

DRAFT FINAL

Summary of Current Water Quality Monitoring Programs in the Delta



Prepared for
Central Valley Regional Water Quality Control Board
State Water Resources Control Board
November 2009

Thomas Jabusch and Alicia Gilbreath
Aquatic Science Center

Table of Contents

List of Acronyms.....	5
List of URLs.....	7
Executive Summary	9
Overview of Monitoring Programs, Sites, and Approaches.....	9
Monitoring Drivers	11
Data Availability	12
Conclusions and Next Steps.....	12
Introduction	13
Acknowledgements	13
Monitoring Drivers and Objectives	14
Regulatory Compliance	15
Source Water Protection.....	16
Environmental Management and Policy Support.....	16
Overview of Existing Monitoring Programs.....	18
Continuous Monitoring.....	18
Receiving Water Monitoring.....	20
Water Supply Monitoring	21
Regional and Watershed Monitoring	21
Monitoring Sites	22
Continuous Monitoring Sites.....	23
Receiving Water Monitoring Sites.....	23
Water Supply Monitoring Sites	24

DRAFT FINAL

Regional and Watershed Program Monitoring Sites25

Approaches and Parameters..... 28

 Continuous Monitoring.....28

 Receiving Water Monitoring.....28

 Water Supply Monitoring30

 Regional and Watershed Monitoring30

Data Availability..... 37

 Public Databases.....37

 Reporting, Availability, and Uses of Delta Monitoring Data.....39

Monitoring Costs 42

Ongoing Multi-Year Studies 45

Synopsis..... 45

Conclusions and Next Steps 51

Appendices 54

 A. Inventory of Existing Delta Water Quality Monitoring Programs55

 A.1 Continuous Monitoring 55

 A.2. Receiving Water Monitoring 71

 A.3. Water Supply Monitoring..... 91

 A.4. Regional and Watershed Monitoring..... 99

 B. Overview Maps of Existing Delta Water Quality Monitoring – by Program Category116

 B.1. Continuous Monitoring 117

 B.2. Receiving Water Monitoring 119

 B.3. Water Supply Monitoring..... 122

 B.4. Regional and Watershed Monitoring..... 124

 C. Overview Maps of Existing Delta Water Quality Monitoring – Selected Parameters
 Organized by Monitoring Program Category 127

 C.1. Ammonia..... 128

DRAFT FINAL

C.2.	Disinfection Byproducts.....	130
C.3.	Dissolved Organic Carbon (DOC)	132
C.4.	Dissolved Oxygen (DO)	134
C.5.	Mercury and Methyl Mercury.....	138
C.6.	Pesticides	140
C.7.	Salinity.....	142
C.8.	Sediment Chemistry.....	146
C.9.	Sediment Toxicity	148
C.10.	Water Toxicity	150
D.	Ongoing Multi-Year Studies	152
	Stockton Deep Water Ship Channel Dissolved Oxygen TMDL.....	152
	POD Toxicity Monitoring with <i>Hyalella azteca</i> and Delta Smelt	153
	U.S. Geological Survey Projects.....	153
	<i>Microcystis</i> Toxicity in the Delta.....	154

List of Acronyms

abs	absorbance
ASC	Aquatic Science Center
BDAT	Bay-Delta and Tributaries Project
BMP	best management practices
BOD	biological oxygen demand
CCC	Contra Costa Canal
CCWD	Contra Costa Water District
CDEC	California Data Exchange Center
CEDEN	California Environmental Data Exchange Network
CFR	Code of Federal Regulations
CMP	Coordinated Monitoring Program
COD	chemical oxygen demand
CSD	community services district
CVP	Central Valley Project
CWA	Clean Water Act
D-1641	Water Right Decision 1641
DBP	disinfection byproduct precursor
DFG	California Department of Fish and Game
DMC	Delta-Mendota Canal
DOC	dissolved organic carbon
DO	dissolved oxygen
DWR	California Department of Water Resources
DWSC	Deep Water Ship Channel
<i>E. coli</i>	<i>Escherichia coli</i>
EC	electrical conductivity
EMP	Environmental Monitoring Program
ETBE	ethyl tert-butyl ether
ID	irrigation district
IEP	Interagency Ecological Program
ILRP	Irrigated Lands Regulatory Program
mgd	million gallons per day
MLML	Moss Landing Marine Laboratories
MRP	monitoring and reporting plan
MS4	municipal separate storm sewer system
MTBE	methyl-tert-butyl ether
MWQI	Municipal Water Quality Investigations
N	nitrogen
NASQAN	National Stream Quality Accounting Network
NAWQA	National Water Quality Assessment Program
NH ₃	ammonia
nm	nanometer
NO ₂	nitrite
NO ₃	nitrate
NPDES	National Pollution Discharge Elimination System
NWIS	National Water Information System

DRAFT FINAL

OC	organic carbon
P	phosphorus
P4	Priority Pollutant Prevention Program
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PBDEs	polybrominated diphenyl ethers
pH	logarithm of the activity of dissolved hydrogen ions (a measure of acidity)
PO ₄	phosphate
POC	particulate organic carbon
POD	pelagic organism decline
PP	pumping plant
R	river
RCSD	regional county sanitation district
RDC	regional data center
RMP	regional monitoring program
SC	specific conductivity
SDWA	Safe Drinking Water Act
SJ	San Joaquin
SJR	San Joaquin River
SJVDA	San Joaquin Valley Drainage Authority
SO ₃	sulfite
SSQP	Sacramento Stormwater Quality Partnership
SRCSD	Sacramento Regional County Sanitation District
SVOCs	semivolatile organic compounds
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
TDS	total dissolved solids
THMFP	trihalomethane-forming potential
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TOC	total organic carbon
TSS	total suspended solids
UC	University of California
URL	uniform resource locator
U.S.	United States (of America)
USGS	U.S. Geological Survey
UV	ultraviolet light
VOCs	volatile organic compounds
VSS	volatile suspended solids
WDL	Water Data Library
WDR	waste discharge requirement
WQ	water quality
WWTF	wastewater treatment facility (plant)
WWTP	wastewater treatment plant

List of URLs

Bay Delta and Tributaries Project – BDAT

<http://bdat.ca.gov/index.html>

Bay Delta and Tributaries Project – Data Retrieval

http://bdat.ca.gov/Php/Data_Retrieval/data_retrieval_closed.php

California Data Exchange Center (CDEC)

<http://cdec.water.ca.gov/>

CDEC Station Search

<http://cdec.water.ca.gov/cgi-progs/staSearch>

Central Valley Water Board, Discharges from Irrigated Lands

http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/index.shtml

Central Valley Water Board, Irrigated Lands Monitoring Program – Monitoring Activity

http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/monitoring/index.shtml

Central Valley Water Board, Surface Water Ambient Monitoring Program (SWAMP)

http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/index.shtml

Central Valley Water Board, Surface Water Ambient Monitoring Program (SWAMP) – San Joaquin River Basin

http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/sjr_swamp.shtml

Central Valley Watershed Monitoring Directory

<http://www.centralvalleymonitoring.org>

Contra Costa Water District

<http://www.ccwater.com/>

Environmental Monitoring Program Homepage

<http://www.baydelta.water.ca.gov/emp/index.html>

Interagency Ecological Program (IEP)

<http://www.water.ca.gov/icp/>

Municipal Water Quality Investigations (MWQI) Home

http://www.wq.water.ca.gov/mwqi/mwqi_index.cfm

MWQI – Publications, MWQI Program Reports

http://www.wq.water.ca.gov/mwqi/pubs.cfm#program_reports

DRAFT FINAL

SFEI: RMP Data

http://www.sfei.org/rmp/rmp_data_index.html

SFEI: RMP Documents

http://www.sfei.org/rmp/rmp_docs.html

SFEI: RMP Home

<http://www.sfei.org/rmp/index.html>

SFEI: RMP News

http://www.sfei.org/rmp/rmp_news.htm

SFEI: RMP Reports

<http://www.sfei.org/sfeireports.htm#RMP>

SRCSd: The Sacramento Coordinated Monitoring Program

<http://srcsd.com/cmp.php>

Station Meta Data: New Jerusalem Drain

http://cdec.water.ca.gov/cgi-progs/staMeta?station_id=NJD

SWP O&M Water Quality Monitoring

<http://www.water.ca.gov/swp/waterquality/>

USGS National Water Quality Assessment (NAWQA) Data Warehouse

<http://infotrek.er.usgs.gov/traverse/f?p=NAWQA:HOME:0>

USGS NAWQA: About the National Water Quality Assessment (NAWQA) Program

<http://water.usgs.gov/nawqa/about.html>

USGS Water Data for the Nation

<http://waterdata.usgs.gov/nwis/>

Water Data Library Home

<http://www.water.ca.gov/waterdatalibrary/>

Executive Summary

At the Delta Regional Monitoring Program (RMP) kick-off workshop in September 2008, stakeholders recognized two major challenges to a better understanding of aquatic resources in the Delta: 1) we are largely unable to address cross-cutting issues, such as the POD, with the current, more tightly focused, approach to monitoring and assessment; and 2) the existing programs are not organized to facilitate integration of data across different programs, which is a prerequisite for conducting the types of analyses that would allow for a more comprehensive view.

