	9.07
Mar-16-2010	8.69
Mar-17-2010	8
Mar-18-2010	7.93
Mar-19-2010	7.54
Mar-20-2010	8.7
Mar-21-2010	9.36
Mar-22-2010	8.94
Mar-23-2010	8.69
Mar-24-2010	8.23
Mar-25-2010	8.15
Mar-26-2010	9.35
Mar-27-2010	8.38
Mar-28-2010	8.05
Mar-29-2010	8.15
Mar-30-2010	8.69
Mar-31-2010	9.28
Apr-01-2010	9.14
Apr-02-2010	9.86
Apr-03-2010	8.5
Apr-04-2010	9.61
Apr-05-2010	6
Apr-06-2010	6.26
Apr-07-2010	7.76

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Apr-08-2010	9.1
Apr-09-2010	8.54
Apr-10-2010	7.83
Apr-11-2010	7.43
Apr-12-2010	7.57
Apr-13-2010	7.46
Apr-14-2010	7.79
Apr-15-2010	8.51
Apr-16-2010	8.37
Apr-17-2010	8.66
Apr-18-2010	8.64
Apr-19-2010	7.99
Apr-20-2010	7.93
Apr-21-2010	7.76
Apr-22-2010	8.43
Apr-23-2010	9
Apr-24-2010	8.83
Apr-25-2010	8.23
Apr-26-2010	7.55
Apr-27-2010	7.31
Apr-28-2010	9.8
Apr-29-2010	11
Apr-30-2010	12
May-01-2010	12
May-02-2010	8.7
May-03-2010	8.4
May-04-2010	8.2
May-05-2010	8.6
May-06-2010	8.5
May-07-2010	8.4
May-08-2010	8.6
May-09-2010	8.8
May-10-2010	8.2
May-11-2010	8.3
May-12-2010	8.3
May-13-2010	8.2
May-14-2010	8.8
May-15-2010	9.1
May-16-2010	8.7
May-17-2010	7.6
May-18-2010	7.1
May-19-2010	6.8
May-20-2010	6.9
May-21-2010	7.4
May-22-2010	7.3
May-23-2010	7
May-24-2010	7.9
May-25-2010	9.6

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
May-26-2010	8.6
May-27-2010	8.3
May-28-2010	8.2
May-29-2010	8.4
May-30-2010	8.1
May-31-2010	7.8
Jun-01-2010	8.3
Jun-02-2010	7.8
Jun-03-2010	8
Jun-04-2010	8.7
Jun-05-2010	8
Jun-06-2010	8.9
Jun-07-2010	8.8
Jun-08-2010	9.2
Jun-09-2010	9.5
Jun-10-2010	8.8
Jun-11-2010	8.7
Jun-12-2010	9.9
Jun-13-2010	10
Jun-14-2010	10
Jun-15-2010	10
Jun-16-2010	10
Jun-17-2010	9.4
Jun-18-2010	8.3
Jun-19-2010	7.4
Jun-20-2010	7.2
Jun-21-2010	6.9
Jun-22-2010	6.3
Jun-23-2010	6.6
Jun-24-2010	7.2
Jun-25-2010	7
Jun-26-2010	6.9
Jun-27-2010	8.3
Jun-28-2010	7.8
Jun-29-2010	7.7
Jun-30-2010	9
Jul-01-2010	8.5
Jul-02-2010	8.8
Jul-03-2010	10
Jul-04-2010	10
Jul-05-2010	9.6
Jul-06-2010	10
Jul-07-2010	11
Jul-08-2010	12
Jul-09-2010	12
Jul-10-2010	12
Jul-11-2010	13
Jul-12-2010	13

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jul-13-2010	12
Jul-14-2010	12
Jul-15-2010	10
Jul-16-2010	9.9
Jul-17-2010	10
Jul-18-2010	10
Jul-19-2010	9.8
Jul-20-2010	9.6
Jul-21-2010	10
Jul-22-2010	11
Jul-23-2010	11
Jul-24-2010	10
Jul-25-2010	11
Jul-26-2010	12
Jul-27-2010	11
Jul-28-2010	9.7
Jul-29-2010	9.3
Jul-30-2010	9.8
Jul-31-2010	11
Aug-01-2010	12
Aug-02-2010	12
Aug-03-2010	12
Aug-04-2010	12
Aug-05-2010	11
Aug-06-2010	11
Aug-07-2010	13
Aug-08-2010	12
Aug-09-2010	12
Aug-10-2010	12
Aug-11-2010	12
Aug-12-2010	11
Aug-13-2010	9
Aug-14-2010	8.3
Aug-15-2010	8.5
Aug-16-2010	8.1
Aug-17-2010	8.5
Aug-18-2010	8.6
Aug-19-2010	11
Aug-20-2010	11
Aug-21-2010	10
Aug-22-2010	9.8
Aug-23-2010	10
Aug-24-2010	11
Aug-25-2010	10
Aug-26-2010	9.2
Aug-27-2010	9.1
Aug-28-2010	10
Aug-29-2010	11

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Aug-30-2010	10
Aug-31-2010	9.2
Sep-01-2010	11
Sep-02-2010	10
Sep-03-2010	9.8
Sep-04-2010	9.4
Sep-05-2010	9.7
Sep-06-2010	10
Sep-07-2010	10
Sep-08-2010	11
Sep-09-2010	11
Sep-10-2010	11
Sep-11-2010	9.5
Sep-12-2010	8.5
Sep-13-2010	8.7
Sep-14-2010	8.6
Sep-15-2010	8.4
Sep-16-2010	8.4
Sep-17-2010	8.1
Sep-18-2010	7.5
Sep-19-2010	7.8
Sep-20-2010	8.1
Sep-21-2010	7
Sep-22-2010	7.8
Sep-23-2010	7.7
Sep-24-2010	7.5
Sep-25-2010	7.5
Sep-26-2010	7.6
Sep-27-2010	8.3
Sep-28-2010	8.6
Sep-29-2010	8.4
Sep-30-2010	8.5
Oct-01-2010	8.5
Oct-02-2010	8.6
Oct-03-2010	8.7
Oct-04-2010	8.2
Oct-05-2010	8.2
Oct-06-2010	8.1
Oct-07-2010	7.2
Oct-08-2010	7.4
Oct-09-2010	7.4
Oct-10-2010	7.2
Oct-11-2010	7.1
Oct-12-2010	5.9
Oct-13-2010	5.6
Oct-14-2010	5.1
Oct-15-2010	5.1
Oct-16-2010	4.8

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Oct-17-2010	4.9
Oct-18-2010	4.9
Oct-19-2010	4.7
Oct-20-2010	5.4
Oct-21-2010	6.1
Oct-22-2010	5.8
Oct-23-2010	7.1
Oct-24-2010	8.3
Oct-25-2010	7.8
Oct-26-2010	7.4
Oct-27-2010	7
Oct-28-2010	6.2
Oct-29-2010	6.4
Oct-30-2010	6.7
Oct-31-2010	7.7
Nov-01-2010	7.3
Nov-02-2010	6.6
Nov-03-2010	5.7
Nov-04-2010	4.8
Nov-05-2010	5.1
Nov-06-2010	5.6
Nov-07-2010	6.3
Nov-08-2010	6.6
Nov-09-2010	5.5
Nov-10-2010	5.3
Nov-11-2010	5.1
Nov-12-2010	4.8
Nov-13-2010	4.6
Nov-14-2010	8
Nov-15-2010	8.4
Nov-16-2010	8.3
Nov-17-2010	8.1
Nov-18-2010	7.3
Nov-19-2010	7
Nov-20-2010	7.1
Nov-21-2010	8.1
Nov-22-2010	8.1
Nov-23-2010	7.4
Nov-24-2010	7.7
Nov-25-2010	9
Nov-26-2010	8.4
Nov-27-2010	8.1
Nov-28-2010	8.4
Nov-29-2010	9.6
Nov-30-2010	7.9
Dec-01-2010	7.8
Dec-02-2010	8.5
Dec-03-2010	8.6

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Dec-04-2010	7.9
Dec-05-2010	6.6
Dec-06-2010	6.7
Dec-07-2010	7.1
Dec-08-2010	7.6
Dec-09-2010	7.8
Dec-10-2010	7.6
Dec-11-2010	7.1
Dec-12-2010	7.1
Dec-13-2010	8.3
Dec-14-2010	8.2
Dec-15-2010	7.9
Dec-16-2010	7.2
Dec-17-2010	8
Dec-18-2010	7.1
Dec-19-2010	7.5
Dec-20-2010	8
Dec-21-2010	7.4
Dec-22-2010	8.8
Dec-23-2010	11
Dec-24-2010	10
Dec-25-2010	11
Dec-26-2010	10
Dec-27-2010	9.1
Dec-28-2010	8.2
Dec-29-2010	8.7
Dec-30-2010	11
Dec-31-2010	9.9
Jan-01-2011	11
Jan-02-2011	11
Jan-03-2011	9
Jan-04-2011	9.5
Jan-05-2011	10
Jan-06-2011	9.2
Jan-07-2011	8.5
Jan-08-2011	9
Jan-09-2011	9.5
Jan-10-2011	9.6
Jan-11-2011	9.4
Jan-12-2011	9.5
Jan-13-2011	9.9
Jan-14-2011	9.8
Jan-15-2011	10
Jan-16-2011	11
Jan-17-2011	10
Jan-18-2011	10
Jan-19-2011	9.8
Jan-20-2011	10

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jan-21-2011	11
Jan-22-2011	10
Jan-23-2011	11
Jan-24-2011	11
Jan-25-2011	11
Jan-26-2011	10
Jan-27-2011	9.8
Jan-28-2011	8.7
Jan-29-2011	9.3
Jan-30-2011	9
Jan-31-2011	8.6
Feb-01-2011	9.1
Feb-02-2011	8.5
Feb-03-2011	8.8
Feb-04-2011	9
Feb-05-2011	9.8
Feb-06-2011	9.5
Feb-07-2011	9.8
Feb-08-2011	10
Feb-09-2011	10
Feb-10-2011	9.9
Feb-11-2011	9.2
Feb-12-2011	9.5
Feb-13-2011	9.8
Feb-14-2011	9
Feb-15-2011	8.9
Mar-16-2011	7.7
Mar-17-2011	8.5
Mar-18-2011	10
Mar-19-2011	9.1
Mar-20-2011	9.8
Mar-21-2011	10
Mar-22-2011	9.3
Mar-23-2011	7.9
Mar-24-2011	8.6
Mar-25-2011	9
Mar-26-2011	9.1
Mar-27-2011	9.1
Mar-28-2011	9.5
Mar-29-2011	9.5
Apr-27-2011	9.6
Apr-28-2011	9.1
Apr-29-2011	8.3
Apr-30-2011	8.8
May-01-2011	9.5
May-02-2011	9.6
May-03-2011	9.6
May-04-2011	8.9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
May-05-2011	9.5
May-06-2011	9.6
May-07-2011	9.5
May-08-2011	9.4
May-09-2011	9
May-10-2011	8.9
May-11-2011	9.8
May-12-2011	9.4
May-13-2011	8.7
May-14-2011	11
May-15-2011	10
May-16-2011	11
May-17-2011	11
May-18-2011	11
May-19-2011	11
May-20-2011	10
May-21-2011	9.8
May-22-2011	10
May-23-2011	10
May-24-2011	11
May-25-2011	9.8
May-26-2011	9.6
May-27-2011	10
May-28-2011	9.7
May-29-2011	10
May-30-2011	9.1
May-31-2011	9.5
Jun-01-2011	9.1
Jun-02-2011	9.8
Jun-03-2011	9.2
Jun-04-2011	9.1
Jun-05-2011	8.7
Jun-06-2011	8.5
Jun-07-2011	8.7
Jun-08-2011	
Jun-09-2011	
Jun-10-2011	
Jun-11-2011	
Jun-12-2011	
Jun-13-2011	
Jun-14-2011	
Jun-15-2011	
Jun-16-2011	
Jun-17-2011	
Jun-18-2011	
Jun-19-2011	
Jun-20-2011	
Jun-21-2011	

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jun-22-2011	13
Jun-23-2011	14
Jun-24-2011	14
Jun-25-2011	14
Jun-26-2011	13
Jun-27-2011	13
Jun-28-2011	11
Jun-29-2011	12
Jun-30-2011	10
Jul-01-2011	11
Jul-02-2011	11
Jul-03-2011	11
Jul-04-2011	10
Jul-05-2011	11
Jul-06-2011	10
Jul-07-2011	12
Jul-08-2011	11
Jul-09-2011	10
Jul-10-2011	9.8
Jul-11-2011	9.8
Jul-12-2011	10
Jul-13-2011	10
Jul-14-2011	9.7
Jul-15-2011	10
Jul-16-2011	9.5
Jul-17-2011	9
Jul-18-2011	9.2
Jul-19-2011	9.5
Jul-20-2011	11
Jul-21-2011	10
Jul-22-2011	10
Jul-23-2011	11
Jul-24-2011	11
Jul-25-2011	12
Jul-26-2011	11
Jul-27-2011	11
Jul-28-2011	13
Jul-29-2011	14
Jul-30-2011	11
Jul-31-2011	12
Aug-01-2011	12
Aug-02-2011	12
Aug-03-2011	10
Aug-04-2011	13
Aug-05-2011	12
Aug-06-2011	9.8
Aug-07-2011	11
Aug-08-2011	10

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Aug-09-2011	10
Aug-10-2011	11
Aug-11-2011	10
Aug-12-2011	11
Aug-13-2011	11
Aug-14-2011	11
Aug-15-2011	11
Aug-16-2011	10
Aug-17-2011	11
Aug-18-2011	10
Aug-19-2011	10
Aug-20-2011	10
Aug-21-2011	10
Aug-22-2011	10
Aug-23-2011	10
Aug-24-2011	10
Aug-25-2011	9.4
Aug-26-2011	9.5
Aug-27-2011	10
Aug-28-2011	9.9
Aug-29-2011	10
Aug-30-2011	7.1
Aug-31-2011	5.8
Sep-01-2011	6.8
Sep-02-2011	10
Sep-03-2011	9.4
Sep-04-2011	8.5
Sep-05-2011	7.9
Sep-06-2011	8.6
Sep-07-2011	9.4
Sep-08-2011	9.2
Sep-09-2011	
Sep-10-2011	
Sep-11-2011	
Sep-12-2011	
Sep-13-2011	8.8
Sep-14-2011	9.8
Sep-15-2011	9.5
Sep-16-2011	9.7
Sep-17-2011	9
Sep-18-2011	8.4
Sep-19-2011	7.9
Sep-20-2011	8.2
Sep-21-2011	9.6
Sep-22-2011	9.2
Sep-23-2011	10
Sep-24-2011	8.8
Sep-25-2011	9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Sep-26-2011	9.4
Sep-27-2011	11
Sep-28-2011	10
Sep-29-2011	9.6
Sep-30-2011	7.2
Oct-01-2011	7
Oct-02-2011	7.1
Oct-03-2011	8
Oct-04-2011	7.8
Oct-05-2011	7.1
Oct-06-2011	6.7
Oct-07-2011	6.4
Oct-08-2011	7.6
Oct-09-2011	8.5
Oct-10-2011	8.5
Oct-11-2011	9.6
Oct-12-2011	8.8
Oct-13-2011	9.6
Oct-14-2011	8.7
Oct-15-2011	8.2
Oct-16-2011	8.6
Oct-17-2011	8.1
Oct-18-2011	8.6
Oct-19-2011	8.9
Oct-20-2011	9.2
Oct-21-2011	10
Oct-22-2011	10
Oct-23-2011	10
Oct-24-2011	10
Oct-25-2011	10
Oct-26-2011	11
Oct-27-2011	10
Oct-28-2011	9.7
Oct-29-2011	8.3
Oct-30-2011	7.6
Oct-31-2011	7.7
Nov-01-2011	9.6
Nov-02-2011	9
Nov-03-2011	9
Nov-04-2011	8.8
Nov-05-2011	7.9
Nov-06-2011	7.3
Nov-07-2011	6.5
Nov-08-2011	6.4
Nov-09-2011	5.6
Nov-10-2011	6.3
Nov-11-2011	6.8
Nov-12-2011	7.4

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Nov-13-2011	7.7
Nov-14-2011	8.1
Nov-15-2011	6.7
Nov-16-2011	7.8
Nov-17-2011	7.3
Nov-18-2011	6.6
Nov-19-2011	6.9
Nov-20-2011	6.9
Nov-21-2011	6.4
Nov-22-2011	6.3
Nov-23-2011	6.5
Nov-24-2011	6.8
Nov-25-2011	6.6
Nov-26-2011	7.4
Nov-27-2011	7.9
Nov-28-2011	7.4
Nov-29-2011	6.7
Nov-30-2011	6.8
Dec-01-2011	8
Dec-02-2011	
Dec-03-2011	
Dec-04-2011	8.5
Dec-05-2011	8
Dec-06-2011	7.8
Dec-07-2011	8.4
Dec-08-2011	
Dec-09-2011	8.3
Dec-10-2011	8.1
Dec-11-2011	7.7
Dec-12-2011	7.4
Dec-13-2011	8
Dec-14-2011	7.6
Dec-15-2011	8.7
Dec-16-2011	8.4
Dec-17-2011	8.6
Dec-18-2011	9
Dec-19-2011	8.8
Dec-20-2011	7.5
Dec-21-2011	8.7
Dec-22-2011	8.5
Dec-23-2011	9.1
Dec-24-2011	7.6
Dec-25-2011	8.7
Dec-26-2011	8.2
Dec-27-2011	8.6
Dec-28-2011	8.8
Dec-29-2011	8.4
Dec-30-2011	7.4

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Dec-31-2011	6.9
Jan-01-2012	7.5
Jan-02-2012	7.3
Jan-03-2012	7.8
Jan-04-2012	8.6
Jan-05-2012	8.6
Jan-06-2012	8.4
Jan-07-2012	7.9
Jan-08-2012	6.8
Jan-09-2012	7.3
Jan-10-2012	7
Jan-11-2012	6.8
Jan-12-2012	6.8
Jan-13-2012	6.4
Jan-14-2012	6.4
Jan-15-2012	6.4
Jan-16-2012	6.8
Jan-17-2012	6.4
Jan-18-2012	7.2
Jan-19-2012	7.2
Jan-20-2012	7.6
Jan-21-2012	6.9
Jan-22-2012	6.7
Jan-23-2012	6.5
Jan-24-2012	5.6
Jan-25-2012	4.5
Jan-26-2012	6.5
Jan-27-2012	6.8
Jan-28-2012	7.5
Jan-29-2012	7.4
Jan-30-2012	6.9
Jan-31-2012	8.1
Feb-01-2012	7.1
Feb-02-2012	7.2
Feb-03-2012	7
Feb-04-2012	7
Feb-05-2012	7.4
Feb-06-2012	7.3
Feb-07-2012	7.4
Feb-08-2012	6
Feb-09-2012	6.1
Feb-10-2012	5.8
Feb-11-2012	6
Feb-12-2012	5.6
Feb-13-2012	4.8
Feb-14-2012	5.1
Feb-15-2012	5.5
Feb-16-2012	5.9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Feb-17-2012	6
Feb-18-2012	6.6
Feb-19-2012	8.5
Feb-20-2012	8.6
Feb-21-2012	8.9
Feb-22-2012	7.8
Feb-23-2012	6.9
Feb-24-2012	8.9
Feb-25-2012	8.7
Feb-26-2012	8.4
Feb-27-2012	7.7
Feb-28-2012	8.8
Feb-29-2012	8.8
Mar-01-2012	8.8
Mar-02-2012	6.9
Mar-03-2012	5.5
Mar-04-2012	5.6
Mar-05-2012	5.8
Mar-06-2012	6.9
Mar-07-2012	
Mar-08-2012	8.6
Mar-09-2012	8.9
Mar-10-2012	8.6
Mar-11-2012	8.7
Mar-12-2012	9.1
Mar-13-2012	9.2
Mar-14-2012	8.9
Mar-15-2012	9.3
Mar-16-2012	8.8
Mar-17-2012	9.1
Mar-18-2012	9
Mar-19-2012	8.6
Mar-20-2012	8.4
Mar-21-2012	9.8
Mar-22-2012	9.6
Mar-23-2012	9.9
Mar-24-2012	9.5
Mar-25-2012	9
Mar-26-2012	9.5
Mar-27-2012	9.6
Mar-28-2012	10
Mar-29-2012	10
Mar-30-2012	10
Mar-31-2012	9.6
Apr-01-2012	9.7
Apr-02-2012	10
Apr-03-2012	9.6
Apr-04-2012	10

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Apr-05-2012	11
Apr-06-2012	11
Apr-07-2012	11
Apr-08-2012	10
Apr-09-2012	11
Apr-10-2012	10
Apr-11-2012	10
Apr-12-2012	11
Apr-13-2012	10
Apr-14-2012	9
Apr-15-2012	9.5
Apr-16-2012	9.2
Apr-17-2012	9.4
Apr-18-2012	10
Apr-19-2012	11
Apr-20-2012	12
Apr-21-2012	11
Apr-22-2012	12
Apr-23-2012	12
Apr-24-2012	11
Apr-25-2012	11
Apr-26-2012	11
Apr-27-2012	10
Apr-28-2012	10
Apr-29-2012	9.4
Apr-30-2012	9.7
May-01-2012	11
May-02-2012	11
May-03-2012	11
May-04-2012	11
May-05-2012	11
May-06-2012	10
May-07-2012	12
May-08-2012	12
May-09-2012	11
May-10-2012	11
May-11-2012	12
May-12-2012	12
May-13-2012	10
May-14-2012	11
May-15-2012	12
May-16-2012	9.9
May-17-2012	12
May-18-2012	12
May-19-2012	13
May-20-2012	14
May-21-2012	13
May-22-2012	14

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
May-23-2012	13
May-24-2012	11
May-25-2012	11
May-26-2012	11
May-27-2012	11
May-28-2012	10
May-29-2012	10
May-30-2012	9.7
May-31-2012	10
Jun-01-2012	10
Jun-02-2012	9.9
Jun-03-2012	10
Jun-04-2012	10
Jun-05-2012	11
Jun-06-2012	11
Jun-07-2012	
Jun-08-2012	10
Jun-09-2012	9.3
Jun-10-2012	9.4
Jun-11-2012	9.7
Jun-12-2012	9.6
Jun-13-2012	10
Jun-14-2012	10
Jun-15-2012	8.7
Jun-16-2012	8.8
Jun-17-2012	9.9
Jun-18-2012	10
Jun-19-2012	10
Jun-20-2012	9.2
Jun-21-2012	8.8
Jun-22-2012	9.3
Jun-23-2012	10
Jun-24-2012	9.1
Jun-25-2012	9.3
Jun-26-2012	9.1
Jun-27-2012	9.6
Jun-28-2012	10
Jun-29-2012	10
Jun-30-2012	10
Jul-01-2012	10
Jul-02-2012	9.6
Jul-03-2012	9.1
Jul-04-2012	9.4
Jul-05-2012	9.7
Jul-06-2012	9.7
Jul-07-2012	10
Jul-08-2012	11
Jul-09-2012	11

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jul-10-2012	11
Jul-11-2012	10
Jul-12-2012	9.8
Jul-13-2012	9.7
Jul-14-2012	9
Jul-15-2012	8.9
Jul-16-2012	8.4
Jul-17-2012	8.5
Jul-18-2012	10
Jul-19-2012	11
Jul-20-2012	10
Jul-21-2012	11
Jul-22-2012	12
Jul-23-2012	12
Jul-24-2012	10
Jul-25-2012	10
Jul-26-2012	9.4
Jul-27-2012	10
Jul-28-2012	9.7
Jul-29-2012	11
Jul-30-2012	10
Jul-31-2012	9.6
Aug-01-2012	9.9
Aug-02-2012	9
Aug-03-2012	7.3
Aug-04-2012	9.1
Aug-05-2012	9.1
Aug-06-2012	9.6
Aug-07-2012	11
Aug-08-2012	14
Aug-09-2012	14
Aug-10-2012	13
Aug-11-2012	12
Aug-12-2012	9.1
Aug-13-2012	10
Aug-14-2012	9.7
Aug-15-2012	9.5
Aug-16-2012	8.6
Aug-17-2012	9.3
Aug-18-2012	8.9
Aug-19-2012	8.6
Aug-20-2012	8.4
Aug-21-2012	9.4
Aug-22-2012	10
Aug-23-2012	11
Aug-24-2012	10
Aug-25-2012	8.4
Aug-26-2012	8.7

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Aug-27-2012	8.7
Aug-28-2012	8.5
Aug-29-2012	8.3
Aug-30-2012	8.7
Aug-31-2012	8.7
Sep-01-2012	8
Sep-02-2012	7.7
Sep-03-2012	7.8
Sep-04-2012	7.9
Sep-05-2012	8.2
Sep-06-2012	8.2
Sep-07-2012	9
Sep-08-2012	9.2
Sep-09-2012	9.2
Sep-10-2012	9
Sep-11-2012	9.2
Sep-12-2012	9.5
Sep-13-2012	9.5
Sep-14-2012	9.8
Sep-15-2012	10
Sep-16-2012	10
Sep-17-2012	10
Sep-18-2012	10
Sep-19-2012	9.2
Sep-20-2012	9.1
Sep-21-2012	10
Sep-22-2012	12
Sep-23-2012	10
Sep-24-2012	8.4
Sep-25-2012	6.8
Sep-26-2012	6.2
Sep-27-2012	7.2
Sep-28-2012	8.6
Sep-29-2012	8.8
Sep-30-2012	7.6
Oct-01-2012	6.6
Oct-02-2012	7
Oct-03-2012	7
Oct-04-2012	7.6
Oct-05-2012	7.2
Oct-06-2012	8.4
Oct-07-2012	7.1
Oct-08-2012	6.7
Oct-09-2012	6.4
Oct-10-2012	6.5
Oct-11-2012	6
Oct-12-2012	5.4
Oct-13-2012	4.8

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Oct-14-2012	5.5
Oct-15-2012	6.1
Oct-16-2012	6.1
Oct-17-2012	5.9
Oct-18-2012	5.7
Oct-19-2012	5.6
Oct-20-2012	6.5
Oct-21-2012	7
Oct-22-2012	6.5
Oct-23-2012	6.3
Oct-24-2012	7.7
Oct-25-2012	8.2
Oct-26-2012	9.3
Oct-27-2012	9.8
Oct-28-2012	6.7
Oct-29-2012	5.4
Oct-30-2012	5.2
Oct-31-2012	5.6
Nov-01-2012	6.7
Nov-02-2012	6
Nov-03-2012	5.2
Nov-04-2012	5
Nov-05-2012	5.4
Nov-06-2012	6.2
Nov-07-2012	6.9
Nov-08-2012	7
Nov-09-2012	6.3
Nov-10-2012	6
Nov-11-2012	5.8
Nov-12-2012	4.4
Nov-13-2012	3.8
Nov-14-2012	6.3
Nov-15-2012	6.1
Nov-16-2012	6.4
Nov-17-2012	6.6
Nov-18-2012	5.7
Nov-19-2012	5.9
Nov-20-2012	6
Nov-21-2012	5.9
Nov-22-2012	5.9
Nov-23-2012	6.7
Nov-24-2012	7
Nov-25-2012	9.6
Nov-26-2012	9.2
Nov-27-2012	8.2
Nov-28-2012	8.2
Nov-29-2012	7.9
Nov-30-2012	7.2

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Dec-01-2012	6.8
Dec-02-2012	6.6
Dec-03-2012	5.6
Dec-04-2012	5.9
Dec-05-2012	8.6
Dec-06-2012	8.5
Dec-07-2012	8.7
Dec-08-2012	9.6
Dec-09-2012	9.5
Dec-10-2012	9.2
Dec-11-2012	9.2
Dec-12-2012	8.3
Dec-13-2012	8.1
Dec-14-2012	8.2
Dec-15-2012	8.2
Dec-16-2012	8.4
Dec-17-2012	7.7
Dec-18-2012	7.1
Dec-19-2012	7.7
Dec-20-2012	7.1
Dec-21-2012	7.2
Dec-22-2012	7.1
Dec-23-2012	7.5
Dec-24-2012	8.3
Dec-25-2012	8.6
Dec-26-2012	7.8
Dec-27-2012	7.8
Dec-28-2012	9
Dec-29-2012	9.2
Dec-30-2012	9.7
Dec-31-2012	9.8
Jan-01-2013	10
Jan-02-2013	9.7
Jan-03-2013	9.1
Jan-04-2013	9.5
Jan-05-2013	10
Jan-06-2013	9
Jan-07-2013	8.3
Jan-08-2013	8.1
Jan-09-2013	10
Jan-10-2013	10
Jan-11-2013	11
Jan-12-2013	9.8
Jan-13-2013	9.8
Jan-14-2013	9.7
Jan-15-2013	9.7
Jan-16-2013	8.6
Jan-17-2013	8.6

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jan-18-2013	
Jan-19-2013	8.1
Jan-20-2013	8.4
Jan-21-2013	8.6
Jan-22-2013	8.2
Jan-23-2013	8.5
Jan-24-2013	7.8
Jan-25-2013	9
Jan-26-2013	7.9
Jan-27-2013	8.6
Jan-28-2013	9
Jan-29-2013	9.3
Jan-30-2013	9.3
Jan-31-2013	9.8
Feb-01-2013	8.7
Feb-02-2013	8.5
Feb-03-2013	8.6
Feb-04-2013	8.9
Feb-05-2013	8.9
Feb-06-2013	8.1
Feb-07-2013	8.2
Feb-08-2013	8.4
Feb-09-2013	9.3
Feb-10-2013	10
Feb-11-2013	9.2
Feb-12-2013	8.6
Feb-13-2013	7.7
Feb-14-2013	8.7
Feb-15-2013	8.4
Feb-16-2013	8.3
Feb-17-2013	9.2
Feb-18-2013	9.5
Feb-19-2013	8.7
Feb-20-2013	8.3
Feb-21-2013	8.8
Feb-22-2013	8
Feb-23-2013	7.7
Feb-24-2013	7.7
Feb-25-2013	8.6
Feb-26-2013	9.2
Feb-27-2013	8.8
Feb-28-2013	9.2
Mar-01-2013	8.4
Mar-02-2013	10
Mar-03-2013	10
Mar-04-2013	8.1
Mar-05-2013	8.1
Mar-06-2013	8

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Mar-07-2013	8.2
Mar-08-2013	8.4
Mar-09-2013	9
Mar-10-2013	9.3
Mar-11-2013	8.4
Mar-12-2013	8.7
Mar-13-2013	8.4
Mar-14-2013	9.2
Mar-15-2013	10
Mar-16-2013	10
Mar-17-2013	9.2
Mar-18-2013	8.6
Mar-19-2013	9.2
Mar-20-2013	11
Mar-21-2013	9.8
Mar-22-2013	9.5
Mar-23-2013	9.8
Mar-24-2013	10
Mar-25-2013	10
Mar-26-2013	10
Mar-27-2013	9.6
Mar-28-2013	9.6
Mar-29-2013	8.4
Mar-30-2013	8.6
Mar-31-2013	9.3
Apr-01-2013	9.4
Apr-02-2013	9.9
Apr-03-2013	9.6
Apr-04-2013	9.8
Apr-05-2013	11
Apr-06-2013	12
Apr-07-2013	12
Apr-08-2013	12
Apr-09-2013	12
Apr-10-2013	11
Apr-11-2013	12
Apr-12-2013	14
Apr-13-2013	13
Apr-14-2013	13
Apr-15-2013	13
Apr-16-2013	12
Apr-17-2013	14
Apr-18-2013	12
Apr-19-2013	11
Apr-20-2013	12
Apr-21-2013	11
Apr-22-2013	12
Apr-23-2013	12