Development of a Delta RMP that would address these challenges will proceed in a phased approach, whose pilot phase (Phase I) would have the following three goals:

1. Build interest, involvement, and momentum by answering interesting and important questions that require a comprehensive, regional view (an example would be: which pyrethroid pesticides are present in important fish spawning and rearing areas in the Delta, and how do these concentrations relate to pyrethroid use patterns?)
2. Develop capabilities for regularly compiling and synthesizing data from existing, ongoing monitoring efforts, and subsequently reporting and disseminating information relevant to stakeholders, and
3. Use this effort as a proof-of-concept that sets the stage and creates capabilities needed for the longer-term regional monitoring.

Phase II will then build on this foundation to define the long-term structure and goals of the Delta RMP. We expect that the long-term program will strive for integration across different programs based on results of the pilot.

This report is a first step in organizing available information on water quality monitoring in the Sacramento-San Joaquin Delta and serves as background for ongoing planning efforts to develop a Delta RMP.

Overview of Monitoring Programs, Sites, and Approaches

Seventeen long-term water quality monitoring programs are underway in the Delta, collecting data at more than 200 different sampling locations. At least 22 different entities are involved in collecting the data, at an estimated annual cost of \$8 to \$12M. These programs include:

- (1) *Continuous monitoring networks* maintained by the Department of Water Resources (DWR), U.S. Bureau of Reclamation (Reclamation), U.S. Geological Survey (USGS), and Interagency Ecological Program (IEP) collect continuous data at over 100 sites and provide an extensive coverage of the entire Delta. The main drivers for continuous data collection are water project-related compliance and water systems operations issues. Continuous monitoring is focused on real-time data of flow and general water quality characteristics such as salinity, temperature, and dissolved oxygen (DO), with more limited coverage of a few other parameters such as chlorophyll fluorescence, organic carbon (OC), and nutrients.
- (2) *Receiving water monitoring* by regulated dischargers under the National Pollution Discharge Elimination System (NPDES) and the Irrigated Lands Regulatory Program (ILRP). The main

DRAFT FINAL

drivers for these monitoring activities are compliance monitoring requirements. We counted 87 receiving water monitoring sites in total. This includes 52 receiving water monitoring sites of wastewater dischargers; 25 receiving water sites of municipal separate storm sewer systems (MS4s), and ten agricultural monitoring sites. All compliance monitoring sites in the Delta can be considered as source indicator sites, since they were selected to characterize water quality issues from a specific source, such as monitoring the effects of a specific type of land use or discharge. Non-point source indicator sites (stormwater and agricultural sites) are typically located in stream and river segments upstream of major confluences and in-Delta sloughs and drains discharging to major waterways in the Delta. Point-source indicator sites (wastewater treatment plants etc.) are in receiving waters upstream and downstream of the point of discharge. Approaches vary considerably among stormwater, point-discharge, and agricultural discharge monitoring. Stormwater programs in the Sacramento and Stockton urban areas use coordinated regional approaches with representative urban discharge and receiving water sites. Wastewater dischargers focus on a few selected fixed sites up- and downstream of their points of discharge. Agricultural water quality coalitions apply a targeted monitoring approach to characterize agriculture-derived discharges and evaluate Best Management Practices (BMP) effectiveness at selected sites representative of agricultural discharges but not necessarily of impacts from specific agricultural areas. Compliance monitoring requirements can vary from a few general water quality parameters for some small wastewater dischargers to analyses of an extensive suite of contaminants that may include disinfection byproducts, metals, mercury, nutrients, pathogens, pesticides, organic contaminants, and toxicity.

- (3) *Water supply monitoring* programs that monitor water quality in the Delta from a drinking water perspective. There are three current efforts in the Delta in this category: Municipal Water Quality Investigations (MWQI), State Water Project (SWP) Water Quality Monitoring Program, and Contra Costa Water District (CCWD) source water monitoring. The main driver for water supply monitoring is source water protection. MWQI monitors a Delta network that includes both continuous and discrete monitoring stations. The Water Quality Monitoring Program and CCWD Source Water Monitoring conduct monitoring at several water supply sites located near the intakes of (or inside) the California and North Bay aqueducts and Contra Costa Canal. Water supply programs monitor general water quality and a wide range of constituents of concern relevant to drinking water, including nutrients, OC, bromide, pathogens, and pesticides.
- (4) *Regional and watershed monitoring* programs that are monitoring Delta surface water to obtain a system-wide picture (e.g., IEP Environmental Monitoring Program [EMP]). Other regional programs that monitor overlapping regions (San Francisco Bay RMP, Sacramento Coordinated Monitoring Program [Sacramento CMP]) also belong here, as well as basinwide, statewide (Surface Water Ambient Monitoring Program [SWAMP]), and national efforts (National Water Quality Assessment Program [NAWQA]). A major driver for these efforts can be characterized as providing information to inform and support environmental management and policy decisions. The cumulative investment in such monitoring efforts is considerable and easily exceeds \$3M, but in the overall picture, this driver is probably secondary to the other two main drivers, regulatory compliance and source water protection. The IEP EMP, for example, the most comprehensive “regional” monitoring program in the Delta, is ultimately driven by water right permit-related monitoring requirements. Similarly, the San Francisco Bay RMP resulted from a regional monitoring permit condition. The IEP EMP conducts discrete monitoring of general water quality, nutrients, phytoplankton, zooplankton, and benthos at 14 sites representing main in- and outflows of the Delta. NAWQA, SWAMP, the San Francisco Bay RMP, and the Sacramento CMP each visit one or more selected integrator or indicator sites near

DRAFT FINAL

the end of major watersheds or legal boundaries. Emphasis of these data collection is on general water quality, mercury, nutrients, and pesticides (USGS), contaminant analysis and toxicity testing (SWAMP), water and sediment chemistry and toxicity (San Francisco Bay RMP), and general water quality, nutrients, and toxic contaminants (Sacramento CMP). The San Francisco Bay RMP and Sacramento CMP are largely done for permit compliance but focus on ambient conditions rather than individual discharge points.

In addition to these long-term monitoring efforts, a number of special studies are carried out in the Delta, including ongoing studies related to the Total Maximum Daily Load (TMDL) for low dissolved oxygen (DO) in the Lower San Joaquin River coordinated by the Central Valley Regional Water Quality Control Board (Central Valley Water Board), a multiyear study of Delta water toxicity to invertebrates (*Hyalella azteca*) and delta smelt (*Hypomesus transpacificus*) by the University of California - Davis (UC Davis) Aquatic Toxicology Laboratory, several USGS research projects, and planned studies by researchers at UC Davis of potential relationships between *Microcystis* toxicity, trophic transfer, and pelagic fish population dynamics in the Delta.

Waste Discharge Requirements issued for maintenance dredging projects stipulate monitoring during, before, and after dredging operations. Generally, monitoring occurs in the immediate vicinity of the work area throughout the duration of the dredging operation and also pertains to site preparation and debris removal. Receiving water monitoring is also required if there is a discharge of effluent to surface waters. Samples are usually analyzed for general water quality parameters such as dissolved oxygen, temperature, pH, and turbidity. Monitoring for additional constituents may be required based on results of the pre-dredge analysis and project application.

Monitoring Drivers

There are three major drivers for monitoring in the Delta:

- (1) *Specific regulatory statutes.* Much of the monitoring activities in the Delta are in response to the flow-related water quality standards and related monitoring requirements that are specified in the State Water Resources Control Board's (State Water Board's) Water Right Decision 1641. Additional compliance monitoring is required by the Central Valley Water Board to comply with the Conditional Waiver of Waste Discharge Requirements (WDRs) for discharges from irrigated lands, WDRs for dredging operations, or NPDES permit compliance orders.
- (2) *Source water protection* is the main driver for programs that monitor water quality in the Delta from a drinking water supply perspective (MWQI, SWP Water Quality Monitoring Program, CCWD Source Water Monitoring)
- (3) *Environmental management and policy support.* A third major driver for collecting data in the Delta is the need for information by resource managers and policy decision-makers about the condition of the system or specific issues of concern (e.g., effects of changes in flows, Pelagic Organism Decline [POD]). This driver usually applies to programs with a specified mission to generate data to inform environmental decisions.

Although there's a range of drivers and objectives, there are also some common themes:

- Information on key constituents of concern, including sources and ambient levels
- Effectiveness of pollution prevention efforts,

DRAFT FINAL

- Assessing the overall environmental health of the Delta, and
- Evaluating long-term trends in receiving water quality.