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Apr-24-2013	12
Apr-25-2013	12
Apr-26-2013	11
Apr-27-2013	10
Apr-28-2013	9.5
Apr-29-2013	9.9
Apr-30-2013	10
May-01-2013	9.7
May-02-2013	9.8
May-03-2013	9.7
May-04-2013	9.9
May-05-2013	9.8
May-06-2013	10.0
May-07-2013	12.0
May-08-2013	12.0
May-09-2013	11.0
May-10-2013	11
May-11-2013	11
May-12-2013	11
May-13-2013	13
May-14-2013	12
May-15-2013	11
May-16-2013	9.8
May-17-2013	10
May-18-2013	12
May-19-2013	9.4
May-20-2013	9.2
May-21-2013	9.4
May-22-2013	8.2
May-23-2013	7.7
May-24-2013	9.6
May-25-2013	8.4
May-26-2013	8
May-27-2013	8.1
May-28-2013	8.9
May-29-2013	10
May-30-2013	9.8
May-31-2013	11
Jun-01-2013	11
Jun-02-2013	10
Jun-03-2013	11
Jun-04-2013	11
Jun-05-2013	11
Jun-06-2013	11
Jun-07-2013	12
Jun-08-2013	12
Jun-09-2013	12
Jun-10-2013	12

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jun-11-2013	12
Jun-12-2013	10
Jun-13-2013	11
Jun-14-2013	12
Jun-15-2013	13
Jun-16-2013	12
Jun-17-2013	13
Jun-18-2013	13
Jun-19-2013	14
Jun-20-2013	14
Jun-21-2013	14
Jun-22-2013	12
Jun-23-2013	12
Jun-24-2013	12
Jun-25-2013	13
Jun-26-2013	13
Jun-27-2013	13
Jun-28-2013	14
Jun-29-2013	14
Jun-30-2013	14
Jul-01-2013	14.0
Jul-02-2013	14.0
Jul-03-2013	14.0
Jul-04-2013	15.0
Jul-05-2013	16.0
Jul-06-2013	15.0
Jul-07-2013	16.0
Jul-08-2013	16.0
Jul-09-2013	17.0
Jul-10-2013	16.0
Jul-11-2013	15.0
Jul-12-2013	15.0
Jul-13-2013	15.0
Jul-14-2013	13.0
Jul-15-2013	13.0
Jul-16-2013	13.0
Jul-17-2013	13.0
Jul-18-2013	16.0
Jul-19-2013	19.0
Jul-20-2013	20.0
Jul-21-2013	21.0
Jul-22-2013	23.0
Jul-23-2013	24.0
Jul-24-2013	25.0
Jul-25-2013	22.0
Jul-26-2013	18.0
Jul-27-2013	16.0
Jul-28-2013	15.0

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jul-29-2013	15.0
Jul-30-2013	16.0
Jul-31-2013	15.0
Aug-01-2013	16.0
Aug-02-2013	19.0
Aug-03-2013	19.0
Aug-04-2013	19.0
Aug-05-2013	19.0
Aug-06-2013	18.0
Aug-07-2013	20.0
Aug-08-2013	18.0
Aug-09-2013	22.0
Aug-10-2013	22.0
Aug-11-2013	24.0
Aug-12-2013	24.0
Aug-13-2013	22.0
Aug-14-2013	22.0
Aug-15-2013	21.0
Aug-16-2013	19.0
Aug-17-2013	20.0
Aug-18-2013	21.0
Aug-19-2013	21.0
Aug-20-2013	23.0
Aug-21-2013	18.0
Aug-22-2013	18.0
Aug-23-2013	18.0
Aug-24-2013	17.0
Aug-25-2013	17.0
Aug-26-2013	19.0
Aug-27-2013	18.0
Aug-28-2013	19.0
Aug-29-2013	18.0
Aug-30-2013	20.0
Aug-31-2013	19.0
Sep-01-2013	20.0
Sep-02-2013	22.0
Sep-03-2013	20.0
Sep-04-2013	18.0
Sep-05-2013	18.0
Sep-06-2013	21.0
Sep-07-2013	20.0
Sep-08-2013	21.0
Sep-09-2013	25.0
Sep-10-2013	27.0
Sep-11-2013	22.0
Sep-12-2013	21.0
Sep-13-2013	19.0
Sep-14-2013	19.0

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Sep-15-2013	21.0
Sep-16-2013	22.0
Sep-17-2013	22.0
Sep-18-2013	23.0
Sep-19-2013	24.0
Sep-20-2013	21.0
Sep-21-2013	22.0
Sep-22-2013	20.0
Sep-23-2013	19.0
Sep-24-2013	20.0
Sep-25-2013	19.0
Sep-26-2013	19.0
Sep-27-2013	21.0
Sep-28-2013	20.0
Sep-29-2013	19.0
Sep-30-2013	18.0
Oct-01-2013	17
Oct-02-2013	17
Oct-03-2013	16
Oct-04-2013	18
Oct-05-2013	17
Oct-06-2013	19
Oct-07-2013	18
Oct-08-2013	18
Oct-09-2013	17
Oct-10-2013	18
Oct-11-2013	
Oct-12-2013	
Oct-13-2013	
Oct-14-2013	
Oct-15-2013	
Oct-16-2013	
Oct-17-2013	
Oct-18-2013	
Oct-19-2013	
Oct-20-2013	
Oct-21-2013	
Oct-22-2013	
Oct-23-2013	
Oct-24-2013	13
Oct-25-2013	12
Oct-26-2013	13
Oct-27-2013	13
Oct-28-2013	13
Oct-29-2013	15
Oct-30-2013	14
Oct-31-2013	13
Nov-01-2013	14

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Nov-02-2013	13
Nov-03-2013	11
Nov-04-2013	12
Nov-05-2013	12
Nov-06-2013	10
Nov-07-2013	12
Nov-08-2013	14
Nov-09-2013	13
Nov-10-2013	13
Nov-11-2013	11
Nov-12-2013	10
Nov-13-2013	11
Nov-14-2013	10
Nov-15-2013	10
Nov-16-2013	10
Nov-17-2013	10
Nov-18-2013	11
Nov-19-2013	11
Nov-20-2013	11
Nov-21-2013	10
Nov-22-2013	11
Nov-23-2013	11
Nov-24-2013	10
Nov-25-2013	10
Nov-26-2013	10
Nov-27-2013	10
Nov-28-2013	12
Nov-29-2013	11
Nov-30-2013	10
Dec-01-2013	10
Dec-02-2013	9
Dec-03-2013	9
Dec-04-2013	10
Dec-05-2013	12
Dec-06-2013	11
Dec-07-2013	11
Dec-08-2013	11
Dec-09-2013	
Dec-10-2013	
Dec-11-2013	14
Dec-12-2013	13
Dec-13-2013	13
Dec-14-2013	13
Dec-15-2013	14
Dec-16-2013	11
Dec-17-2013	10
Dec-18-2013	10
Dec-19-2013	9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Dec-20-2013	9
Dec-21-2013	11
Dec-22-2013	11
Dec-23-2013	11
Dec-24-2013	11
Dec-25-2013	12
Dec-26-2013	12
Dec-27-2013	12
Dec-28-2013	12
Dec-29-2013	11
Dec-30-2013	11
Dec-31-2013	10
Jan-01-2014	9
Jan-02-2014	10
Jan-03-2014	9
Jan-04-2014	9
Jan-05-2014	9
Jan-06-2014	9
Jan-07-2014	10
Jan-08-2014	10
Jan-09-2014	9
Jan-10-2014	9
Jan-11-2014	9
Jan-12-2014	9
Jan-13-2014	9
Jan-14-2014	9
Jan-15-2014	11
Jan-16-2014	10
Jan-17-2014	9
Jan-18-2014	10
Jan-19-2014	10
Jan-20-2014	10
Jan-21-2014	10
Jan-22-2014	9
Jan-23-2014	11
Jan-24-2014	12
Jan-25-2014	14
Jan-26-2014	14
Jan-27-2014	13
Jan-28-2014	12
Jan-29-2014	12
Jan-30-2014	10
Jan-31-2014	12
Feb-01-2014	12
Feb-02-2014	12
Feb-03-2014	12
Feb-04-2014	12
Feb-05-2014	12

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Feb-06-2014	13
Feb-07-2014	13
Feb-08-2014	11
Feb-09-2014	13
Feb-10-2014	13
Feb-11-2014	13
Feb-12-2014	12
Feb-13-2014	13
Feb-14-2014	13
Feb-15-2014	14
Feb-16-2014	14
Feb-17-2014	15
Feb-18-2014	14
Feb-19-2014	14
Feb-20-2014	14
Feb-21-2014	13
Feb-22-2014	12
Feb-23-2014	12
Feb-24-2014	12
Feb-25-2014	12
Feb-26-2014	11
Feb-27-2014	10
Feb-28-2014	12
Mar-01-2014	14
Mar-02-2014	12
Mar-03-2014	12
Mar-04-2014	12
Mar-05-2014	12
Mar-06-2014	12
Mar-07-2014	12
Mar-08-2014	12
Mar-09-2014	12
Mar-10-2014	11
Mar-11-2014	11
Mar-12-2014	12
Mar-13-2014	12
Mar-14-2014	12
Mar-15-2014	12
Mar-16-2014	13
Mar-17-2014	14
Mar-18-2014	14
Mar-19-2014	14
Mar-20-2014	13
Mar-21-2014	13
Mar-22-2014	12
Mar-23-2014	12
Mar-24-2014	12
Mar-25-2014	12

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Mar-26-2014	12
Mar-27-2014	12
Mar-28-2014	11
Mar-29-2014	11
Mar-30-2014	10
Mar-31-2014	11
Apr-01-2014	12
Apr-02-2014	12
Apr-03-2014	13
Apr-04-2014	13
Apr-05-2014	12
Apr-06-2014	12
Apr-07-2014	12
Apr-08-2014	12
Apr-09-2014	11
Apr-10-2014	11
Apr-11-2014	12
Apr-12-2014	11
Apr-13-2014	11
Apr-14-2014	12
Apr-15-2014	12
Apr-16-2014	13
Apr-17-2014	13
Apr-18-2014	13
Apr-19-2014	12
Apr-20-2014	12
Apr-21-2014	12
Apr-22-2014	13
Apr-23-2014	12
Apr-24-2014	13
Apr-25-2014	14
Apr-26-2014	16
Apr-27-2014	17
Apr-28-2014	19
Apr-29-2014	17
Apr-30-2014	17
May-01-2014	
May-02-2014	
May-03-2014	
May-04-2014	
May-05-2014	
May-06-2014	
May-07-2014	10
May-08-2014	11
May-09-2014	11
May-10-2014	11
May-11-2014	12
May-12-2014	12

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
May-13-2014	12
May-14-2014	12
May-15-2014	12
May-16-2014	12
May-17-2014	12
May-18-2014	12
May-19-2014	12
May-20-2014	12
May-21-2014	12
May-22-2014	13
May-23-2014	13
May-24-2014	14
May-25-2014	15
May-26-2014	15
May-27-2014	14
May-28-2014	14
May-29-2014	15
May-30-2014	15
May-31-2014	17
Jun-01-2014	16
Jun-02-2014	16
Jun-03-2014	16
Jun-04-2014	16
Jun-05-2014	17
Jun-06-2014	16
Jun-07-2014	16
Jun-08-2014	16
Jun-09-2014	16
Jun-10-2014	15
Jun-11-2014	15
Jun-12-2014	14
Jun-13-2014	15
Jun-14-2014	15
Jun-15-2014	13
Jun-16-2014	13
Jun-17-2014	13
Jun-18-2014	14
Jun-19-2014	13
Jun-20-2014	17
Jun-21-2014	18
Jun-22-2014	14
Jun-23-2014	12
Jun-24-2014	12
Jun-25-2014	11
Jun-26-2014	10
Jun-27-2014	11
Jun-28-2014	13
Jun-29-2014	17

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jun-30-2014	17
Jul-01-2014	
Jul-02-2014	
Jul-03-2014	
Jul-04-2014	
Jul-05-2014	
Jul-06-2014	
Jul-07-2014	
Jul-08-2014	
Jul-09-2014	
Jul-10-2014	
Jul-11-2014	
Jul-12-2014	
Jul-13-2014	
Jul-14-2014	
Jul-15-2014	
Jul-16-2014	
Jul-17-2014	
Jul-18-2014	
Jul-19-2014	22
Jul-20-2014	22
Jul-21-2014	21
Jul-22-2014	21
Jul-23-2014	20
Jul-24-2014	18
Jul-25-2014	16
Jul-26-2014	14
Jul-27-2014	16
Jul-28-2014	18
Jul-29-2014	19
Jul-30-2014	20
Jul-31-2014	21
Aug-01-2014	20
Aug-02-2014	21
Aug-03-2014	22
Aug-04-2014	22
Aug-05-2014	21
Aug-06-2014	21
Aug-07-2014	22
Aug-08-2014	27
Aug-09-2014	28
Aug-10-2014	27
Aug-11-2014	26
Aug-12-2014	27
Aug-13-2014	26
Aug-14-2014	28
Aug-15-2014	27
Aug-16-2014	27

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Aug-17-2014	28
Aug-18-2014	29
Aug-19-2014	28
Aug-20-2014	29
Aug-21-2014	29
Aug-22-2014	25
Aug-23-2014	26
Aug-24-2014	26
Aug-25-2014	25
Aug-26-2014	25
Aug-27-2014	25
Aug-28-2014	26
Aug-29-2014	27
Aug-30-2014	26
Aug-31-2014	26
Sep-01-2014	28
Sep-02-2014	28
Sep-03-2014	28
Sep-04-2014	28
Sep-05-2014	30
Sep-06-2014	30
Sep-07-2014	29
Sep-08-2014	31
Sep-09-2014	32
Sep-10-2014	29
Sep-11-2014	30
Sep-12-2014	29
Sep-13-2014	29
Sep-14-2014	29
Sep-15-2014	30
Sep-16-2014	31
Sep-17-2014	30
Sep-18-2014	32
Sep-19-2014	29
Sep-20-2014	29
Sep-21-2014	28
Sep-22-2014	28
Sep-23-2014	29
Sep-24-2014	30
Sep-25-2014	29
Sep-26-2014	30
Sep-27-2014	28
Sep-28-2014	28
Sep-29-2014	30
Sep-30-2014	27
Oct-01-2014	27
Oct-02-2014	33
Oct-03-2014	31

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Oct-04-2014	30
Oct-05-2014	31
Oct-06-2014	32
Oct-07-2014	31
Oct-08-2014	29
Oct-09-2014	31
Oct-10-2014	31
Oct-11-2014	33
Oct-12-2014	30
Oct-13-2014	32
Oct-14-2014	31
Oct-15-2014	32
Oct-16-2014	32
Oct-17-2014	32
Oct-18-2014	36
Oct-19-2014	34
Oct-20-2014	33
Oct-21-2014	34
Oct-22-2014	30
Oct-23-2014	30
Oct-24-2014	28
Oct-25-2014	31
Oct-26-2014	28
Oct-27-2014	26
Oct-28-2014	28
Oct-29-2014	26
Oct-30-2014	27
Oct-31-2014	25
Nov-01-2014	24
Nov-02-2014	18
Nov-03-2014	12
Nov-04-2014	18
Nov-05-2014	16
Nov-06-2014	15
Nov-07-2014	16
Nov-08-2014	23
Nov-09-2014	25
Nov-10-2014	26
Nov-11-2014	27
Nov-12-2014	26
Nov-13-2014	28
Nov-14-2014	27
Nov-15-2014	30
Nov-16-2014	26
Nov-17-2014	28
Nov-18-2014	27
Nov-19-2014	27
Nov-20-2014	24

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Nov-21-2014	28
Nov-22-2014	
Nov-23-2014	
Nov-24-2014	
Nov-25-2014	
Nov-26-2014	
Nov-27-2014	
Nov-28-2014	
Nov-29-2014	
Nov-30-2014	
Dec-01-2014	
Dec-02-2014	11
Dec-03-2014	12
Dec-04-2014	15
Dec-05-2014	15
Dec-06-2014	16
Dec-07-2014	17
Dec-08-2014	17
Dec-09-2014	17
Dec-10-2014	18
Dec-11-2014	18
Dec-12-2014	15
Dec-13-2014	14
Dec-14-2014	12
Dec-15-2014	10
Dec-16-2014	12
Dec-17-2014	14
Dec-18-2014	13
Dec-19-2014	13
Dec-20-2014	14
Dec-21-2014	13
Dec-22-2014	13
Dec-23-2014	13
Dec-24-2014	15
Dec-25-2014	14
Dec-26-2014	13
Dec-27-2014	14
Dec-28-2014	13
Dec-29-2014	14
Dec-30-2014	14
Dec-31-2014	14
Jan-01-2015	13
Jan-02-2015	12
Jan-03-2015	14
Jan-04-2015	13
Jan-05-2015	12
Jan-06-2015	10
Jan-07-2015	9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jan-08-2015	9
Jan-09-2015	10
Jan-10-2015	10
Jan-11-2015	10
Jan-12-2015	11
Jan-13-2015	12
Jan-14-2015	10
Jan-15-2015	10
Jan-16-2015	8
Jan-17-2015	10
Jan-18-2015	8
Jan-19-2015	8
Jan-20-2015	11
Jan-21-2015	16
Jan-22-2015	17
Jan-23-2015	17
Jan-24-2015	16
Jan-25-2015	14
Jan-26-2015	14
Jan-27-2015	14
Jan-28-2015	16
Jan-29-2015	20
Jan-30-2015	21
Jan-31-2015	19
Feb-01-2015	16
Feb-02-2015	17
Feb-03-2015	17
Feb-04-2015	16
Feb-05-2015	16
Feb-06-2015	14
Feb-07-2015	13
Feb-08-2015	16
Feb-09-2015	16
Feb-10-2015	14
Feb-11-2015	14
Feb-12-2015	15
Feb-13-2015	15
Feb-14-2015	15
Feb-15-2015	14
Feb-16-2015	13
Feb-17-2015	13
Feb-18-2015	12
Feb-19-2015	10
Feb-20-2015	10
Feb-21-2015	9
Feb-22-2015	10
Feb-23-2015	10
Feb-24-2015	9

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Feb-25-2015	7
Feb-26-2015	8
Feb-27-2015	16
Feb-28-2015	15
Mar-01-2015	12
Mar-02-2015	12
Mar-03-2015	12
Mar-04-2015	13
Mar-05-2015	12
Mar-06-2015	11
Mar-07-2015	15
Mar-08-2015	15
Mar-09-2015	14
Mar-10-2015	14
Mar-11-2015	13
Mar-12-2015	13
Mar-13-2015	14
Mar-14-2015	13
Mar-15-2015	12
Mar-16-2015	11
Mar-17-2015	11
Mar-18-2015	10
Mar-19-2015	
Mar-20-2015	11
Mar-21-2015	12
Mar-22-2015	13
Mar-23-2015	17
Mar-24-2015	15
Mar-25-2015	14
Mar-26-2015	13
Mar-27-2015	13
Mar-28-2015	13
Mar-29-2015	13
Mar-30-2015	14
Mar-31-2015	13
Apr-01-2015	14
Apr-02-2015	13
Apr-03-2015	14
Apr-04-2015	13
Apr-05-2015	14
Apr-06-2015	14
Apr-07-2015	13
Apr-08-2015	13
Apr-09-2015	14
Apr-10-2015	14
Apr-11-2015	13
Apr-12-2015	13
Apr-13-2015	11

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Apr-14-2015	10
Apr-15-2015	9
Apr-16-2015	11
Apr-17-2015	13
Apr-18-2015	14
Apr-19-2015	14
Apr-20-2015	14
Apr-21-2015	13
Apr-22-2015	14
Apr-23-2015	15
Apr-24-2015	15
Apr-25-2015	15
Apr-26-2015	14
Apr-27-2015	15
Apr-28-2015	14
Apr-29-2015	15
Apr-30-2015	14
May-01-2015	15
May-02-2015	14
May-03-2015	15
May-04-2015	16
May-05-2015	16
May-06-2015	16
May-07-2015	16
May-08-2015	17
May-09-2015	17
May-10-2015	16
May-11-2015	16
May-12-2015	17
May-13-2015	18
May-14-2015	17
May-15-2015	18
May-16-2015	19
May-17-2015	18
May-18-2015	17
May-19-2015	17
May-20-2015	18
May-21-2015	19
May-22-2015	19
May-23-2015	19
May-24-2015	18
May-25-2015	19
May-26-2015	19
May-27-2015	19
May-28-2015	19
May-29-2015	19
May-30-2015	19
May-31-2015	19

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jun-01-2015	19
Jun-02-2015	20
Jun-03-2015	19
Jun-04-2015	20
Jun-05-2015	16
Jun-06-2015	16
Jun-07-2015	17
Jun-08-2015	
Jun-09-2015	
Jun-10-2015	
Jun-11-2015	
Jun-12-2015	
Jun-13-2015	
Jun-14-2015	
Jun-15-2015	
Jun-16-2015	
Jun-17-2015	
Jun-18-2015	
Jun-19-2015	
Jun-20-2015	19
Jun-21-2015	20
Jun-22-2015	20
Jun-23-2015	18
Jun-24-2015	19
Jun-25-2015	
Jun-26-2015	
Jun-27-2015	
Jun-28-2015	
Jun-29-2015	
Jun-30-2015	
Jul-01-2015	26
Jul-02-2015	26
Jul-03-2015	27
Jul-04-2015	27
Jul-05-2015	27
Jul-06-2015	28
Jul-07-2015	30
Jul-08-2015	
Jul-09-2015	
Jul-10-2015	
Jul-11-2015	
Jul-12-2015	
Jul-13-2015	
Jul-14-2015	
Jul-15-2015	
Jul-16-2015	
Jul-17-2015	
Jul-18-2015	

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Jul-19-2015	
Jul-20-2015	
Jul-21-2015	
Jul-22-2015	
Jul-23-2015	
Jul-24-2015	
Jul-25-2015	
Jul-26-2015	
Jul-27-2015	
Jul-28-2015	
Jul-29-2015	
Jul-30-2015	
Jul-31-2015	
Aug-01-2015	
Aug-02-2015	
Aug-03-2015	
Aug-04-2015	
Aug-05-2015	
Aug-06-2015	
Aug-07-2015	
Aug-08-2015	
Aug-09-2015	
Aug-10-2015	
Aug-11-2015	
Aug-12-2015	
Aug-13-2015	
Aug-14-2015	
Aug-15-2015	
Aug-16-2015	
Aug-17-2015	
Aug-18-2015	
Aug-19-2015	
Aug-20-2015	
Aug-21-2015	
Aug-22-2015	
Aug-23-2015	
Aug-24-2015	
Aug-25-2015	
Aug-26-2015	
Aug-27-2015	
Aug-28-2015	
Aug-29-2015	
Aug-30-2015	
Aug-31-2015	
Sep-01-2015	
Sep-02-2015	
Sep-03-2015	
Sep-04-2015	

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Sep-05-2015	
Sep-06-2015	
Sep-07-2015	
Sep-08-2015	
Sep-09-2015	
Sep-10-2015	
Sep-11-2015	
Sep-12-2015	
Sep-13-2015	
Sep-14-2015	
Sep-15-2015	
Sep-16-2015	
Sep-17-2015	
Sep-18-2015	
Sep-19-2015	
Sep-20-2015	
Sep-21-2015	
Sep-22-2015	
Sep-23-2015	
Sep-24-2015	
Sep-25-2015	
Sep-26-2015	
Sep-27-2015	
Sep-28-2015	
Sep-29-2015	
Sep-30-2015	
Oct-01-2015	
Oct-02-2015	
Oct-03-2015	
Oct-04-2015	
Oct-05-2015	
Oct-06-2015	
Oct-07-2015	
Oct-08-2015	
Oct-09-2015	
Oct-10-2015	
Oct-11-2015	
Oct-12-2015	
Oct-13-2015	
Oct-14-2015	
Oct-15-2015	
Oct-16-2015	
Oct-17-2015	
Oct-18-2015	
Oct-19-2015	
Oct-20-2015	
Oct-21-2015	
Oct-22-2015	

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Oct-23-2015	
Oct-24-2015	
Oct-25-2015	
Oct-26-2015	
Oct-27-2015	
Oct-28-2015	
Oct-29-2015	
Oct-30-2015	
Oct-31-2015	
Nov-01-2015	
Nov-02-2015	
Nov-03-2015	
Nov-04-2015	
Nov-05-2015	
Nov-06-2015	
Nov-07-2015	
Nov-08-2015	
Nov-09-2015	
Nov-10-2015	
Nov-11-2015	
Nov-12-2015	
Nov-13-2015	
Nov-14-2015	
Nov-15-2015	
Nov-16-2015	
Nov-17-2015	
Nov-18-2015	8
Nov-19-2015	9
Nov-20-2015	9
Nov-21-2015	8
Nov-22-2015	8
Nov-23-2015	8
Nov-24-2015	8
Nov-25-2015	8
Nov-26-2015	9
Nov-27-2015	8
Nov-28-2015	13
Nov-29-2015	12
Nov-30-2015	12
Dec-01-2015	12
Dec-02-2015	13
Dec-03-2015	13
Dec-04-2015	12
Dec-05-2015	13
Dec-06-2015	13
Dec-07-2015	13
Dec-08-2015	13
Dec-09-2015	11

Attachment A, Table 4. San Luis Drain Daily Boron Data for Figure C-8 (mg/L)

Date	Boron
Dec-10-2015	10
Dec-11-2015	10
Dec-12-2015	9
Dec-13-2015	6
Dec-14-2015	14
Dec-15-2015	15
Dec-16-2015	15
Dec-17-2015	16
Dec-18-2015	14
Dec-19-2015	14
Dec-20-2015	14
Dec-21-2015	14
Dec-22-2015	14
Dec-23-2015	14
Dec-24-2015	14
Dec-25-2015	14
Dec-26-2015	14
Dec-27-2015	13
Dec-28-2015	14
Dec-29-2015	14
Dec-30-2015	13
Dec-31-2015	13

APPENDIX D
COSTS FOR PLANNED BUNDLE

Supplemental Information Related to Cost Estimates for Specific Implementation Actions Included in the Preferred Alternative (Planned Bundle) –

This appendix is an excerpt from Attachment A of the *Development of a Basin Plan Amendment for Salt and Boron in the Lower San Joaquin River (LSJR): Task 5 – Economic Analysis* Report by Larry Walker Associates (LWA) Team (October 5, 2015)

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Table D-1. Estimated Annual Cost of Monitoring and Surveillance Program for Lower San Joaquin River Reach 83 Related to Compliance Assessment for Proposed Electrical Conductivity Water Quality Objective and Performance Goal

Task	Labor	Direct	Laboratory	Total	Notes
Preparation & Installation	$ 9,840	$ 32,000	$ 200	$ 42,040	Purchase of two sensors with telemetry
Monthly Maintenance & Sample Collection	$ 23,520	$ 1,800	$ 2,250	$ 27,570	Boron sample collection and sensor calibration
Data Review and Compilation	$ 29,520	$ 100	$ -	$ 29,620	
Annual Report	$ 12,000	$ 100	$ -	$ 12,100	
TOTAL	$ 74,880	$ 34,000	$ 2,450	**$ 111,330**	

Labor rate assumptions: Field Engineer @ $150/hr Field Technician @ $100/hr Monitoring Manager @ $180/hr

Cost estimate developed by Brian Laurenson, P.E., Larry Walker Associates, July 13, 2015.

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Table D-2. Nitrogen Application Rate for Sub Areas Used in WARMF Baseline Modeling

Fertilizer Category	lb/day	10% Reduction (lb/day)	Annual Reduction (Tons)/year
Ammonia as N	494,640	49,464	9,027
Nitrate as N	23,767	2,377	434
Total	518,407	51,841	9,461

Fertilizer Formulation	Ammonia	Nitrate	Urea	Cost/Ton	Nitrogen Compound	Local Use	Cost Portio
	%	%		$	$/Ton	%	$/ton
Anhydrous	82			750	915	10	91
UN32	7.6	7.6	16.8	500	1,563	85	1,328
Am-Nitrate 34-0-0	17	17		550	1,618	5	81
							1,500

Cost Reduction Estimate

Fertilizer Category	$/year
Ammonia as N	13,545,020
Nitrate as N	650,826
Total	14,195,846

Annual cost savings as presented in Table 4 of Task 5 Memo ($14,200,000)

Cost estimate developed by Mark J. Roberson, PhD, CPSS, Senior Soil & Water Scientist, Formation Environmental, August 26, 2015.

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Assumptions used in the estimation of costs to install and operate drip/microspray irrigation in portions of select subareas currently not irrigated by this method (cotton NOT included)

Total Acreage with Drip Potential

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Acreage			
Almonds & Pistachios		3	0	0	3
Cotton		0	0	0	0
Cucurbits		16	0	0	16
Orchard (Other Deciduous)		22,172	32,492	73,496	128,160
Olives, citrus, and subtropicals (Subtropical Trees)		306	436	2	744
Vineyard		1,142	1,086	5,868	8,096
Total		23,639	34,014	79,366	137,019

Existing Drip/micro

	Portion Drip/Micr	Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro	%	Acreage			
Almonds & Pistachios	62%	2	0	0	2
Cotton	0%	0	0	0	0
Cucurbits	25%	4	0	0	4
Orchard (Other Deciduous)	38%	8,513	12,475	28,218	49,206
Olives, citrus, and subtropicals (Subtropical Trees)	3%	10	14	0	25
Vineyard	95%	1,086	1,032	5,577	7,695
Total		9,614	13,522	33,796	56,932

2014 DWR Prop 84 acres (proportional to existing)

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Acreage			
Almonds & Pistachios		0	0	0	0
Cotton		0	0	0	0
Cucurbits		0	0	0	0
Orchard (Other Deciduous)		791	1,159	2,621	3,953
Olives, citrus, and subtropicals (Subtropical Trees)		1	1	0	2
Vineyard		Prop 84 not applied tovineyard			
Total		792	1,160	2,621	4,574

Existing Plus DWR Prop 84 acres

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Acreage			
Almonds & Pistachios		2	0	0	2
Cotton		0	0	0	0
Cucurbits		4	0	0	4
Orchard (Other Deciduous)		9,304	13,634	30,840	53,778
Olives, citrus, and subtropicals (Subtropical Trees)		11	16	0	27
Vineyard		1,086	1,032	5,577	7,695
Total		10,407	14,682	36,417	61,506

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Assumptions used in the estimation of costs to install and operate drip/microspray irrigation in portions of select subareas currently not irrigated by this method (cotton NOT included)

Additional Potential Acreage (assumes all acreage goes to 100%)

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Acreage			
Almonds & Pistachios		1	0	0	1
Cotton		0	0	0	0
Cucurbits		12	0	0	12
Orchard (Other Deciduous)		12,868	18,858	42,656	74,382
Olives, citrus, and subtropicals (Subtropical Trees)		295	420	2	717
Vineyard		57	54	290	401
Total		13,233	19,332	42,949	75,513

Capital Cost (Based on Prop 84 capital, over seven-year life)	355	$/acre/year
O&M Cost (Irrigated Lands Regulatory Program PEIS)	128	$/acre/year
Total Annual Cost/Acre	483	$/acre/year

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Cost/Year			
Almonds & Pistachios		$ 439	$ -	$ -	$ 439
Cotton		$ -	$ -	$ -	$ -
Cucurbits		$ 5,685	$ -	$ -	$ 5,685
Orchard (Other Deciduous)		$ 6,213,833	$ 9,106,019	$ 20,597,583	$ 35,917,436
Olives, citrus, and subtropicals (Subtropical Trees)		$ 142,414	$ 202,759	$ 1,041	$ 346,213
Vineyard		$ 27,296	$ 25,953	$ 140,235	$ 193,485
Total		$ 6,389,667	$ 9,334,731	$ 20,738,860	$ 36,463,258

Annual O&M cost as presented in Table 4 of Task 5 Memo	$ 9,600,000
Capital cost as presented in Table 4 of Task 5 Memo	$ 26,800,000

Cost estimate developed by Mark J. Roberson, PhD, CPSS, Senior Soil & Water Scientist, Formation Environmental, August 26, 2015.