Data Availability

There is currently no single online access point for Delta surface water data. Many, but not all, Delta water quality data are available online in one of the five primary databases: Bay-Delta and Tributaries Project (BDAT), California Environmental Data Exchange Network (CEDEN), California Data Exchange Center (CDEC), Water Data Library (WDL), and National Water Information System (NWIS). All of these databases are public. Data from some other efforts, such as the Sacramento CMP, are made available by request. Some programs have strong public outreach components and prioritize making data broadly available and accessible, including the IEP EMP, MWQI, the San Francisco Bay RMP, and NAWQA. Compliance monitoring data from the NPDES programs (wastewater and stormwater) are currently not available online. Data from the ILRP are available on the Central Valley Water Board's ILRP website. Overall, a comprehensive search for Delta water quality data will require accessing several databases and making specific request for additional data sources that are not available online. In addition, different programs use different methods and have different conventions for parameter names, site names, and methods. They may even use different geospatial reference systems and different basin or watershed boundaries. All these issues combined make it difficult to obtain timely access to monitoring results or combine the data for broader analyses.

Conclusions and Next Steps

Probably all users of Delta water quality information would benefit from a better picture of system-wide baseline conditions and trends. However, environmental management and policy support currently plays a secondary role as a driver for Delta water quality monitoring, compared to the other two main drivers, regulatory compliance and source water protection.

An initial step for shifting existing monitoring resources toward a more integrated approach will be to develop a set of shared, regional monitoring objectives, with the goal to developing a better system-wide picture that will then better inform policy and management decisions. Existing sites representing the main in- and outflows of the Delta may be the “lowest hanging fruits” for coordinating existing monitoring and could be an initial focus for data integration efforts and a regional monitoring pilot program.

Introduction

This report is a first step in organizing available information on water quality monitoring in the legal Delta. It considers all ongoing long-term monitoring effort and multi-year studies with a focus on water quality and/or hydrology. It does not include discussions of ecological monitoring (e.g. the various fish monitoring programs conducted by the Department of Fish and Game [DFG] and other agencies) or recent short-term studies that have already been completed (such as Dr. Weston's [UC Berkeley] work concerning the sources, seasonality, and toxicity of pyrethroid pesticides in the Delta).

This report is intended primarily as an important background for stakeholders involved in the ongoing planning efforts to develop a Regional Monitoring Program (RMP) for the Delta. It will help ensure that the Delta RMP builds on existing efforts to the extent possible and will also support upcoming discussions about regional monitoring questions and indicators, regional coordination, data integration, and funding. In particular, the detailed information presented here will help reveal where redundancies could lead to cost sharing and other efficiencies, and where important data gaps remain to be filled.

Acknowledgements

The summary of existing monitoring is based on information extracted from the Central Valley Monitoring Directory (www.centralvalleymonitoring.org). Staff from the Aquatic Science Center (ASC) and Central Valley Water Board collaboratively populated the Monitoring Directory with surface water monitoring program information, with funding and support by the State Water Board and the U.S. Environmental Protection Agency Region 9 Water Division. Monitoring metadata were gathered through internet searches, reviews of NPDES and water right permits, reviews of existing monitoring inventories, and directly contacting monitoring program managers and staff in various agencies with requests to review and update directory entries and provide missing and additional information. Chun Kim, Kim Nguyen, and Adam Ballard at the Central Valley Water Board and Alicia Gilbreath, Thomas Jabusch, Cristina Grosso, Pia Loft at the ASC did the lions share of collecting the monitoring information and reviewing, formatting, and uploading the data to the monitoring directory. The following people generously provided their time and resources by contributing monitoring information, fielding information requests within their organizations, and/or reviewing program entries in the Central Valley Monitoring Directory: Dolly Baxa (UC Davis), Joe Christen (California Department of Water Resources [DWR]), Joe Domagalski (U.S. Geological Survey [USGS]), Jessica Edwards-Brandt (Contra Costa Water District [CCWD]), Roger Fujii (USGS), Karen Gehrts (DWR), Christine Joab (Central Valley Water Board), Tamara Kraus (USGS), Gene Lee (Reclamation), Cindy Messer (DWR), Barry Montoya (DWR), Tim Nelson (DWR), Brianne Noble (DWR), Bob Nozuka (DWR), Vyomini Pandya (Sacramento Regional County Sanitation District [SRCSD]), Cathy Ruhl (USGS), Deanna Sereno (Contra Costa Water District) and Inge Werner (UC Davis). The following individuals reviewed a previous draft of this report, or specific portions of it, and contributed helpful ideas and comments: Brock Bernstein; Jay Davis and Rainer Hoenicke (ASC); Adam Ballard, Jeanne Chilcott, Susan Fregien, Kathy Harder, Chris Jimmerson, Karen Larsen, Kim Schwab, and Alisha Wenzel (Central Valley Water Board); Tom Kimball and Curtis Yip (State Water Board), Stan Dean (SRCSD), Mike Dempsey (DWR), Carol DiGiorgio (DWR), Chris Eacock (Reclamation), Jessica Edwards-Brandt, John Hunt (UC Davis), Vyomini Pandya, and Debbie Webster (Central Valley Clean Water Agencies).

Monitoring Drivers and Objectives

- *Most but not all monitoring in the Delta is driven by specific regulatory statutes requiring monitoring to ensure surface water protection. In addition, monitoring is undertaken to ensure source water protection.*
- *Other significant monitoring activities are driven by specific information needs of managers and decision-makers about the condition of the system or specific issues of concern (e.g., effects of changes in flows, POD).*
- *Although there is a range of drivers and objectives, there are also some common themes:*
 - *Information on key constituents of concern, including sources and ambient levels*
 - *Effectiveness of pollution prevention efforts,*
 - *Assessing the overall environmental health of the Delta, and*
 - *Evaluating long-term trends in receiving water quality.*

Drivers of surface water monitoring activities in the Delta can be divided into three major groups (Table 1):

- 1) Regulatory monitoring requirements related to the federal Clean Water Act (CWA) and the State Porter-Cologne Water Quality Control Act that are implemented by the State and Regional Water Boards,
- 2) Source water protection and operational needs of the California water projects and local water agencies, and
- 3) Issue-specific and general monitoring needs to inform water quality management and protection decisions.

Table 1. Drivers of monitoring activities in the Delta.

Categories	Drivers
Regulatory compliance	<ul style="list-style-type: none"> • Water Right Decision 1641 (D-1641) • Conditional Waiver of Waste Discharge Requirements (ILRP) • NPDES permit requirements (wastewater and stormwater) • Other regulatory-driven, project-based monitoring, such as for maintenance dredging, levee repairs, etc.
Source water protection	<ul style="list-style-type: none"> • Source/export water quality <ul style="list-style-type: none"> – Drinking water standards (Safe Drinking Water Act, SDWA) – California water project contractual requirements • Water treatment operations

Environmental management and policy support

- Establishing baseline conditions
- Trends and variability
- Aquatic resources assessments
- Issues (e.g. POD)
- Processes (e.g. impacts of water export on Delta transport)
- Model calibration and validation
- Effectiveness of pollution prevention efforts, incl. regulatory requirements

Regulatory Compliance

- *Most of the monitoring activities in the Delta are in response to the flow-related water quality standards and related monitoring requirements that are specified in the State Water Board's Water Right Decision 1641.*
- *Additional compliance monitoring required by the Central Valley Water Board¹ is carried out by the agricultural water quality coalitions to comply with the Conditional Waiver of WDRs for discharges from irrigated lands and by NPDES permit holders (including stormwater) to assess compliance with NPDES permit orders.*

DWR, Reclamation, and USGS maintain “continuous recorder” stations required by D-1641. However, the bulk of the water right permit-related monitoring is carried out by the IEP EMP, which investigates the impacts of the State Water Project (SWP) and federal Central Valley Project (CVP) on fishery resources in the Delta and North Bay.

D-1641 states that “in order to ensure compliance with the water quality objectives, to identify meaningful changes in any significant water quality parameters potentially related to operation of the State Water Project or the Central Valley Project, and to reveal trends in ecological changes potentially related to project operations, Licensee/Permittee shall, independently or in cooperation with other agencies or individuals:

- Perform the Water Quality and Baseline Monitoring program described in this Order (D-1641); and
- Conduct ongoing and future monitoring surveys as recommended by the DFG, the U.S. Fish and Wildlife Service, or the National Marine Fisheries Service, and acceptable to the Executive Director of the State Water Board concerning food chain relationships, fisheries impacts, or impacts to brackish tidal marshes, as they are affected by operations of the State Water Project or the Central Valley Project in the Delta and Suisun Marsh.”

Other routine compliance monitoring in the Delta is driven by ILRP Conditional Waiver and NPDES permit conditions. NPDES self-monitoring objectives often relate directly to the primary goal of assuring compliance.

¹ The Code of Federal Regulations Title 40 section 122.48 requires that all NPDES permits specify monitoring and reporting requirements. California Water Code Sections 13267 and 13383 authorizes the Regional Water Quality Control Board to require technical and monitoring reports.