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Assumptions used in the estimation of costs to install and operate drip/microspray irrigation in portions of select subareas currently not irrigated by this method (cotton included)

Total Acreage with Drip Potential

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Acreage			
Almonds & Pistachios		3	0	0	3
Cotton		92,562	16	0	92,578
Cucurbits		16	0	0	16
Orchard (Other Deciduous)		22,172	32,492	73,496	128,160
Olives, citrus, and subtropicals (Subtropical Trees)		306	436	2	744
Vineyard		1,142	1,086	5,868	8,096
Total		116,201	34,029	79,366	229,596

Existing Drip/micro

	Portion Drip/Micr	Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro	%	Acreage			
Almonds & Pistachios	62%	2	0	0	2
Cotton	0%	0	0	0	0
Cucurbits	25%	4	0	0	4
Orchard (Other Deciduous)	38%	8,513	12,475	28,218	49,206
Olives, citrus, and subtropicals (Subtropical Trees)	3%	10	14	0	25
Vineyard	95%	1,086	1,032	5,577	7,695
Total		9,614	13,522	33,796	56,932

2014 DWR Prop 84 acres (proportional to existing)

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Acreage			
Almonds & Pistachios		0	0	0	0
Cotton		0	0	0	0
Cucurbits		0	0	0	0
Orchard (Other Deciduous)		791	1,159	2,621	3,953
Olives, citrus, and subtropicals (Subtropical Trees)		1	1	0	2
Vineyard		Prop 84 not applied to vineyard			
Total		792	1,160	2,621	4,574

Existing Plus DWR Prop 84 acres

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Acreage			
Almonds & Pistachios		2	0	0	2
Cotton		0	0	0	0
Cucurbits		4	0	0	4
Orchard (Other Deciduous)		9,304	13,634	30,840	53,778
Olives, citrus, and subtropicals (Subtropical Trees)		11	16	0	27
Vineyard		1,086	1,032	5,577	7,695
Total		10,407	14,682	36,417	61,506

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Assumptions used in the estimation of costs to install and operate drip/microspray irrigation in portions of select subareas currently not irrigated by this method (cotton included)

Additional Potential Acreage (assumes all acreage goes to 100%)

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Acreage			
Almonds & Pistachios		1	0	0	1
Cotton		92,562	16	0	92,578
Cucurbits		12	0	0	12
Orchard (Other Deciduous)		12,868	18,858	42,656	74,382
Olives, citrus, and subtropicals (Subtropical Trees)		295	420	2	717
Vineyard		57	54	290	401
Total		105,795	19,347	42,949	168,090

Capital Cost (Based on Prop 84 capital, over seven-year life)	355 $/acre/year
O&M Cost (Irrigated Lands Regulatory Program PEIS)	128 $/acre/year
Total Annual Cost/Acre	483 $/acre/year

		Grasslands	Northwest	East Valley Floor	Total
Crop categories amenable to drip/micro		Cost/Year			
Almonds & Pistachios		$ 439	$ -	$ -	$ 439
Cotton		$ 44,695,948	$ 7,571	$ -	$ 44,703,519
Cucurbits		$ 5,685	$ -	$ -	$ 5,685
Orchard (Other Deciduous)		$ 6,213,833	$ 9,106,019	$ 20,597,583	$ 35,917,436
Olives, citrus, and subtropicals (Subtropical Trees)		$ 142,414	$ 202,759	$ 1,041	$ 346,213
Vineyard		$ 27,296	$ 25,953	$ 140,235	$ 193,485
Total		$ 51,085,615	$ 9,342,302	$ 20,738,860	$ 81,166,776

Annual O&M cost as presented in Table 4 of Task 5 Memo	$ 21,500,000
Capital cost as presented in Table 4 of Task 5 Memo	$ 59,700,000

Cost estimate developed by Mark J. Roberson, PhD, CPSS, Senior Soil & Water Scientist, Formation Environmental, August 26, 2015.

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Grassland Bypass Project

Project Funding from 1996 to 2015

Project	Funding Program	Funding Source	Grant Funding	Loan Funding	District Funding	Total
Grassland Bypass Construction	SWRCB State Revolving Fund	California		$ 600,000		$ 600,000
Charleston D.D. Recirculation System	SWRCB State Revolving Fund	California		$ 320,000		$ 320,000
Charleston D.D. Recirculation System : CH-3					$ 71,200	$ 71,200
Firebaugh Canal W.D. Recirculation Systems					$ 271,100	$ 271,100
Pacheco W.D. Drainwater Recirculation System	SWRCB State Revolving Fund	California		$ 1,375,000		$ 1,375,000
Panoche W.D. Drainwater Recirculation System	SWRCB State Revolving Fund	California		$ 4,228,000		$ 4,228,000
Panoche D.D. Road Watering Project	Panoche D.D.	District			$ 12,000	$ 12,000
Reuse Land Purchase & Initial Development	Prop 13 (Directed Action)	California	$ 17,500,000			$ 17,500,000
2004-05 Development Project	USBR	Federal	$ 970,000		$ 95,900	$ 1,065,900
GBP Operational Budget (FY 97 - FY 16)	Grassland Area Farmers	District			$ 18,373,156	$ 18,373,156
Halophyte Development Project	USBR	Federal	$ 290,000		$ 15,000	$ 305,000
Grassland Integrated Drainage Management Proj.	Prop 13	California	$ 987,200		$ 246,800	$ 1,234,000
PE-5 Pump Station	Panoche D.D.	District			$ 13,200	$ 13,200
Panoche D.D. SJRIP Reuse Development Project	SWRCB - Prop 50	California	$ 389,500		94,800	$ 484,300
SJRIP Reuse Expansion Project	USBR	Federal	$ 890,000			$ 890,000
USBR 1.65 Appropriations	USBR	Federal	$ 1,650,000			$ 1,650,000
USBR/CalFed Salinity Management Grant (2007/2008)	USBR	Federal	$ 7,000,000			$ 7,000,000
USBR/CalFed Salinity Management Grant (2009)	USBR	Federal	$ 6,384,719			$ 6,384,719
IRWM Grant: Reuse Land Purchase	SWRCB - Prop 50	California	$ 10,915,870			$ 10,915,870
IRWM Grant: Reuse Land Development	SWRCB - Prop 50	California	$ 3,628,000			$ 3,628,000
SJRIP Operations (FY 02 through FY 15)	Grassland Area Farmers	District			$ 6,000,000	$ 6,000,000
USBR SJR Salinity Management Program 2010	USBR	Federal	$ 4,000,000			$ 4,000,000
USBR SJR Salinity Management Program 2011	USBR	Federal	$ 4,245,000			$ 4,245,000
USBR SJR Salinity Management Program 2012	USBR	Federal	$ 4,200,000			$ 4,200,000
USBR SJR Salinity Management Program 2013	USBR	Federal	$ 3,900,000			$ 3,900,000
USBR SJR Salinity Management Program 2014	USBR	Federal	$ 3,800,000			$ 3,800,000
Algal-Bacterial Selenium Reduction Proj. (ABSR)	USBR/DWR/CalFed	Fed/Calif.	$ 3,352,000		$ 225,000	$ 3,577,000
IRWM Grant: Salt Disposal Development	SWRCB - Prop 50	California	$ 4,600,000			$ 4,600,000
Panoche W.D. Ag Drainage Loan Project - Irri. Imprvmnts	SWRCB	California		$ 1,800,000		$ 1,800,000
Pacheco W.D. Acquisition of Improved Irrigation Equipment	SWRCB State Revolving Fund	California		$ 737,500		$ 737,500
Panoche D.D. Acquisition of Improved Irrigation Equipment	SWRCB State Revolving Fund	California		$ 4,997,294		$ 4,997,294
Firebaugh Canal W.D. Irrigation Improvement Funding Prg.	Firebaugh Canal W.D.	District			$ 8,600,000	$ 8,600,000
Firebaugh Canal W.D. Irrigation Improvement Funding Prg.	SWRCB State Revolving Fund	California		$ 1,000,000		$ 1,000,000
IRWM Grant: Ground Water Pumping	SWRCB - Prop 50	California	$ 5,702,000		$ 457,890	$ 6,159,890
Distribution Facilities Improvement Grant	SWRCB - Prop 40/50	California	$ 1,000,000			$ 1,000,000
Firebaugh Canal W.D. Canal Lining Projects	Firebaugh Canal W.D./USBR	Federal/District	$ 300,000		$ 945,000	$ 1,245,000
Firebaugh Canal W.D. Shaw Avenue Pipeline	Firebaugh Canal W.D.	District			$ 205,000	$ 205,000
Total:			**$ 85,704,289**	**$ 15,057,794**	**$ 35,626,046**	**$ 136,388,129**

IRWM: Integrated Regional Water Management Program, California Proposition 50.

Local Funding:	$	35,626,046
State Funding (Grant)	$	46,398,570
State Funding (Loan)	$	15,057,794
Federal Funding (Grant)	$	39,305,719
	$	136,388,129

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APPENDIX E
COSTS FOR DESALINATION

Cost Estimate for Preliminary Conceptual Desalination Project

This appendix is an excerpt prepared by Carollo Engineers (subcontractors) and originally presented as Attachment B of the *Development of a Basin Plan Amendment for Salt and Boron in the Lower San Joaquin River (LSJR): Task 5 – Economic Analysis* Report by Larry Walker Associates (LWA) Team (October 5, 2015)

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1) PURPOSE

The purpose of this document is to:

1. Describe the preliminary concept for a regional desalination facility designed to control salinity inputs to Reach 83 of the Lower San Joaquin River (LSJR) to a level that would support the achievement of a potential salinity water quality objective (WQO) of 1,010 µmhos/cm EC as measured in the LSJR at Crows Landing.
2. Provide a planning level cost estimate for implementing the project.
3. Provide an estimate of the greenhouse gas emissions resulting from the operation of the facility.

The regional desalination facility is identified as potential Implementation Action 5a in Table 1 of the Report entitled "Task No. 4 – Implementation Planning for Proposed Salinity Objectives," (LWA, 2015). In addition, through the work conducted by the LSJR Committee (LSJRC) and its consultants, this potential implementation action was identified as a salinity management alternative ("Planned Plus Maximum Treatment Focus Alternative" - Section 3.3.2, LWA 2015) that was modeled to determine if the diversion and treatment of agricultural drainage flows from upstream of Reach 83, followed by the discharge of treated, low total dissolved solids (TDS) water just downstream of the diversion points, could result in the achievement of a potential salinity WQO of 1,010 µmhos/cm EC as measured in the LSJR at Crows Landing (Section 4.1, LWA, 2015).

The Maximum Treatment Alternative is considered a preliminary conceptual project at this planning level stage of analysis. The desalination facility, which is the major component of the Alternative, would pump all drainage water from three sources, Mud Slough, Salt Slough, and the Gustine Area, at two diversion points to a proposed 160 million gallons per day (mgd) reverse osmosis (RO) treatment facility located in the Grassland Drainage Area, outside of the 100-year floodplain (**see Figure 1).** The two diversion points would be located along Mud Slough and Salt Slough just upstream of the confluence with the LSJR. The project would remove salts from the diverted flows using a RO process, and then pump low TDS water back to Mud Slough and Salt Slough immediately downstream of the initial diversion points. Approximately 20 percent of the flows removed from the three drainage sources would be lost in the concentrated brine produced by the RO process. This concentrated brine would then have to be pumped out of the basin for ultimate disposal to the ocean via a proposed Central Valley Brine Line (CDM Smith, 2014) as described in the Strategic Salt Accumulation Land and Transportation Study (SSALTS) Draft Final Phase 2 Report – Development of Potential Salt Management Strategies (CDM Smith, 2014).

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2) DESCRIPTION OF DESALINATION FACILITIES

The facilities required to achieve desalination of the Mud and Salt Slough inputs to the LSJR include two pump stations, pipelines, and a RO treatment facility. The following major pipelines would be required:

- Untreated water (feed to the RO treatment facility from the two drainage courses);
- Finished water return (low TDS product water from the RO treatment facility to the two drainage courses); and
- Concentrated brine (high TDS waste from the RO treatment facility).

A preliminary, planning level concept map of pipelines and facilities that would be needed is provided in **Figure 1** and summarized in **Table 1**. The locations of the facilities and pipelines are shown for the purposes of developing the concept-level project to help inform and facilitate development of the treatment alternative, and are not intended to depict a fully developed alternative or recommendation. Development of the concept-level project did not include a comparison of siting options, facility siting or conveyance alternatives, field reconnaissance, considerations of environmental impacts or habitat impacts in affected waterways or lands, communication with land owners, etc.

Table 1 Estimated Capacities of Desalination Facilities
Cost Estimate for Preliminary Conceptual Desalination Project

Infrastructure Identification	Conceptual Capacity/Diameter	Conceptual Quantity
Desalination Facility	160 mgd(1)	100 acres
Untreated Water Pipelines	84-inch	42,000 Linear Feet
Drainage Water Supply Lift Stations	160 mgd (each)	2 Lift Stations
Desalination Finished Water Pipelines	54 to 84-inch	40,000 Linear Feet
Desalination Concentrate Pipeline	42-inch	36,000 Linear Feet

(1) 160 mgd capacity is based on the peak flow to the desalination facility. On average, the desalination facility would treat 22 mgd.

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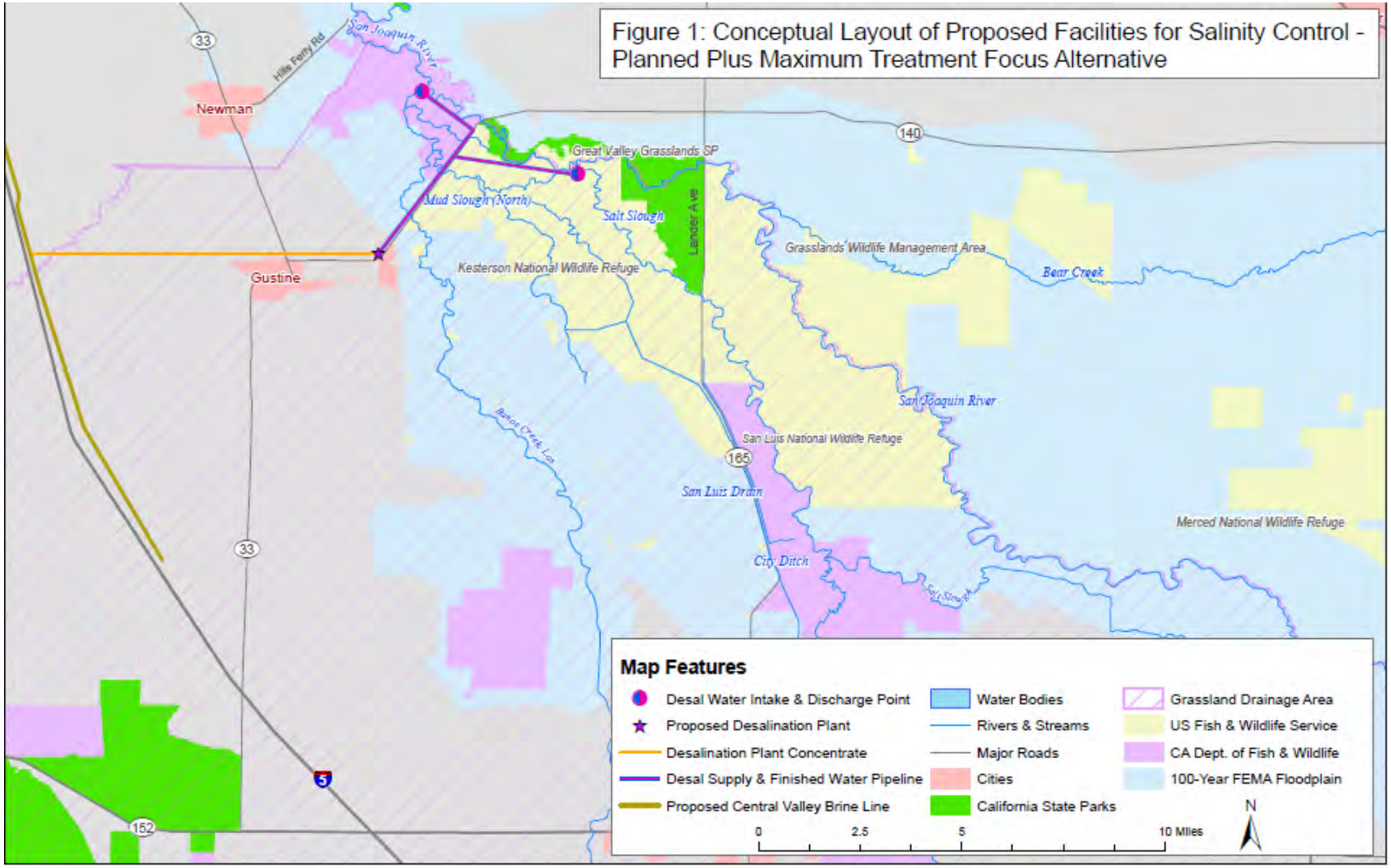
Figure 1: Conceptual Layout of Proposed Facilities for Salinity Control - Planned Plus Maximum Treatment Focus Alternative
Newman
Gustine
Hills Ferry Rd
San Joaquin River
Great Valley Grasslands SP
Mud Slough (North)
Salt Slough
Lander Ave
Kesterson National Wildlife Refuge
Grasslands Wildlife Management Area
Bear Creek
San Joaquin River
San Luis National Wildlife Refuge
San Luis Drain
Merced National Wildlife Refuge
City Ditch
Salt Slough
33
140
165
5
152
Map Features
Desal Water Intake & Discharge Point
Proposed Desalination Plant
Desalination Plant Concentrate
Desal Supply & Finished Water Pipeline
Proposed Central Valley Brine Line
Water Bodies
Rivers & Streams
Major Roads
Cities
California State Parks
Grassland Drainage Area
US Fish & Wildlife Service
CA Dept. of Fish & Wildlife
100-Year FEMA Floodplain
0
2.5
5
10 Miles
N