DRAFT FINAL

An additional significant monitoring driver are Waste Discharge Requirements issued for maintenance dredging projects, which specify required monitoring during, before, and after dredging operations. Albeit reoccurring for most dredging projects, these monitoring activities are project-specific, short-term monitoring efforts (i.e., monitoring in the immediate vicinity of the work area throughout the duration of the dredging operation including site preparation and debris removal) and fall somewhat outside the presented discussion of long-term ambient water quality monitoring efforts.

Source Water Protection

Source water protection is the major driver for MWQI, the SWP Water Quality Monitoring Program, the Delta-Mendota Canal (DMC) Water Quality Monitoring Program, and CCWD's Source Water Monitoring.

MWQI provides monitoring data to state water contractors and other stakeholders, such as CALFED, on key constituents of concern. The SWP Water Quality Monitoring Program collects data to 1) document spatial and temporal changes in SWP water quality; 2) plan water treatment operational changes; 3) identify and respond to pollution or other water quality episodes; and 4) compare SWP water quality to drinking water standards, Article 19 contractual requirements, or other criteria. CCWD source water monitoring provides information on Delta water prior to intake and treatment for water supply. The DMC Water Quality Monitoring Program measures flow, salinity, selenium and total dissolved solids (TDS) in water exported to water contractors on the westside via the DMC.

Environmental Management and Policy Support

A third major driver for collecting data in the Delta is the need for information by resource managers and policy decision-makers about specific issues and the overall condition of the system. This driver usually applies to programs with a specified mission to generate data to inform environmental decisions.

The mission of NASQAN is to annually monitor and assess concentrations and loads of selected constituents delivered by major rivers to coastal waters of the U.S., and to monitor and identify major source areas in selected inland sub-basins that contribute significantly to adverse conditions in receiving waters. National-scale objectives of NASQAN are to assess: 1) concentrations and loads of nitrogen, phosphorus, carbon, silica, dissolved solids, selected pesticides, and suspended-sediment to coastal waters of the U.S.; and, 2) changes in concentrations and loads of these constituents through time.

NAWQA has the mission to evaluate the conditions of the Nations' waterbodies to inform water resource management and protection decisions. The program goal is to provide an understanding of water quality conditions and how those conditions may vary locally, regionally, and nationally; whether conditions are getting better or worse over time; and how natural features and human activities affect those conditions. Regional NAWQA study units have the overall goals to assess water quality in the Sacramento and San Joaquin River Basins. There is an emphasis on nutrients and pesticides in the San Joaquin Basin and on metals, including mercury, in the Sacramento Basin. The USGS Trends Network has the objective to provide baseline information on water quality (inorganic parameters) and select contaminants such as nutrients and pesticides.

DRAFT FINAL

On a regional level, the RMP for Water Quality in the San Francisco Estuary² has the specific goal to collect data and communicate information about water quality in the San Francisco Estuary to support management decisions. The program's focus is San Francisco Bay, but it has two monitoring stations in the Delta.

In the Sacramento region, the Sacramento CMP characterizes ambient levels of pollutants of concern in the Sacramento River. Another objective is encourage coordination among the numerous water quality monitoring programs in the Sacramento Region and to perform outreach to convey information to the public and other agencies.

The SWAMP is conducting two larger-scale assessment efforts at a network of integrator sites: Contaminant Trend Monitoring at Integrator Sites statewide and Seasonal Trend Monitoring at Central Valley Integrator Sites.

The Contaminant Trend Monitoring at Integrator Sites is a long-term trends component of the SWAMP statewide assessment of California streams and has the goal to detect meaningful change in the concentrations of stream-borne contaminants and their effects in large watersheds at time scales appropriate to management decision making. Three specific goals are: (1) determine long-term trends in stream contaminant concentrations and effects; (2) relate water quality indicators to land-use characteristics and management effort; and (3) establish a network of sites throughout the state to serve as a backbone for collaboration with local, regional, and federal monitoring.

The Seasonal Trend Monitoring at Central Valley Integrator Sites is designed to answer the following questions: (1) what is the spatial variability of ambient water quality in the Central Valley; (2) what is the seasonal variability of ambient water quality in the Central Valley; (3) what is the long-term trend in water quality; and (4) is there evidence beneficial uses are not being protected?

Data from the Agricultural Subsurface Drainage Program is used to support the Salt and Boron and Selenium TMDLs in the San Joaquin River Basin.

Although some monitoring efforts are more driven by one factor than the other, more than one of the major drivers applies to most of the programs. For example, the IEP undertakes monitoring efforts to gauge the environmental health of the estuary in general, which goes far and beyond the program's core function of water right permit-related compliance monitoring. D-1641 continuous recorder data are mainly collected for water permit-related operations but also used for additional studies, modeling, and analyses. In fact, most monitoring programs specify objectives related to informing specific environmental management needs.

The Monitoring and Reporting Plans (MRPs) of the Agricultural Water Quality Coalitions specifically state that data are used to characterize discharges from irrigated lands to surface waters and to evaluate the effectiveness of management practice implementation efforts.

Specific objectives of NPDES programs that go beyond the primary goal of assuring compliance include activities associated with stormwater management plans, such as:

² Formerly the RMP for Toxic Substances in San Francisco Bay

DRAFT FINAL

- Measuring and improving the effectiveness of the Storm Water Management Plans³
- Assessing the chemical, physical (e.g. temperature, turbidity), and biological (i.e., pathogens) impacts on receiving waters resulting from urban runoff
- Characterizing urban runoff
- Identifying sources of pollutants
- Assessing the overall health and evaluating long-term trends in receiving water quality

Overview of Existing Monitoring Programs

By our count, there are 17 ongoing surface water monitoring programs in the Delta. At least 22 different entities are involved in collecting the data.

For a general overview, the existing monitoring efforts can be grouped into four basic categories that loosely reflect the main functional approaches to monitoring in the Delta:

- 1) Continuous: high frequency monitoring
- 2) Receiving water monitoring: compliance monitoring to assess impacts to receiving water
- 3) Water supply: monitoring to assess source water quality
- 4) Regional and watershed: comprehensive regional and/or watershed studies to establish baseline conditions and trends; assess aquatic resources; or investigate issues (e.g. POD) and processes (e.g. impacts of water export on Delta transport).

These four major categories emerged from an initial review of existing programs, their objectives, and their monitoring activities. Table 2 provides an overview of existing surface water monitoring programs by function. Appendix A provides more detailed summaries of each program.

This overview is limited to surface water monitoring programs measuring any aspects of water quality in the Delta. The report evaluates existing monitoring from several perspectives: 1) monitoring drivers; 2) program function; 3) types of monitoring sites; 4) approaches; 5) data availability; and 6) size of effort (in terms of amounts of dollars spent). This approach is an attempt to logically organize and help digest the large amount of information that was gathered and summarized. We did this in the hope of providing a useful framework for the next working step of identifying specific opportunities for improving coordination and cost effectiveness of water quality monitoring in the Delta.

Continuous Monitoring

DWR, Reclamation, and USGS maintain continuous recorders in the Delta for measuring flow and other physical-chemical parameters (electrical conductivity [EC], temperature, etc).

Continuous monitoring is separated here from discrete sampling and placed in its own category.

The **USGS Delta Flows Network** provides long-term flow data throughout the Delta since 1987. The data are used on a daily basis by the water project operators and as a framework for understanding how

³ Sacramento Stormwater Quality Partnership: provide measurement for the success of the Stormwater Quality Improvement Plan and BMPs

DRAFT FINAL

the tidal currents, river inflows, water project exports, temporary barriers, and Delta Cross Channel gate operations impact transport within the upper estuary. The data are also used routinely for numerical model calibration and validation and are regularly leveraged into large interdisciplinary process-based studies.

Table 2. Existing Delta surface monitoring programs by main function.

Function	Programs
Continuous Monitoring	<ul style="list-style-type: none"> • Continuous Multiparameter Monitoring (IEP EMP) • Continuous Recorder Sites (DWR, Reclamation) • Delta Flows Network (USGS) • Delta-Mendota Canal Water Quality Monitoring (Reclamation) • Surface Water Monitoring (DWR)
Receiving Water Monitoring	<ul style="list-style-type: none"> • Irrigated Lands Regulatory Program (Central Valley Water Board) • NPDES Self Monitoring Program (wastewater and stormwater) (Central Valley Water Board) • Sacramento Regional Wastewater Treatment Plant (WWTP) Priority Pollutant Prevention Program (P4 – SRCSD)
Water Supply Monitoring	<ul style="list-style-type: none"> • Municipal Water Quality Investigations (DWR) • Source Water Monitoring (Contra Costa Water District) • State Water Project Water Quality Monitoring (DWR)
Regional and Watershed Monitoring	<ul style="list-style-type: none"> • Agricultural Subsurface Drainage Program (Central Valley Water Board) • Discrete Physical/Chemical Water Quality Sampling (IEP EMP) • National Water Quality Assessment Program (USGS) • San Francisco Bay RMP (San Francisco Estuary Institute [SFEI]) • Sacramento Coordinated Monitoring Program (SRCSD and the Sacramento Stormwater Quality Partnership [SSQP]) • Surface Water Ambient Monitoring Program (SWAMP – Central Valley Water Board and State Water Board)

Under the umbrella of the Interagency Ecological Program (IEP), DWR, Reclamation, and USGS operate “**continuous recorder sites**” mandated by **Water Right Decision 1641 (D-1641)**. The IEP EMP conducts **continuous multiparameter monitoring**.

Independently from the IEP, the **DWR Central District’s Surface Water Unit** operates a network of tidal gages in the Delta.⁴ DWR has also installed a network of organic carbon (OC) analyzers to provide real-time monitoring of total and dissolved OC (TOC and DOC, respectively) at key points in the Delta sampled by the **SWP Water Quality Monitoring Program** and **MWQI**. The **Delta-Mendota Canal (DMC) Water Quality Monitoring Program** has one station inside the canal near the DMC headquarters.

⁴ The **San Joaquin Valley Drainage Authority** provides funding for a continuous station at the New Jerusalem Drain that is formally owned and operated by DWR.

Receiving Water Monitoring

These are compliance monitoring programs that are collecting data in the Delta because of monitoring requirements incorporated into NPDES permits or the Irrigated Lands Conditional Waivers.

There are seventeen discharge permits with ongoing **NPDES self-monitoring** requirements in Delta surface waters. This includes fourteen wastewater discharge permits (permit holders include municipalities, businesses, and a state prison) with monitoring sites on receiving waters upstream and downstream of their points of discharge, one regional stormwater permit in the Sacramento urban area, and two stormwater permits in the Stockton urban area (Table 3).

Table 3. NPDES permits in the Delta.

NPDES Permits
<p>Wastewater Permits</p> <ul style="list-style-type: none"> • City of Brentwood Wastewater Treatment Plant (WWTP) • City of Lodi, White Slough Water Pollution Control Plant • City of Manteca, Lathrop and Dutra Farms, Wastewater Treatment Facility (WWTF) • City of Rio Vista and Eco Resources, Inc. Trilogy WWTP, Northwest WWTF • City of Rio Vista, Beach WWTF • City of Sacramento Combined Sewer System • City of Stockton WWTF • City of Tracy WWTP • Deuel Vocational Institution • GWF Power System, L.P. Wilbur Avenue East Power Plant Antioch (Site IV) • Mountain House Wastewater Treatment Plant • Oakwood Lake Water District (Brown Sand, Inc.) • Sacramento Regional County Sanitation District, Sacramento Regional WWTP • Town of Discovery Bay
<p>Stormwater Permits</p> <ul style="list-style-type: none"> • City of Stockton and County of San Joaquin Storm Water Discharges from Municipal Separate Storm Sewer System • County of Sacramento and Cities of Citrus Heights, Elk Grove, Folsom, Galt and Sacramento Storm Water Dischargers From Municipal Separate Storm Sewer Systems • Stockton Port District Facility-Wide Storm Water Discharges from Municipal Separate Storm Sewer System and Non-Storm Water Discharges from the Port of Stockton

In the Sacramento area, public agencies including the County of Sacramento and Cities of Citrus Heights, Elk Grove, Folsom, Galt and Sacramento, joined to form **SSQP**, which implemented a coordinated stormwater monitoring program in 1992. Within the legal Delta, the stormwater monitoring program currently monitors one site along the Sacramento River at Freeport Bridge. Monitoring is done by the Sacramento Coordinated Monitoring Program (see Regional and Watershed Monitoring Section). Stormwater monitoring in the Stockton urban area currently occurs under two separate NPDES permits. The **City of Stockton/County of San Joaquin Stormwater Program** monitors nineteen

DRAFT FINAL

receiving water sites inside the legal Delta, including two sites in the Stockton Deep Water Ship Channel, three sites on the Calaveras River, and additional sites on smaller Stockton area creeks and sloughs. The **Port of Stockton** monitors five receiving water sites under a separate NPDES permit that regulates stormwater discharges within the Stockton Port District.

Two agricultural coalitions, the **Sacramento Valley Water Quality Coalition** and the **San Joaquin County & Delta Water Quality Coalition**, and the **South San Joaquin Irrigation District** implement monitoring of water quality in the Delta as required by the Regional Water Board under the ILRP. The agricultural groups are monitoring ambient water and sediments for toxicity and a suite of water quality constituents (e.g., pesticides, metals, nutrients, etc.) at ten sites in the Delta.

Water Supply Monitoring

This category includes programs that monitor water quality in the Delta from a drinking water supply perspective. There are three current efforts: MWQI, the SWP Water Quality Monitoring Program, and CCWD source water monitoring.

MWQI is funded by 15 municipal state water contractors to provide information on constituents important to drinking water. The **SWP Water Quality Monitoring Program** routinely monitors chemical, physical and biological parameters. Both MWQI and the SWP Water Quality Monitoring Program combine discrete (grab) samples and continuous monitoring. **CCWD** carries out extensive water quality monitoring at its Delta drinking water intakes. CCWD also contributes funding to MWQI and the USGS Delta Flows Network for key drinking water constituents and disinfection byproduct precursors.

Regional and Watershed Monitoring

This category includes programs that monitor Delta surface water to obtain a system-wide picture (e.g., IEP EMP). Other regional programs that monitor overlapping regions (San Francisco Bay RMP, Sacramento CMP) also belong here, as well as basinwide, statewide (SWAMP), and national efforts (NAWQA).

The **IEP EMP** is the most comprehensive water quality monitoring program in the Delta. Initiated in 1974, it is currently mandated by Water Right Decision 1641 and carried out jointly by the water right permittees operating the State Water Project (DWR) and Central Valley Project (Reclamation). Assistance is provided by DFG and USGS through in-kind contributions (e.g., laboratory, technical reviews, and continuous monitoring station operation). Water quality compliance and baseline monitoring stipulated in D-1641 includes continuous monitoring and discrete sampling.

The **USGS Office of Water** maintains national surface water quality networks that provide stakeholders with reliable information over time for a fixed set of stations. Two sites in the Delta, Sacramento River at Freeport and San Joaquin River at Vernalis, are included in two of the USGS fixed site networks, the National Stream Quality Accounting Network (NASQAN) and NAWQA's Trend Network for Streams.

NASQAN monitors the quality of water at the terminus of large watersheds entering receiving waters through bimonthly sampling and provides some of the funding for the Freeport and Vernalis sites, which are operated through NAWQA.

DRAFT FINAL

NAWQA is designed to assess historical, current, and future water-quality conditions in representative river basins and aquifers nationwide. As part of the program, investigations are conducted within "study units" throughout the Nation to provide a framework for national and regional water-quality assessment. The Sacramento River Basin and San Joaquin-Tulare Basins represent two of the study units in this program. The Vernalis and Freeport sites are currently being sampled as part of the NAWQA trends network. The basic sampling strategy includes the collection of fish, benthic invertebrates, and algae, and the description of instream and riparian habitat.

The **San Francisco Bay RMP** is a public-private partnership between regulators, dischargers, industry representatives, and scientists to measure water quality in the San Francisco Estuary, with a primary focus on San Francisco Bay. SFEI, an independent nonprofit organization, administers and manages the program and also conducts many of the associated special studies. The RMP measures water, sediment, and tissue chemistry as well as water and sediment toxicity at two stations in the Delta near the confluence of the San Joaquin and Sacramento rivers. Although the San Francisco Bay RMP is done largely for permit compliance of Bay Area dischargers, it studies ambient conditions of San Francisco Bay and not individual points of discharge.

The **Sacramento CMP**, a joint effort of the SRCSD and SSQP, was implemented with the fundamental purpose to develop high-quality data to aid in the implementation of water quality policy and regulations in the Sacramento area. The Ambient Monitoring Program is the primary water quality monitoring element of the Sacramento CMP.

SWAMP is a statewide monitoring effort designed to assess the conditions of California's surface waters. The program is administered by the State Water Board. Responsibility for implementation of monitoring activities is shared with the Regional Water Boards. To maximize resources, all Central Valley Water Board monitoring efforts are coordinated with existing monitoring programs—both internal programs (TMDLs, agricultural subsurface drainage, WDRs, and ILRP) and external programs (other agencies such as USGS and grant-funded projects). Statewide SWAMP studies currently have two sampling sites in the Delta: Sacramento River at Hood and San Joaquin River at Airport Way (aka, Vernalis). Sampling conducted at this station includes sediment chemistry and sediment toxicity testing. Central Valley Water Board SWAMP is implementing a Seasonal Trend Monitoring program that will monitor OC, water chemistry, pathogens, and water toxicity at Central Valley Integrator Sites, including Sacramento River at Hood and San Joaquin River at Airport Way.