Untreated Water Conveyance

As shown in **Figure 1**, untreated water would be pumped from two (2) pump stations: the Salt Slough Pump Station and Mud Slough Pump Station. The volume of untreated water pumped would be determined by the mass of TDS removal needed upstream of Crows Landing in order to meet a potential EC WQO of 1,010 µmhos/cm as measured in LSJR at Crows Landing. The evaluation is based on the Watershed Analysis Risk Management Framework (WARMF) simulated results for Crows Landing generated from the Maximum Treatment Alternative modeling run, using a daily time step, and assumes that untreated water would be pumped from each of the drainage courses with the following priority: Salt Slough then Mud Slough (Section 4.1, LWA,2015). The daily flows and 30-day average TDS concentrations from the WARMF simulation for the drainage courses were used in this evaluation. It is important to note that on worst-case days (when highest TDS load reductions upstream of Crows Landing would be required), 100 percent of flow from both drainage courses would be pumped for treatment.

RO Treatment Facility

The untreated water from the drainage courses would be desalinated in a RO treatment process. To operate an RO process effectively, the untreated water requires pretreatment to remove particulate matter from the RO Feed. The planning level desalination process consists of coarse screening at each of the drainage course pump stations, fine screening at the treatment facility, followed by a coagulation/flocculation process, microfiltration, and RO. Ancillary facilities would include microfiltration backwash treatment, solids handling (from screening and microfiltration processes), and various chemical addition facilities including antiscalant, sulfuric acid, and lime.

Using baseline drainage water quality data for Salt Slough and Mud Slough included in the WARMF model and RO membrane modeling software, estimates for water recovery and salt rejection were made for the preliminary conceptual desalination project. The use of a standard brackish water RO membrane is assumed.

The preliminary estimates indicate that an 80-percent water recovery and 98-percent salt rejection could be achieved in the treatment facility. This indicates that, for every ten (10) gallons of water removed from the drainage courses, eight (8) gallons of low TDS product water would be returned and that for every ten (10) pounds of TDS removed from the drainage course, 9.8 pounds would be removed as brine. These estimated values for water recovery and salt rejection were then applied to the daily flow and TDS values provided in the WARMF simulation to estimate daily finished water flows and TDS returned to the LSJR. While the RO treatment process will remove TDS from the untreated water pumped from Salt and Mud sloughs, constituents similar to boron will pass through the RO membrane (at a pH less than 9, boric acid has a neutral charge and is similar in size to

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water molecules).

The next step of this conceptual level analysis was to determine the required capacity of the treatment process. This was accomplished by using the Planned Alternative WARMF simulation results of the daily TDS loadings in excess of the potential EC WQO of 1,010 µmhos/cm that would need to be removed upstream of Crows Landing (LWA, 2015), and the estimated feed TDS concentration of the combined drainage courses to determine required daily treatment flows. The daily treatment flows were then used to estimate the maximum treatment flow required. A 30-day running average was calculated from the daily data to dampen the daily variation of flow and TDS in the drainage water to be treated.

Using the WARMF simulated flow and TDS data from October 1995 to September 2013, it was determined that the desalination facility would need to have the capacity to treat 160 mgd of drainage water in order to reliably meet the potential EC WQO of 1,010 µmhos/cm during times when TDS load reductions upstream of Crows Landing are greatest. On average, it was estimated that the RO facility would treat 22 mgd. The conceptual desalination facility would be constructed as a modular system with the ability to bring modules online and offline, as needed, to treat flows necessary to meet the potential 1,010 µmhos/cm EC WQO. It should be noted that the RO facility would not be continuously operated, since, at times, the river meets the proposed EC objective without treatment. However, idling of facilities would be necessary when active treatment is not occurring, as a means to keep treatment processes operating as designed and available for treatment when required. The modular operation would increase the unit cost of the RO product due to the increased maintenance and membrane replacement costs of the 160 mgd facility.

Finished Water/Concentrate Conveyance

At the RO treatment facility, the untreated water would be processed into two effluent streams: low TDS finished water (permeate) and high TDS concentrate. As shown on the concept map (**Figure 1)**, the finished water pipeline would approximately follow the route of the untreated water pipeline and discharge back into the two (2) drainage courses downstream of the intake locations on Salt Slough and Mud Slough. The concentrate pipeline would be routed west to discharge the concentrate waste into a proposed Central Valley Brine Line.

3) GREENHOUSE GAS EMISSION EVALUATION

The greenhouse gas (GHG) emissions estimate for this preliminary conceptual project is based on the estimated annual purchased energy consumption (40,000,000 kWh/year based on the annual average flow of 22 mgd) for the operation of the Salt Slough and Mud Slough pump stations and the RO treatment facility. The GHGs of concern at treatment plants include carbon dioxide (CO_2), and, to a lesser degree, methane (CH_4)

and nitrous oxide (N_2O). Each of these can be emitted indirectly through the use of purchased electricity.

Emissions were converted into carbon dioxide equivalent (CO_2e) emissions. The major GHG in the atmosphere is CO_2. Other GHGs differ in their ability to absorb heat in the atmosphere. For example, CH_4 has 25 times the capacity to absorb heat relative to CO_2 over a hundred-year time horizon, so it is considered to have a global warming potential (GWP) of 25. N_2O has 298 times the capacity over a hundred-year time horizon and is given a GWP of 298. Therefore, a pound of emissions of CO_2 is not the same in terms of climatic impact as a pound of CH_4 or N_2O emitted. CO_2e emissions are calculated by multiplying the amount of emissions of a particular GHG by its GWP. These GWPs are taken from the Intergovernmental Panel on Climate Change Fourth Assessment Report (2007) for a 100-year time horizon. These GWPs are used today by international convention and the U.S. to maintain the value of the carbon dioxide "currency", and are used in this evaluation to maintain consistency with international practice.

The GHG emissions resulting from the purchase of 40,000,000 kWh/year for the operation of the pump stations and the RO treatment facility would total 15,989 metric tons of CO_2e based on emission factors for the state of California. Because these are indirect emissions, they are not a regulated source and would not be reported to the State or EPA.

4) DESALINATION PROJECT COST ESTIMATE

Preliminary capital, operations and maintenance (O&M), and life-cycle costs were developed for the Preliminary Conceptual Desalination Project. The estimated costs are presented in the following sections.

Level of Accuracy

This cost estimate is considered a Class 5 (order-of-magnitude) estimate, as classified by the Association for the Advancement of Cost Engineering International. Class 5 cost estimates are suitable for concept screening. The expected accuracy range of a Class 5 estimate is within +50 percent and -30 percent.

Capital, O&M, and Life-Cycle Cost Assumptions

The assumptions used in the development of the Preliminary Conceptual Desalination Project capital and O&M costs are summarized in **Table 2**. The costs do not include any possible buy-in fees for the purchase of disposal capacity in a proposed Central Valley Brine line. However, due to the significant impact of residual management on annual O&M costs, estimates for concentrate disposal (salt removed from river) and solids hauling and disposal (solids removed from untreated river water) have been included in the O&M estimate. These values were estimated based on typical costs for inland desalination facilities located in Southern California.

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Table 2 Capital, O&M, and Life-Cycle Cost Assumptions
Cost Estimate for Preliminary Conceptual Desalination Project

Parameter	Unit	Value
Peak Flow to Treatment(1)	Mgd	160
Average Flow to Treatment(2)	mgd	22
Power	$/kWh	$0.125
Lime (slaked)	$/lb	$0.20
Sulfuric Acid	$/lb	$0.03
Scale Inhibitor	$/lb	$0.95
Membrane Elements - 8 inch diameter	$/element	$500.00
Membrane Elements - MF	$/element	$775.00
Cartridge Filters	$/filter	$12.00
Step 1 Cleaning Chemical Cost	$/lb	$2.82
Step 2 Cleaning Chemical Cost	$/lb	$3.16
Step 3 Cleaning Chemical Cost	$/lb	$2.00
Plant Operating Factor	-	0.98
O&M Inflation	%/year	0
Discount Rate	%/year	5
Term	years	30

(1) The peak flow was used to develop the Capital Costs.
(2) The average flow was used to develop the O&M Costs.

Capital Costs

The capital costs consist of all items that would be constructed/purchased for the Preliminary Conceptual Desalination Project. The direct cost of each process is based on the following:

- Vendor-quoted information.
- Cost curves based on historical costs from other projects.
- Typical planning level values.

The conceptual level capital costs are summarized in **Table 3**. Costs are based on 2015 dollars (20-City Engineering News-Record (ENR) Construction Cost Index, April 2015 - 9,992). Costs to purchase land for the facilities are not included.

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Table 3 Capital Costs
Cost Estimate for Preliminary Conceptual Desalination Project

Component Description	Cost
Salt Slough Pump Station and Intake Structure	$22,000,000
Mud Sough Pump Station and Intake Structure	$22,000,000
Untreated Water Pipelines	$30,300,000
MF/RO Desalination Facility(2)	$283,000,000
Desalination Finished Water Pipeline	$26,900,000
Desalination Concentrate Pipeline	$18,800,000
Total Direct Cost	**$403,000,000**
Project Level Allowance @ 50 percent	$201,500,000
Subtotal	**$604,500,000**
Sales Tax @ 9 percent(3)	$27,200,000
Subtotal	$631,700,000
Contractor General Conditions @ 6 percent	$37,900,000
Subtotal	**$669,600,000**
General Contractor Overhead and Profit @ 12 percent	$80,400,000
Total Estimated Construction Cost	**$750,000,000**
Engineering and Contract Administration @ 20 percent	**$150,000,000**
Total Estimated Project Cost	**$900,000,000**

(1) Capital costs are based on a peak capacity of 160 mgd.
(2) Conceptual facility design and cost estimate does not consider boron removal.
(3) Calculated assuming 50 percent of direct costs are taxable.

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers, Inc. have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. Carollo Engineers, Inc. cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

Operations and Maintenance Costs

O&M costs include the labor, utilities, chemicals, maintenance, membrane replacement, and brine disposal required to operate a MF/RO system. The conceptual level O&M costs are summarized in **Table 4**.

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Table 4 O&M Costs

Cost Estimate for Preliminary Conceptual Desalination Project

Component Description	Cost
Total Power Cost ($/yr)	$4,900,000
Chemical Costs ($/yr)	$2,100,000
MF/RO Membrane Replacement Costs ($/yr)	$931,000
Cartridge Filter Costs ($/yr)	$51,000
Maintenance Costs ($/yr)	$1,300,000
Laboratory Costs ($/yr)	$50,000
Concentrate Disposal Costs ($/yr)	$4,600,000
Solids Hauling and Disposal Costs ($/yr)	$900,000
Labor Costs ($/yr)	$1,310,000
Annual O&M Cost ($/yr):	**$16,100,000**
Annual O&M Cost ($/kgal):	**$2.05**
Annual O&M Cost ($/AF):	**$667**

(1) Due to the variability of EC in the LSJR, the RO treatment facility would not operate continuously. Flows could range from zero to 160 mgd when in operation. O&M costs are based on a yearly average flow of 22 mgd.

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers, Inc. have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. Carollo Engineers, Inc. cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

Life Cycle Costs

A life cycle cost analysis was performed for the Preliminary Conceptual Desalination Project. The life-cycle costs are based on a discount rate of 5 percent per year and the life- cycle period of 30 years. The life-cycle costs are summarized in **Table 5**.

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Table 5 Life-Cycle Costs Cost Estimate for Preliminary Conceptual Desalination Project

Component Description	Cost
Total Project Cost(1) ($)	$900,000,000
Annual O&M Cost(2) ($/yr) 30-	$16,100,000
year Life-Cycle Cost ($)	$1,148,000,000

(1) Total Project costs are based on peak capacity of 160 mgd.
(2) O&M costs are based on an average flow of 22 mgd.

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers, Inc. have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. Carollo Engineers, Inc. cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

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5) REFERENCES

CDM Smith. 2014. Strategic Salt Accumulation Land and Transportation Study

(SSALTS) Phase 2 – Development of Potential Salt Management Strategies. Draft Final Report. Prepared for San Joaquin Valley Drainage Authority. Submitted by CDM Smith. September 2014.

Larry Walker Associates (LWA) 2015. Task #4 – Implementation Planning for Proposed Salinity Objectives. Prepared for San Joaquin Valley Drainage Authority. Submitted by Larry Walker Associates, Inc., in association with Systech Water Resources, Carollo Engineers, and PlanTierra. July 2015.

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APPENDIX F
ENVIRONMENTAL CHECKLIST

The Central Valley Regional Water Quality Control Board (Central Valley Water Board or Board), as a Lead Agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.), is responsible for evaluating the potential environmental impacts that may occur due to changes made to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan). However, the Secretary of Resources has determined that the Board's Basin Planning Program is considered a certified regulatory program, which means that the Board is exempt from the requirement to prepare an environmental impact report for basin planning activities. (Pub. Res. Code, § 21080.5; Cal. Code Regs., tit. 14, § 15251(g).)

The Staff Report and this Checklist satisfy the requirements of State Water Board's Regulations for Implementation of CEQA, Exempt Regulatory Programs, which are found at California Code of Regulations, title 23, section 3775 et seq.

PROJECT INFORMATION

1. Project Title:	Development of a Basin Plan Amendment for Salt and Boron in the Lower San Joaquin River (LSJR) LSJR Reach 83 Electrical Conductivity (EC) Water Quality Objective (WQO) and EC Performance Goal for Seasonal and Water Year Considerations
2. Lead Agency Name and Address:	Central Valley Regional Water Quality Control Board 11020 Sun Center Drive, #200, Rancho Cordova, CA 95670
3. Contact Person and Phone Number:	James Brownell, Engineering Geologist (916) 464-4675 Anne Littlejohn, Senior Environmental Scientist, (916) 464-4840 Jeanne Chilcott, Environmental Program Manager, (916) 464-4788
4. Project Location:	The project is located within the LSJR watershed, in the Central Valley within portions of San Joaquin, Stanislaus, Merced, Madera, and Fresno Counties. Reach 83 of the LSJR is where proposed salinity WQOs would apply and is defined as that segment of the San Joaquin River from the mouth of the Merced River to Vernalis.
5. Project Sponsor's Name and Address:	LSJR Committee through coordination with the Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS) Initiative
6. General Plan Designation:	N/A (multiple jurisdictions)
7. Zoning:	N/A (multiple jurisdictions)

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8. Description of Project:

The proposed action (Preferred Alternative) is to adopt an EC WQOs and an EC Performance Goal for seasonal and water year considerations in Reach 83[1] of the LSJR, as shown in Table F-1. The proposed EC WQO and EC Performance Goal are protective of the existing beneficial uses, including agricultural irrigation supply water (AGR) beneficial use and the potential municipal and domestic supply (MUN) beneficial use, designated in Reach 83. The WQO and Performance Goal consider agriculture's seasonal demands for water diverted from Reach 83, while at the same time accounting for the fact that ambient water quality conditions are greatly influenced by the hydrologic conditions, including the presence of return flows, in the San Joaquin River Basin.

The Preferred Alternative sets an EC WQO in the LSJR of 1,550 µS/cm. Compliance with the WQO in Reach 83 shall be evaluated as a 30-day running average at Crows Landing and Maze Road. The WQO would apply as indicated in Table F-1, except during an "extended dry period. An Extended Dry Period is defined using the State Water Resources Control Board's (SWRCB's) San Joaquin Valley "60-20-20" Water Year Hydrologic Classification[2] included in Revised Water Right Decision 1641 to assign a numeric indicator to a water-year type as follows (SWRCB 2000):

- Wet -- 5
- Above Normal -- 4
- Below Normal -- 3
- Dry -- 2
- Critically Dry -- 1

The indicator values will be used to determine when an Extended Dry Period is in effect:

- An Extended Dry Period shall begin when the sum of the current year's 60-20-20 indicator value and the previous two year's 60-20-20 indicator values total six (6) or less.
- An Extended Dry Period shall be deemed to exist for one water year (12 months) following a period with an indicator value total of six (6) or less.

During an Extended Dry Period (defined above), the following shall be taken into consideration to ensure that beneficial uses are protected in Reach 83 of the LSJR (as measured at Crows Landing):

- <u>Protection of the potential MUN beneficial use</u>: The EC WQO shall be the Short-Term specific conductance secondary MCL level contained in the Water Quality Control Plan (Basin Plan) for the Sacramento River Basin and the San Joaquin River Basin. (Currently incorporated from Table 64449- B of 22 CCR § 64449 at the level of 2,200 µS/cm as the average of the previous four (4) consecutive quarterly samples).
- <u>Protection of the AGR beneficial use</u>: The EC WQO shall be 2,470 µS/cm as a 30-day running average (derived from the Hoffman model results for 75% crop yield for almonds, 5th percentile rainfall, and 15% leaching fraction).

[1] Reach 83 is defined as that segment of the San Joaquin River from the mouth of the Merced River to Vernalis.

[2] The method for determining the San Joaquin Valley Water Year Hydrologic Classification (e.g., critical, dry, below normal, above normal, wet) is defined in the SWRCB Revised Water Right Decision 1641, March 2000, Figure 2, page 189. This method uses the best available estimate of the 60-20-20 San Joaquin Valley water year hydrologic classification at the 75% exceedance level using the best available data published in the California Department of Water Resources' ongoing Bulletin 120 series.

Table F-1: LSJR Reach 83 EC Water Quality Objective and Performance Goal for Seasonal and Water Year Considerations (µS/cm) during Non-Extended Dry Periods

Water Year Type	Irrigation Season		Non-irrigation Season
	March – June	July - September	October - February
Wet	**1,350 (PG)** & 1,550 (WQO)		1,550 (WQO)
Above Normal	**1,350 (PG)** & 1,550 (WQO)		1,550 (WQO)
Below Normal	**1,350 (PG)** & 1,550 (WQO)	1,550 (WQO)	
Dry	**1,350 (PG)** & 1,550 (WQO)	1,550 (WQO)	
Critical	1,550 (WQO)		

The Preferred Alternative sets an EC Performance Goal of 1,350 µS/cm during the irrigation season for specific water year types (Table F-1). Attainment of the EC Performance Goal in Reach 83 shall be evaluated as a 30-day running average at Crows Landing and Maze Road. The 1,350 µS/cm EC value is proposed as a Performance Goal because:

- The Watershed Analysis Risk Management Framework (WARMF) modeling of the Planned Bundle (Planned Alternative) indicates that, after full implementation of the key actions underway within the LSJR Basin, the ambient water quality within Reach 83 of the LSJR will not exceed an EC value of 1,350 µS/cm at Crows Landing or at Maze Road. However, due to model uncertainty, the WQO was set at 1,550 µS/cm which is the value that is reasonably protective of the AGR (irrigation supply water) beneficial use based on Hoffman modeling results agreed to by stakeholders representing the local agricultural industry (95% crop yield for almonds, 5th percentile rainfall, 15% leaching fraction).
- Agricultural supply water at 1,350 µS/cm or lower would provide a higher level of protection during the irrigation season based on Hoffman modeling results.
- Water quality at 1,350 µS/cm or better would also help to maintain the soil salinity balance by flushing the salt accumulated below the root zone during Extended Dry Periods.

The EC Performance Goal and the Extended Dry Period exception included in the Preferred Alternative accounts for the seasonal and annual hydrologic conditions that affect both the quantity and quality of the water in the LSJR diverted for AGR and MUN beneficial uses. The Performance Goal will be used to measure progress toward achievement of better water quality during the irrigation season of non-Extended Dry Periods when EC levels lower than the EC WQO would be beneficial to agriculture and are considered achievable. The Extended Dry Period exception exists to allow discharges to the LSJR to occur under hydrologic conditions when it is anticipated that agriculture will value water availability over water quality (water with EC concentrations greater than the propose WQO of 1,550 µS/cm.)). A detailed discussion of the project alternatives considered, including the Preferred Alternative, is provided in *Development of a Basin Plan Amendment for Salt and Boron in the Lower San Joaquin River (LSJR): Task 4 – Implementation Planning for Proposed Salinity Objectives* (LWA 2015a).

Based on Watershed Analysis Risk Management Framework (WARMF) modeling results, the proposed 1,550 µS/cm EC WQO associated with the Preferred Alternative is expected to reliably be met in the San Joaquin River at Crows Landing with implementation of planned actions to manage/reduce salts that were modeled for the Preferred Alternative. The planned actions included in the Preferred Alternative are listed in Table F-2. These planned actions, included as part of the Preferred Alternative, are described in detail in the Task 4 Report (LWA 2015a). All of the actions included in Table F-2, with the exception of 2c and 3a, are already scheduled to occur in the project area during the next 5 – 10 years, independent of the establishment of the proposed 1,550 µS/cm EC WQO. The planned action expected to provide the most significant salinity load reductions to Reach 83 of the LSJR based on WARMF modeling is 10b--the completion of the Grassland Bypass Project (GBP). The GBP was initiated

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in 1995 and is scheduled to be completed at the end of 2019.

Table F-2: Planned Actions in Reach 83 of the Lower San Joaquin River that Will Assist in Meeting the Preferred Alternative's Proposed Electrical Conductivity Water Quality Objective.

Planned Action	Status
1. Controlled Timing of Salinity Discharges	See actions 12a and 12b
2c. Reduce Point Sources of Salinity (Implementation of POTW salinity management plan)	Pending
3a. Reduce Nonpoint Sources of Salinity (Reduction in nitrogen fertilizer application)	Pending
8b. Water Conservation – Optimize Existing Irrigation Efficiency	Pending
9a. Installation of New High Efficiency Irrigation and Delivery Systems	Pending
10b. Sequential Reuse and Volume Reduction – Salt Accumulation Area (Grassland Bypass Project)	CEQA completed Entrix (2009). Final Environmental Impact Statement and Environmental Impact Report for Grassland Bypass Project, 2010-2019. Prepared for U.S. Bureau of Reclamation and San Luis & Delta- Mendota Water Authority. August.
12a. Drainage Water Recirculation – Tailwater Recovery	CEQA in progress (1) Patterson Irrigation District: Two Drains Project – U.S. Bureau of Reclamation and Patterson Irrigation District (2014). Draft Environmental Assessment/Initial Study and Negative Declaration for Patterson Irrigation District Two Drains Project. May. (2) Grassland Water District: North Grasslands Water Conservation and Water Quality Control Project – CEQA document under review (2015).
12b. Drainage Water Recirculation – Tilewater Recovery	Pending

Two wastewater treatment facilities for the Cities of Modesto and Turlock, currently operate discharges into Reach 83 in compliance with National Pollutant Discharge Elimination System (NPDES) permits. Future salinity-related effluent limitations for these facilities will need to consider the proposed EC WQO of 1,550 µS/cm, if adopted, and will need to account for the continued effects of water conservation, water supply constraints, and Extended Dry Periods. The proposed EC WQO or Performance Goal for Reach 83 is not expected to result in the need to construct supplementary facilities or additions to the existing wastewater treatment facilities in the Cities of Modesto and Turlock. Considerations regarding the implementation of proposed EC WQOs in NPDES permits governing discharges to Reach 83 are included in Chapter 6 of the Basin Plan Amendment Staff Report and in Appendix D of the Task 4 Report (LWA 2015a).

Existing Conditions

The most recent major hydrologic change to the LSJR was the adoption of the Selenium Control Program in 1996 which includes implementation of the GBP. The GBP systematically reduces selenium, salt and boron loading to the LSJR from a 90,000-acre agricultural area. The GBP began operation in 1996 and is scheduled to achieve zero discharge discharge by 2019. In addition, the Control Program for Salt and Boron Discharges to the LSJR was adopted by the Central Valley Water Board in 2004 to meet salinity WQOs at Vernalis. As part of the Program, a Real-Time Salinity Management Program (RTMP) was approved by the Central Valley Water Board in 2014,

For baseline conditions, 30-day running average EC water quality at Crows Landing (location with poorest water quality in Reach 83) was evaluated from the beginning of the GBP through 2013. The information was evaluated against irrigation season and Water-Year type as classified in State Water Resources Control Board's San Joaquin Valley "60-20-20" Water Year Hydrologic (wet to critically dry). A summary of the proposed WQOs and Performance Goals is depicted in Table F-1.

Proposed Program of Implementation

In addition to the actions already being implemented within the San Joaquin River Basin (Basin), the following are key actions that would assist in meeting the proposed EC WQO:

- Full Implementation of the Grassland Bypass Project - Initiated in 1996, the GBP has prevented subsurface drainage discharges with elevated levels of selenium, salt and boron from entering channels supplying wetland habitat by consolidating and then discharging the drainage via a portion of the San Luis Drain to Mud Slough and then to the LSJR. In addition, the Grassland Bypass Project has progressively reduced the loads of these constituents entering the San Luis Drain by approximately 80 percent, 63 percent, and 63 percent, respectively, since the project was implemented. Phase I of the GBP was operated under waste discharge requirements (WDRs) issued in 1998 and Phase II was covered by a 2001 WDR update. New WDRs were adopted by the Central Valley Water Board in July 2015 for Phase III of the project, which is located in the Grassland watershed sub-basin of the San Joaquin River Basin. It is projected, based on WARMF modeling results, that the Preferred Alternative EC WQO of 1,550 µS/cm should be consistently achieved after full implementation of the GBP. The GBP is currently scheduled to be completed by December 31, 2019. As such, the effective date of the proposed action should be established to coincide with the completion of the GBP.

The following activities are currently being implemented under the control program to meet salinity WQOs at Vernalis and support the monitoring components necessary to evaluate future trends in water quality within Reach 83 (including key monitoring stations at Crows Landing and Maze Blvd.):

- Implementation of Components of the Real Time Management Program (RTMP)– The RTMP is an umbrella program to optimize/maximize the export of salt from groundwater, perched zones, and agricultural drain water from the LSJR Basin while ensuring that salinity WQOs are met at Vernalis. The Central Valley Water Board has approved the RTMP in the Basin Plan as an alternative salt management strategy in lieu of monthly salt load allocations enforced by the Central Valley Water Board. RTMP facilitates the control and timing of wetland, agricultural drainage, and/or other discharges to the LSJR to coincide with periods when the river has capacity to assimilate additional salts up to a WQO.

- Water Quality Monitoring - Routine EC and boron monitoring would be conducted in the LSJR at Crows Landing and Maze Road Bridge to assess compliance with the proposed EC WQO and EC Performance Goal and the existing boron WQOs for Reach 83 to determine the effectiveness of the implementation program. A long-term monitoring and reporting program, carried out under either one or more existing ambient water quality monitoring programs or established as a separate entity, will be developed to determine compliance with the EC WQO and Performance Goal in Reach 83, as well as evaluate the effectiveness of the implementation program. The long-term

monitoring and reporting program are described in detail in the Task 6 Memorandum written in support of the proposed project (LWA 2015b).

Direct and Indirect Physical Environmental Effects

Implementation of the key actions already scheduled within the Basin, are anticipated to meet the EC WQO that would be promulgated by the proposed action. The proposed action also includes establishment of an EC Performance Goal in Reach 83 and routine EC and boron monitoring in the LSJR at Crows Landing and Maze Road Bridge. The EC and boron monitoring would not result in adverse physical effects to the environment. The proposed action would not result in any direct or indirect environmental effects that have not already been evaluated in other CEQA documents for salinity objectives at Vernalis (State Water Resouces Control Board, 2006); Control Program for Salt and Boron Discharges to the LSJR (Central Valley Water Board, 2004); and Grassland Bypass Project (Central Valley Water Board, 2010).

The proposed alternative includes a re-opener option in 10-years to evaluate success at meeting both WQOs and Performance Goals as well as implementation of planned activities. The evaluation process will allow consideration of potential future hydrologic modifications that may change the assimilative capacity of the LSJR (San Joaquin River Restoration Project (USBR, 2012) and South Delta Flow Objectives (draft for review, State Board, 2016).

Comments Received

The Central Valley Water Board hosted a public scoping meeting for the proposed action on March 30, 2009. Public comments were received until April 15, 2009. A list of the commenters and their respective organizations is presented in Table F-3. The Central Valley Water Board took into consideration all comments received when selecting the proposed action.

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Table F-3 List of Commenters

Letter No.	Commenter	Date	Agency/Organization	Topic/Concern
1	Daniel B. Cozad	3/16/2009	Central Valley Salinity Coalition (CV SALTS)	Coordination amongst CV SALTS and Central Valley Water Board to establish SJR standards
2	Dustin Cooper	4/14/2009	San Joaquin River Exchange Contractors Water Authority	Consistency of the SED under CEQA
3	Kenneth Petruzzelli	4/14/2009	San Joaquin River Group	Evaluate beneficial uses; CALSIM II modeling; Real Time Management program
4	Karna E. Harrigfeld	4/15/2009	Stockton East Water District	Timeline; identifying salt sources; reduced flows because of TMDL
5	Dante John Nomellini, Jr.	4/15/2009	Central Delta Water Agency/South Delta Water Agency	Establishing salinity and boron objectives *above* Vernalis
6	Deeanne M. Gillick	4/15/2009	County of San Joaquin/San Joaquin County Flood Control and Water Conservation District	Timeline; reduced flows; protection of beneficial uses; New Melones flow
7	Michelle Light	4/15/2009	U.S. Bureau of Reclamation	Suggested models and methods of analysis

9. Surrounding Land Uses and Setting: (Briefly describe the project's surroundings)

Reach 83 of the LSJR is the applicable segment where proposed salinity levels will apply. Reach 83 flows northwest through the San Joaquin Valley, from the San Joaquin River's confluence with the Merced River to Vernalis. The land surrounding Reach 83 consists primarily of farmland.

10. Other public agencies whose approval is required: (e.g., permits, financing approval, or participation agreement)

State Water Resources Control Board, Office of Administrative Law and United States Environmental Protection Agency must approve the Basin Plan Amendment before it becomes regulation. In addition, a Basin Plan Amendment is not final until the State Water Board files, with the Secretary of the Natural Resources Agency, a Notice of Decision and either the California Department of Fish and Wildlife's written "No Effect" Determination or a copy of its Environmental Filing Fee Cash Receipt.

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ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐	Aesthetics	☐	Agriculture and Forest Resources	☐	Air Quality
☐	Biological Resources	☐	Cultural Resources	☐	Geology / Soils
☐	Greenhouse Gas Emissions	☐	Hazards & Hazardous Materials	☐	Hydrology / Water Quality
☐	Land Use / Planning	☐	Mineral Resources	☐	Noise
☐	Population / Housing	☐	Public Services	☐	Recreation
☐	Transportation / Traffic	☐	Utilities / Service Systems	☐	Mandatory Findings of Significance
☐	None With Mitigation				

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EVALUATION OF THE ENVIRONMENTAL IMPACTS IN THE CHECKLIST

1) The Board must complete an environmental checklist before the adoption of plans or policies for the Basin/208 Planning program as certified by the Secretary for Natural Resources. The checklist becomes a part of the Substitute Environmental Documentation (SED).