The **Agricultural Subsurface Drainage Program** of the Central Valley Water Board collects data in the San Joaquin River at Vernalis/Airport Way to support the Salt and Boron and Selenium Total Maximum Daily Loads (TMDL) programs for the lower San Joaquin River.

Monitoring Sites

- *The Delta is covered by extensive continuous monitoring networks maintained and funded by DWR, USGS, and Reclamation.*
- *In addition, there is ongoing receiving water monitoring at 87 counted sites to assess specific impacts of point source, agricultural, and stormwater-derived discharges.*
- *Eight water supply indicator sites maintained by DWR, Reclamation, and CCWD are located near the intakes of (or inside) the California and North Bay aqueducts and Delta-Mendota and Contra Costa canals. In addition, MWQI monitors nine key locations in the Delta for drinking water constituents of concern.*

DRAFT FINAL

- *A total of six integrator sites representing major in- and outflows of the Delta are the specific and sole sampling points inside the Delta for some monitoring efforts looking at basinwide spatial and temporal trends: SWAMP samples at Hood and Airport Way (bottoms of the Sacramento River and San Joaquin basins, respectively); NAWQA at Freeport (Sacramento River basin), Vernalis (San Joaquin basin outflow) and Yolo Bypass; and SFEI at Sacramento and San Joaquin river stations near the Delta outflow to San Francisco Bay.*

Figure 1 provides an overview of monitoring sites sampled by ongoing monitoring activities in the Delta. Appendix A includes maps of monitoring sites for each monitoring program. Appendix B includes maps showing the Delta monitoring locations organized by category.

Continuous Monitoring Sites

DWR, Reclamation, and USGS collect continuous data at over 100 sites in the Delta.

Several continuous water quality monitoring networks (Map B.1) are sampling the entire Delta for various purposes (see previous section on monitoring drivers and objectives) and are coordinated with each other at varying degrees. The DWR Central District operates and maintains the largest Delta-wide network with 48 continuously monitoring tide stations in the Delta. A continuous station in New Jerusalem Drain is funded by the San Joaquin Valley Drainage Authority (SJDVA). The IEP EMP has 7 continuous multiparameter monitoring sites representing the main inflows and outflows of the central Delta. Other Delta-wide continuous water quality monitoring networks include the Delta Flows Network (30 sites; USGS) and D-1641 Continuous Recorder Sites (16) sites; DWR, Reclamation, and USGS⁵. MWQI (DWR) continuously monitors four integrator stations representing the main river inflows (Sacramento River at Hood and San Joaquin River at Vernalis) and the intakes of the Central Valley Project (Jones Pumping Plant) and State Water Project (H.O. Banks Pumping Plant). MWQI also conducts discrete sampling at these four locations on a bi-weekly basis. The DMC water quality monitoring program has a network of continuous monitoring “checks” along the canal. One check near DMC headquarters is inside the legal Delta

Receiving Water Monitoring Sites

- *A total of ten agricultural discharge indicator sites are located in representative canals, sloughs, and drains of Delta islands.*
- *Stormwater-related indicator sites in receiving waters are located in the Sacramento River in the Sacramento urban area, and in the San Joaquin River, Stockton Deep Water Ship Channel, and other waterways in the Stockton urban area.*
- *Wastewater dischargers are located peripherally around the inner Delta and their local monitoring sites are more or less aligned along the major waterways of the Delta, the Sacramento, San Joaquin, and Old Rivers.*

Receiving water monitoring sites (Map B.2) can be grouped into two types: 1) non-point source indicator sites and 2) point-source indicator sites.

Non-point source indicator sites include monitoring sites of ILRP and the stormwater monitoring

⁵ Some D-1641 recorder sites are also parts of other Delta networks: sites maintained by DWR are part of the Central Districts’ surface water monitoring network, and sites maintained by USGS are part of the Delta Flows Network. Several continuous recorders are maintained by the DWR Environmental Water Quality and Estuarine Studies Branch.

DRAFT FINAL

programs in the Delta. Non-point source indicator sites are selected to characterize water quality issues from a specific non-point source, such as monitoring the effects of a specific type of land use or discharge. Non-point source indicator sites are typically located in stream and river segments upstream of the major river confluences as well as in in-Delta sloughs and drains discharging to major waterways in the Delta.

The Sacramento Valley Water Quality Coalition is currently sampling five sites in the North Delta (Grand Island Drain, Shag Slough, Tule Canal, Ulatis Creek, and Z Drain), and the San Joaquin County & Delta Water Quality Coalition is currently sampling four island drains in the Central and South Delta (Roberts Island, South Webb Tract, Terminous Tract, and Walthall Slough). The South San Joaquin Irrigation District monitors one site in a drain in the South Delta (Drain 11 at Walsal Slough).

In the Sacramento urban area, the monitoring sites of SSQP are selected to characterize urban storm water discharges and its effects on receiving waters in urban areas of Sacramento County. The monitoring stations (river, urban tributaries, and urban discharge) are distributed across the permit area. Within the legal boundary of the Delta, the SSQP is monitoring one sampling location located along the Sacramento River at the Freeport Bridge, in coordination with the Sacramento CMP.

There is also a stormwater program under way in the Stockton urban area that includes receiving water monitoring sites in the Stockton Deep Water Ship Channel, Calaveras River, Mosher Slough, Smith Canal, and Duck Creek. The Stockton Port District MRP includes receiving water sites in the San Joaquin River, Deep Water Ship Channel, and Burns Cutoff. These are separate monitoring programs required under two different permits and are currently not coordinated.

NPDES self-monitoring programs of regulated point-source dischargers collect samples at indicator sites in receiving waters upstream and downstream of their point of discharge. Monitoring sites at receiving waters include locations along the San Joaquin River (18 sites); Old River (8 sites); Sacramento River (11 sites⁶); Deuel Drain, Dredger Cut, Marsh Creek, and Snodgrass Slough (2 sites each); and Bishop Cut, Grant Line Canal, Highline Canal, White Slough, and Wicklund Cut (1 site each).

Water Supply Monitoring Sites

MWQI maintains a monitoring network representing the main in- and outflows of the Delta, and the major water intakes to the SWP and CVP. The SWP Water Quality Monitoring Program and CCWD monitor for water supply purposes at sites near the intakes or inside their conveyance systems in the Delta.

Water supply monitoring sites are typically located near water intakes and inside the water conveyance system of water suppliers. MWQI has nine sampling sites in the Delta, four of which have real-time sampling capabilities, that were selected based on logistical considerations and the availability of existing long-term data records. CCWD monitors source water at four locations covering the West (Mallard Slough intake), Central (Contra Costa Canal near Rock Slough and the Contra Costa Canal pumping plant), and South (Old River intake) Delta. The SWP Water Quality Monitoring Program monitors two

⁶ These sites are: Delta King, Miller Park, Captain's Table, Wooden Stairs, Freeport, Cliffs Marina, River Mile 44, Receiving Water Site 4 downstream and offshore from the City of Rio Vista Northwest WWTF point of discharge to the Sacramento River, and Receiving Water Sites 1 (upstream), 2 (downstream), and 3 (downstream) of the City of Rio Vista Beach WWTF. The three sites monitored by the Sacramento Regional WTP P4 (Freeport upstream of the Sacramento Regional WTP, Cliffs Marina, River Mile 44) are included in this count.

DRAFT FINAL

locations near the intake of the California Aqueduct in the South Delta (Clifton Court Forebay and Harvey O. Banks Pumping Plant Headworks) and one near the intake of the North Bay Aqueduct in the North Delta (Barker Slough Pumping Plant).

Regional and Watershed Program Monitoring Sites

IEP EMP monitors 12 sites in the Delta representing the main inflows and outflows. NAWQA, SWAMP, the San Francisco Bay RMP, and the Sacramento CMP each visit one or more selected integrator or indicator sites near the end of major watersheds or legal boundaries.

The IEP EMP is the most comprehensive regional monitoring program in the Delta. The IEP study area includes the entire Delta within its legal boundaries, as well as portions of Suisun and San Pablo Bays, with 22 sites representing the main inflows and outflows. Currently, 12 sites in the Delta are sampled by the IEP EMP. Other regional or watershed monitoring programs visit a few selected indicator or integrator sites in the Delta.

An integrator site is usually at the downstream end of a basin and is representative of the effects of a variety of land-uses and other variables on metrics such as water quality or biological communities. The main integrator sites in the Delta are Hood (Sacramento River), Vernalis (San Joaquin River) and Mallard Island (Delta outflow). These sites or nearby locations are part of all Delta-wide monitoring efforts. The following monitoring efforts are monitoring one or several integrator sites in the Delta.

The SWAMP monitors two integrator sites in the Delta, Sacramento River at Hood and San Joaquin River at Airport Way. These two sites represent discharge points at the base of the Sacramento River and San Joaquin River Basins and are most likely to characterize accumulation of contaminants from the total watershed. As such key locations, they are monitored by various programs and offer potential for collaboration with both internal programs (e.g. TMDL, and Grants) and external stakeholders (e.g. Department of Water Resources). The two sites are part of an integrator network of 30 sites that are intended to serve as a long-term framework for a Central Valley trend monitoring program as well as part of the Statewide Stream Contaminant Trend Monitoring Program. Site selection criteria that were specifically identified by the Stream Contaminant Trend Monitoring program include:

- contamination potential: the site represents changes in contaminant concentration and effects over time and in relation to human activity
- availability of previous data on sediment contaminant concentrations, biological impacts, and other relevant water quality data;
- site-specific conditions are appropriate for contaminant monitoring (depositional areas, sufficient flow, appropriate channel morphology, substrate, availability of fine-grained depositional sediment, etc.);
- safe access by boat is available;
- location near stream gauges, and
- collaboration potential with other organization monitoring at or near the site (e.g. IEP and DWR).

The Agricultural Subsurface Drainage Program collects data at the San Joaquin River at Vernalis/Airport Way as the discharge point of the San Joaquin River basin.

DRAFT FINAL

The USGS NAWQA program maintains integrator sites at the bottom of the Sacramento and San Joaquin watersheds and in the Yolo Bypass. In general, NAWQA sites are located near discharge points of large watersheds characterized by heterogeneous land uses. NAWQA monitoring sites in the Delta include Sacramento River at Freeport, San Joaquin River at Vernalis, and Yolo Bypass at I-80.

The San Francisco Bay-focused RMP for Water Quality in the Estuary visits two sites near Sherman Island in the San Joaquin and Sacramento Rivers as part of its annual sampling campaign. These sites represent integrator sites near the termini of both rivers at the Delta outflow. These sites have been selected as integrator sites to characterize the quality of water entering San Francisco Bay and leaving the Delta.

The Sacramento CMP is monitoring two sampling locations along the Sacramento River (Freeport and River Mile 44) just inside the northern legal boundary of the Delta. Monitoring sites have been selected to provide water quality data to assess the influence of urban inputs from the Sacramento community.

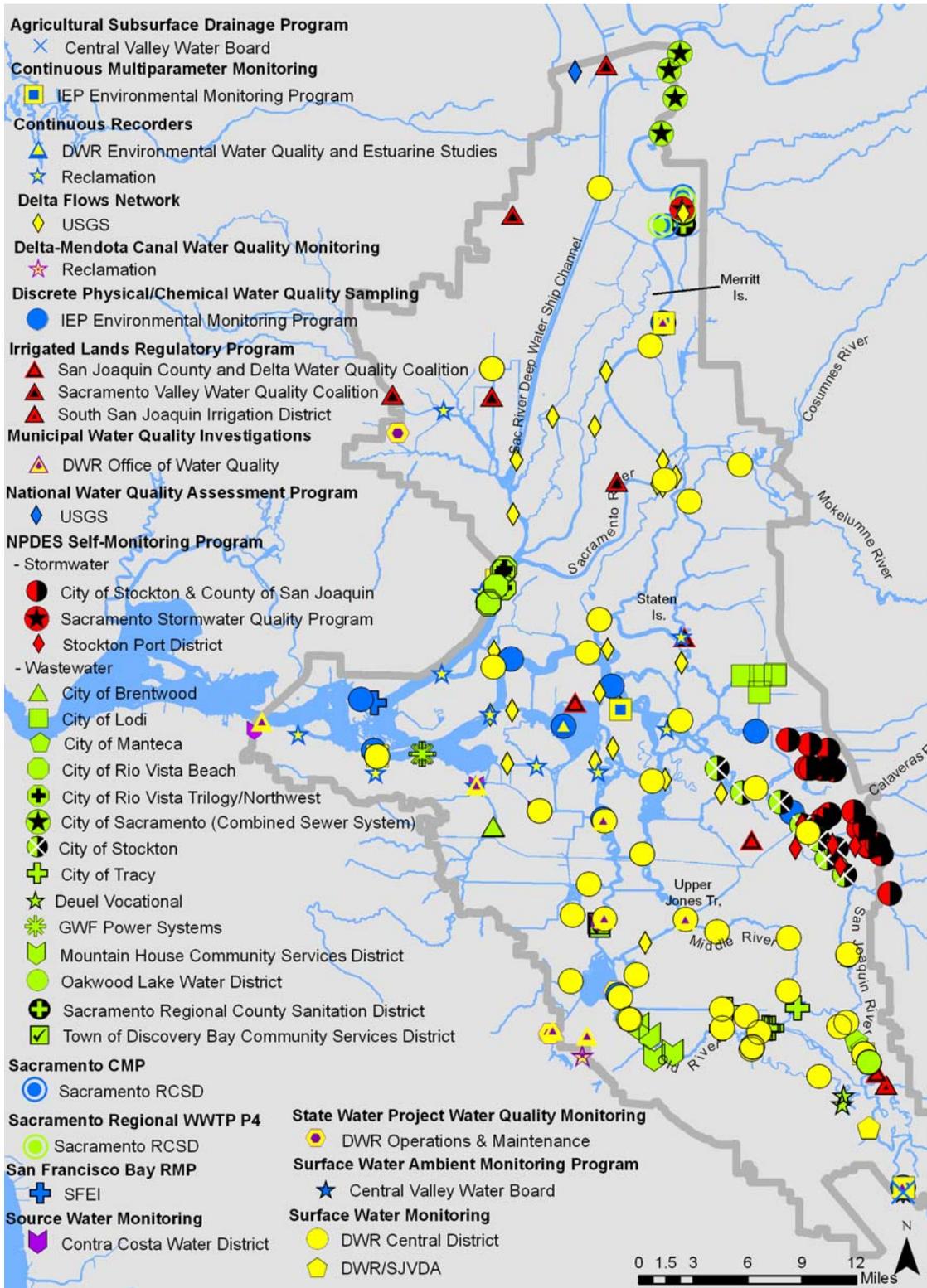


Figure 1. Overview of Delta monitoring sites by program. See Appendix A for more detailed maps of monitoring sites by program.

Approaches and Parameters

Table 4 provides an overview of the approaches, geographic coverage, and parameters used by ongoing long-term monitoring efforts. Appendix C contains maps showing monitoring sites for selected parameters coded by monitoring category and program.

Continuous Monitoring

Continuous monitoring focuses mainly on flow and general water quality characteristics such as salinity, temperature, and turbidity with limited coverage of a few other parameters such as chlorophyll fluorescence, organic carbon, and nutrients. IEP EMP and MWQI augment the continuous network monitoring with monthly grab samples.

The extensive DWR Central District Surface Water Monitoring network provides continuous data of flow magnitude and direction and general chemical water quality characteristics. Electrical conductivity (EC) is measured continuously at 24 of these stations. Measurements are recorded at 15-minute intervals and then reduced to a report format. At each EC site, equations are available to convert EC to chlorides and total dissolved solids. Several of the EC stations in the Delta also continuously monitor temperature and provide 15-minute temperature data.

The Delta Flows Network provides continuous data of flow and general water quality, including chlorophyll a measurements at some sites.

Continuous monitoring sites mandated by Water Right Decision 1641 include continuous recorders and multiparameter stations⁷:

- Continuous recorder: continuous recording (every 15 minutes) of water temperature, electrical conductivity and/or dissolved oxygen.
- Multiparameter: continuous multiparameter monitoring (every 15 to 60 minutes) of water temperature, EC, pH, dissolved oxygen, turbidity, chlorophyll fluorescence, tidal elevation; and meteorological data (air temperature, wind speed and direction, solar radiation).

MWQI continuous monitoring stations provide real-time sampling of total and dissolved organic carbon [TOC/DOC] at all four stations, and bromide, chloride, nitrate, sulfate, and fluoride at San Joaquin River near Vernalis and Delta P.P. Headworks (Banks). The SWP continuous monitoring stations in the Delta provide real-time measurements of EC, pH, temperature, turbidity, and UV. The DMC Water Quality Monitoring Program continuously monitors salinity in water exports carried south to the San Joaquin Westside by the DMC.

Receiving Water Monitoring

- *Stormwater management programs monitor a wide range of parameters at urban runoff sites and in receiving waters. Measured parameters include general water quality as well as contaminants such as mercury and other metals, nutrients, pathogens, and pesticides.*
- *The agricultural water quality coalitions have selected a total of 10 sites representative of agricultural-derived*

⁷ Not all parameters (or constituents) listed under a monitoring type are required at all stations.

DRAFT FINAL

discharges from Delta islands for a targeted monitoring approach. Parameters include general water quality, nutrients, metals, pesticides, and toxicity.