2) For each environmental category in the checklist, the Board must determine whether the project will cause any adverse impact. If there are potential impacts that are not included in the sample checklist, those impacts should be added to the checklist.

3) If the Board determines that a particular adverse impact may occur as a result of the project, then the checklist boxes must indicate whether the impact is "Potentially Significant," "Less than Significant with Mitigation Incorporated," or "Less than Significant."

   a) "Potentially Significant Impact" applies if there is substantial evidence that an impact may be significant. If there are one or more "Potentially Significant Impact" entries on the checklist, the SED must include an examination of feasible alternatives and mitigation measures for each such impact, similar to the requirements for preparing an environmental impact report.

   b) "Less than Significant with Mitigation Incorporated" applies if the Board or another agency incorporates mitigation measures into the SED that will reduce an impact that is "Potentially Significant" to a "Less than Significant Impact." If the Board does not require the specific mitigation measures itself, then the Board must be certain that the other agency will in fact incorporate those measures.

   c) "Less than Significant" applies if the impact will not be significant, and mitigation is therefore not required.

   d) If there will be no impact, check the box under "No Impact."

4) The Board must provide a brief explanation for each determination in the checklist. The explanation may be included in the written report described in section 3777(a)(1) or in the checklist itself. The explanation of each issue should identify: (a) the significance criteria or threshold, if any, used to evaluate each question; and (b) the specific mitigation measure(s) identified, if any, to reduce the impact to less than significant. The Board may determine the significance of the impact by considering factual evidence, agency standards, or thresholds. If the "No Impact" box is checked, the Board should briefly provide the basis for that answer. If there are types of impacts that are not listed in the checklist, those impacts should be added to the checklist.

5) The Board must include mandatory findings of significance if required by CEQA Guidelines section 15065.

6) The Board should provide references used to identify potential impacts, including a list of information sources and individuals contacted.

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I. AESTHETICS. Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

Discussion: The project area stretches from Vernalis to the Merced River through San Joaquin and Stanislaus counties near the cities of Ripon, Modesto, Turlock, Patterson, and Newman. The project site borders lands designated for agricultural activities by both counties. Interstate 5 (I-5) runs though the southwest of Stanislaus County and branches off into Interstate 580 (I-580) which extends along the southwest of San Joaquin County. Caltrans designates these segments as State Scenic Highway (Caltrans 2011a; 2011b).

The proposed action involves establishing a new EC WQO that primarily would be met through the completion of the Grassland Bypass Project. The proposed action also includes establishment of an EC Performance Goal in Reach 83 and routine EC and boron monitoring in the LSJR at Crows Landing and Maze Road Bridge. The action's primary objective is to protect the AGR (irrigation supply water) and potential MUN (municipal and domestic supply) beneficial uses in Reach 83 of the LSJR. Implementation would not require any physical disturbance or ground moving activities, or any other physical effect that may affect aesthetic resources. The proposed project is not anticipated to change flow patterns from those that would occur without the project. Project operation would not include any new sources of light or nighttime glare nor would implementation affect the integrity of any State Scenic Highway. The project would result in no impact to aesthetics in the project area.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
II. AGRICULTURE AND FOREST RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997, as updated) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the Project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

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Discussion: The project area contains several urban areas, such as the cities of Modesto, Turlock, Merced, and Los Banos, as well as other rural communities that are generally situated near regional roadways. These cities and communities are surrounded by agricultural lands, including lands designated as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Department of Conservation [DOC] 2015). There are no forest lands within the project area.

The key actions utilized to meet the new EC WQO would not involve land use changes, ground disturbing activities, or other physical impacts. Because the proposed action would not result in the loss of agricultural lands, including those designated as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance or land zoned for agricultural use or lands within a Williamson Act contract, there would be no impact.

Because the project area does not contain forest lands, the proposed action would have no impact on forest

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
III. AIR QUALITY. Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied on to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☒
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☒
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒

Discussion: The project area is located in San Joaquin and Stanislaus counties. Both counties are within the area regulated for air quality standards attainment by the San Joaquin Valley Air Pollution Control District (SJVAPCD). SJVAPCD is considered an attainment area for the federal 8-hour Carbon Monoxide (CO) standard and an extreme ozone nonattainment area for the federal 8-hour ozone standard.

Implementation and operation of the proposed action would not involve activities that would produce air pollutants. Local air quality plans established by SJVAPCD would not be affected nor would any sensitive receptors in the project area experience an increase in concentrations of air pollutants.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES. Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?	☐	☐	☐	☒
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?	☐	☐	☐	☒
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

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Discussion:

The establishment of the proposed salinity objectives in the LSJR would not result in any potentially-significant impacts to biological resources because the implementation program associated with the proposed salinity objectives is expected to result in an improvement to the existing water quality conditions within the LSJR. The proposed EC WQO for Reach 83 was developed to be protective of all beneficial uses in the LSJR, including the AGR (irrigation supply water) and MUN (municipal and domestic supply) beneficial uses. A review of the designated beneficial uses in Reach 83 determined that the AGR and MUN uses were more sensitive to salinity than either the aquatic life beneficial uses (Kennedy/Jenks Consultants, 2010) or stock watering (Kennedy/Jenks, Consultants, 2013).

Though the proposed salinity objectives for the LSJR are higher than those recognized by the Bay-Delta Plan to be protective of striped bass spawning within the South Delta, in the area of Prisoners Point (440 uS/cm EC from April through May), water quality within the LSJR is significantly different from the South Delta

areas where the Bay-Delta Plan established the 440 uS/cm water quality objectives. The Prisoner Point area which is downstream of Reach 83, was specifically delimited for protection of striped bass spawning due to low salinity flows from the Sacramento River that enter the area through the Delta Cross Channel.

Reach 83 has not presented optimal habitat for striped bass spawing since the hydrologic modifications described in Section 2 of the Staff Report were constructed decades ago. In addition, regulatory measures have contributed to the establishment of an environmental baseline that limits the ability of striped bass to spawn in the LSJR: the Bay-Delta Plan itself recognized that when it set a salinity WQO of 1,000 uS/cm upstream of Prisoners Point in the LSJR at Vernalis, such an action would establish a salinity barrier that would likely prevent striped bass from spawning upstream and into the project area (State Water Resources Control Board, 1991). These sub-optimal conditions for striped bass spawing in the LSJR are considered part of the environmental baseline for evaluating potentially-significant impacts associated with the adoption of the proposed Basin Plan Amendment.

The new salinity objectives were developed in consideration of State and federal regulations, including the State's Sources of Drinking Water Policy, the Basin Plan, State and federal water regulations, and other State and federal requirements relevant to drinking water, stock drinking water, agricultural irrigation uses, and aquatic life protection. The completion of the Grassland Bypass Project would provide the greatest management of salinity loads to achieve the new EC WQO. Implementation of the proposed action would not result in the physical alteration of a natural environment such that there would be any adverse effects on federally- or State-listed species. The proposed action would not conflict with any Habitat Conservation Plans, Natural Community Conservation Programs, or local policies designed to protect biological resources. The project would not result in a depletion of biodiversity in aquatic and riparian habitats near the project area.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
V. CULTURAL RESOURCES. Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	☐	☐	☐	☒
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

Discussion: The proposed action would not involve physical alterations of existing structures or any ground disturbance. Adverse change or the destruction of significant cultural resources would not result from the monitoring of water quality within Reach 83.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. GEOLOGY AND SOILS. Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☒
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

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Discussion: The 2002 Alquist-Priolo Earthquake Fault Zoning Map shows that the project area is not located within any Earthquake Fault Zones; Landslide and Liquefaction Zones; or Fault Zones, Landslide and Liquefaction Zones (DOC 2002). Implementation of the proposed action would not include development of new structures and would not expose people or structures to areas of strong seismic shaking, landslide, or liquefaction. The use or implementation of septic tanks or additional waste water disposal systems is not a component of the proposed action.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. GREENHOUSE GAS EMISSIONS. Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☐	☒
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

Discussion: The proposed action involves establishing a new EC WQO that primarily would be met through the completion of the Grassland Bypass Project. The proposed EC WQO or Performance Goal for Reach 83 is not expected to result in the need to construct supplementary facilities such as desalting facilities or additions to the existing wastewater treatment facilities in the Cities of Modesto and Turlock. Project activities would not include the use of GHG generating equipment or machinery. There would be no release of GHG-related pollutants as a result of project implementation.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VIII. HAZARDS AND HAZARDOUS MATERIALS. Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and/or accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

Discussion: Implementation of the proposed action would not create a significant hazard or involve the handling of hazardous materials.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IX. HYDROLOGY AND WATER QUALITY. Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☒
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial on- or offsite erosion or siltation?	☐	☐	☐	☒
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in on- or offsite flooding?	☐	☐	☐	☒
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Result in inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

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Discussion: The proposed EC WQOs for Reach 83 were developed to be protective of all beneficial uses in the LSJR, including the AGR (irrigation supply water) and MUN (municipal and domestic supply) beneficial uses. The new salinity objective was developed in consideration of State and federal regulations, including the State's Sources of Drinking Water Policy, the Basin Plan, State and federal water regulations, and other State and federal requirements relevant to drinking water, stock drinking water, agricultural irrigation uses, and aquatic life protection.

Upon adoption and implementation of the proposed EC WQOs, changes to NPDES permits may be necessary. Water quality-based effluent limitations will be required in NPDES permits for dischargers that have reasonable potential to cause or contribute to an instream excursion of the EC WQOs in the LSJR based on the monthly average receiving water EC at the first diversion point downstream of their outfall providing AGR irrigation supply or MUN beneficial use.

The completion of the Grassland Bypass Project would provide the greatest management of salinity loads to achieve the new EC WQO. Implementation of the project would set an EC objective to ensure protection of the beneficial uses designated for Reach 83 of the LSJR. Review of water quality conditions since initiation of the GBP indicates that salinity sporadically exceeded currently proposed objectives. Modeling of scheduled implementation activities indicate that the water quality may improve to levels below the propose EC WQOs, thus resulting in an overall improvement of water quality.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
X. LAND USE AND PLANNING. Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, a general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Discussion: The proposed action involves implementing a new EC WQO that primarily would be met through completion of the Grassland Bypass Project, a project that was previously approved. The proposed action would not result in any land use changes and would not result in development of any structures or physical facilities and would therefore not physically divide an established community. The proposed action would also not conflict with any Habitat Conservation Plans or Natural Community Conservation Plans and would comply with local, State, and federal land use policies.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XI. MINERAL RESOURCES. Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☐	☒

Discussion: Project implementation and operation would not include changes in existing or planned land use, disturbance of soil, or development of structures or facilities that could impact or reduce the availability of mineral resources.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XII. NOISE. Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or in other applicable local, state, or federal standards?	☐	☐	☐	☒
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Discussion: The proposed action would not generate substantial noise and would comply with relevant and applicable local, State, and federal standards. Project activities include monitoring and testing of water quality conditions, and would not involve the use of noise-generating equipment.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIII. POPULATION AND HOUSING. Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing homes, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion: The main objective of the proposed action is to protect the AGR (irrigation supply water) beneficial use in Reach 83. The project area currently serves primarily as agricultural land. Implementation of the proposed action would not result in addition or removal of any homes and therefore would not result in an increase in population or in the displacement of people or homes.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIV. PUBLIC SERVICES. Would the project:				
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

Discussion: The proposed EC WQO or Performance Goal for Reach 83 is not expected to result in the need to construct supplementary facilities or additions to the existing wastewater treatment facilities in the Cities of Modesto and Turlock. Considerations regarding the implementation of proposed EC WQOs in NPDES permits governing discharges to Reach 83 are included in Chapter 6 of the Basin Plan Amendment Staff Report and in Appendix D of the Task 4 Report (LWA 2015a). Implementation of the proposed action would not require any physical alterations that would conflict with or reduce access to public services. Monitoring of salinity levels in Reach 83 would not result in the obstruction of service-designated routes or roadways.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XV. RECREATION. Would the project:				
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	☐	☒

Discussion: The proposed action's main objective is to protect the AGR (irrigation supply water) beneficial use in Reach 83 of the LSJR by establishing a new EC WQO. The new WQO primarily would be achieved through the completion of the Grassland Bypass Project. The proposed action also includes the establishment of an EC Performance Goal in Reach 83 and routine EC and boron monitoring in the LSJR at Crows Landing and Maze Road Bridge. Implementation of the proposed action would not increase population and would not increase use of existing recreational facilities or demand for new recreational facilities. There would be no impact

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVI. TRANSPORTATION/TRAFFIC. Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☐	☒
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	☒

Discussion: The proposed action would not produce an increase in traffic levels or require the construction of new roadways. Project activities would have no effect on air traffic.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVII. UTILITIES AND SERVICE SYSTEMS. Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand, in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

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Discussion: The proposed action involves the establishment of a new EC WQO that primarily would be met through the completion of the Grassland Bypass Project, a project that has previously undergone CEQA review and been approved. Additionally, the proposed action includes the establishment of an EC Performance Goal in Reach 83, as well as routine EC and boron monitoring in the LSJR at Crows Landing and Maze Road Bridge.

If adopted in a Basin Plan Amendment, the proposed WQO for Reach 83 would be used in the derivation of future effluent limitations contained in NPDES permits for the publically owned treatment works (POTW) operated by the Cities of Modesto and Turlock. The Central Valley Water Board, the entity responsible for developing effluent limitations and issuing NPDES permits, is required to adopt effluent limitations that protect the AGR (irrigation water supply) and MUN (municipal and domestic supply) beneficial uses in the LSJR, that do not impact the attainment of the existing Vernalis EC objectives, and that comply with State and federal antidegradation policies. While future EC effluent limitations for the Cities of Modesto and Turlock cannot be developed at this time (i.e., prior to the expiration of each city's current NPDES permit),

future NPDES permitting determinations will need to account for the continued effects of water conservation, water supply constraints, and Extended Dry Periods. Water quality-based effluent limitations will be required in NPDES permits for dischargers that have reasonable potential to cause or contribute to an instream excursion of the EC WQOs in the LSJR. The proposed implementation program clarifies that reasonable potential calculations will be based on the monthly average receiving water EC at the first diversion point downstream of their outfall providing AGR irrigation supply or MUN beneficial use. If a point source discharge is found to have a reasonable potential to cause or contribute to an instream excursion of the EC WQOs, water quality-based effluent limits shall be based either on EC concentrations or TDS loading to account for appropriate protection during dry weather versus wet weather flows. The proposed EC WQOs for Reach 83 are not expected to result in the need to construct supplementary facilities or additions to the existing wastewater treatment facilities in the Cities of Modesto and Turlock. Project implementation would not involve new storm water facilities or the discharge of solid waste or landfill servicing. There would be no impact.

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	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE.				
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☐	☐	☒
c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

Discussion: As previously discussed, the proposed action's main objective is to protect the AGR (irrigation supply water) beneficial use in Reach 83 of the LSJR by establishing a new EC WQO. Review of water quality conditions since initiation of the GBP indicates that salinity sporadically exceeded currently proposed objectives. Modeling of scheduled implementation activities indicate that the water quality may improve to levels below performance goals. The proposed project sets objectives below historic levels and sets goals to significantly improve water quality. The abovementioned activities do not require the physical alteration of existing structures or habitats and would not result in the loss of an endangered, threatened, or listed species, or any historically significant resources. The proposed project recognizes the need to protect short-term MUN during extended dry periods—even though there are no diversions existing or planned. There would be no cumulatively considerable adverse effects on the environment or human beings. Implementation of the proposed action would improve water quality of the project site for the benefit of biological and human use.

Authority: Public Resources Code Sections 21083, 21083.5. Reference:

Government Code Sections 65088.4.
Public Resources Code Sections 21080, 21083.5, 21095; *Eureka Citizens for Responsible Govt. v. City of Eureka* (2007) 147 Cal.App.4th 357; *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal.App.4th at 1109; *San Franciscans Upholding the Downtown Plan v. City and County of San Francisco* (2002) 102 Cal.App.4th 656.

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