The scope of parameters measured by wastewater dischargers can differ widely and depends on the discharge volume, its origins and composition, and the extent of integration with other monitoring efforts. Some of the NPDES self-monitoring is limited to general water quality characteristics such as salinity, oxygen, pH and temperature, while other compliance monitoring efforts analyze for a whole suite of contaminants that may include disinfection byproducts, metals, mercury, nutrients, pathogens, pesticides, organic contaminants, and toxicity.

Stormwater programs in the Sacramento and Stockton urban area combine area-wide monitoring (network monitoring) with targeted monitoring and research studies. SSQP collects urban runoff data from representative long-term urban discharge monitoring sites and coordinates with the Sacramento CMP to monitor representative sites in the Sacramento River. Within the legal Delta, the stormwater monitoring program currently monitors one site along the Sacramento River at Freeport Bridge. The program collects data to quantify long term trends of a core list of constituents and includes less frequent monitoring of a longer list of constituents for “screening” efforts to modify the core constituent list. The Stockton Stormwater Monitoring Program monitors receiving water sites in the Stockton Deep Water Ship Channel, Calaveras River, and smaller water bodies in the Stockton urban area. The Port of Stockton monitors receiving water sites in the San Joaquin River, Stockton Deep Water Ship Channel, and Burns Cutoff.

River monitoring for SSQP in the Sacramento River at Freeport is done in partnership with the Sacramento CMP (see Regional and Watershed Monitoring below) at least six times a year. The samples are analyzed for many pollutants including bacteria, metals, pesticides, and herbicides. Toxicity testing will also be performed during the current permit term (2008-2013). The testing includes toxicity evaluations on water flea (*Ceriodaphnia dubia*) and fathead minnow (*Pimephales promelas*).

The agricultural coalitions conduct targeted monitoring studies with an emphasis on characterizing agricultural-derived discharges and documenting the effectiveness of BMPs. Ambient monitoring of agricultural discharge is accomplished using three types of monitoring: assessment, core, and special project monitoring. Assessment monitoring is conducted at newly established monitoring sites or sites that have not been fully characterized, as well as during every third year of core site monitoring. Assessment monitoring consists of monthly sampling for general physical parameters (including flow), nutrients, pathogens, metals, pesticides, and toxicity. All coalitions measure sediment toxicity at some sites. Core site monitoring utilizes a trend monitoring approach at sites where assessment monitoring has already been conducted, or at other sites demonstrated to be appropriate for long-term trend monitoring, and that have been adequately characterized. The core monitoring occurs on a monthly basis, and consists of nutrients, general physical parameters (including flow), and pathogens, as well as other parameters specifically requested by the Regional Water Board. Special project monitoring occurs at locations where waste-specific monitoring or targeted source identification studies must take place. This includes monitoring where the Coalition or another entity is implementing an applicable TMDL or specific targeted studies for the implementation of a Coalition Management Plan that results from exceedances. Management Plans are required when more than one exceedance of the same constituent has occurred at a given site during a three year period.

NPDES Self-Monitoring Programs of point dischargers in the Delta (businesses, cities, counties, municipalities, and state permittees) conduct sampling of receiving water sites up- and downstream of the point of discharge. Constituents and sampling frequency vary between permits and monitoring is

DRAFT FINAL

often limited to periods when there are effluent discharges. Receiving water samples are typically grab samples and analyses commonly include general water quality characteristics (DO, temperature, pH, turbidity, EC), major ions (chloride), metals and trace elements (copper), nutrients (ammonia, nitrate), pathogens (fecal coliform), and toxicity. The sampling frequency can range from weekly to annual monitoring and varies among constituents. Receiving water monitoring requirements are subject to change every five years (per permit cycle) for NPDES permits.

Water Supply Monitoring

MWQI, the SWP Water Quality Monitoring Program, and CCWD monitor general water quality and a wide range of constituents of concern for drinking water, including nutrients, OC, pathogens, and pesticides. The DMC Water Quality Monitoring Program monitors salinity and selenium in Delta water exports to the San Joaquin Westside.

MWQI and the SWP Water Quality Monitoring Program combine continuous monitoring (see above) with monthly grab sampling (general water quality, TOC/DOC, metals, nutrients, and disinfection byproducts). The SWP Water Quality Monitoring Program maintains and operates a network of stations throughout the entire SWP. In the Delta, the program conducts monitoring of general water quality near the intakes of the California and North Bay Aqueducts. CCWD monitors source water by means of a regional monitoring network that includes four sites in the West, Central, and South Delta near its Delta water intakes. Biological assessments (algae etc.) are performed weekly; most other parameters (including general water quality, major ions, nutrients, TOC, pathogens, and metals) are measured monthly. Additionally, CCWD monitors salinity (EC and chloride concentration) and alkalinity on a daily basis. The DMC Water Quality Monitoring Program conducts continuous monitoring for salinity and monthly grab sampling to determine selenium concentrations in water exports carried south to the San Joaquin Westside by the DMC.

Regional and Watershed Monitoring

- *The IEP EMP conducts discrete monitoring of general water quality, nutrients, phytoplankton, zooplankton, and benthos at 12 sites representing main in- and outflows of the Delta.*
- *USGS monitors general water quality, mercury, nutrients, and pesticides at integrator sites at the bottoms of the Sacramento and San Joaquin watersheds and in the Yolo Bypass.*
- *The SWAMP Statewide Stream Contaminant Trend Monitoring program will take sediment samples annually at Sacramento River at Hood and San Joaquin River at Airport Way (Vernalis) for contaminant analysis and toxicity testing. A Central Valley Water Board Seasonal Trend study is linked to the statewide program and analyzes water quality and water column toxicity four times per year.*
- *The San Francisco Bay RMP measures water and sediment chemistry and toxicity at two stations near the confluence of the San Joaquin and Sacramento rivers and collects bivalves as biosentinels for tissue analyses of mercury and other metals.*
- *The Sacramento CMP tests for general water quality, nutrients, and toxic contaminants at two receiving water sites in the Sacramento River.*

Regional and watershed monitoring includes the IEP EMP and studies in regions overlapping the Delta or in subregions of the Delta (Map B.4).

The IEP EMP combines continuous multiparameter monitoring (see above) at 7 sites with discrete

DRAFT FINAL

physical/chemical water quality sampling at 12 sites representing main in- and outflows of the Delta. The discrete sampling is conducted by the DWR and includes the following types of monitoring:

- Physical-chemical: discrete physical-chemical monitoring (near-monthly) of macronutrients (inorganic forms of nitrogen, phosphorus, and silicon); total suspended solids; total dissolved solids; total, particulate and dissolved organic nitrogen and carbon; chlorophyll a, DO, EC (specific conductance), turbidity, Secchi depth, and water temperature.
- Phytoplankton: Discrete sampling for phytoplankton enumeration or algal pigment analysis (near-monthly).
- Zooplankton: Tow or pump sampling for zooplankton, mysids, and amphipods (near monthly).
- Benthos: Benthos and sediment grab samples (quarterly or monthly).

EMP discrete physical/chemical sampling sites represent the main inflows and outflows of the Delta. Most of the current sampling stations and variables have been monitored since 1970. Beginning in 1975, the water quality sampling times were planned to occur within a one hour window of the expected occurrence of high tide slack at the sampling location. Since 1995, samples are acquired monthly. Vertical and horizontal profiles are also conducted monthly at all zooplankton tow sites for the following constituents: water temperature, dissolved oxygen concentration, specific conductance, turbidity, and chlorophyll a in vivo fluorescence.

Regional monitoring programs with sampling sites inside and outside the legal Delta include the RMP for Water Quality in the Estuary (focus on San Francisco Bay, hence also referred to as the San Francisco Bay RMP), the Sacramento CMP (focus on the Sacramento urban area), and ambient surface water monitoring programs of the Central Valley Water Board.

The San Francisco Bay RMP visits two Delta sites in its annual sampling cruise, Sacramento River and San Joaquin River. The stations are close to the confluence of the two rivers near Mallard Island. Parameters measured in the water column include general water quality, chlorophyll, mercury, metals, and pesticides. Sediment samples are analyzed for mercury, metals, nutrients, and organic contaminants such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and polybrominated diphenyl ethers (PBDEs). Mussels are collected and analyzed for mercury and other metals. The RMP also measures loads of pollutants from the Delta to the San Francisco Bay, with an event-based approach where data are collected every five years. Water and sediment toxicity are tested as well. The San Francisco Bay RMP is the only program that includes tissue analyses in its routine measurements.

Sampling under the Ambient Monitoring Program of the Sacramento CMP began in December 1992 and continues at present in coordination with SSQP (see Receiving Water Monitoring above). The current sampling is on an event basis and includes 3 storm events and 3 fixed events in February, June and October. The cooperative effort saves money and achieves the goal to develop high quality data in the most cost effective manner. Two sites within the legal Delta, Sacramento River at Freeport and River Mile 44, are sampled 6-8 times per year. These samples are composite collected over the cross-section of the river to have representative water quality data. The Sacramento CMP tests for a variety of water quality constituents and contaminants, such as nutrients, toxins (e.g., metals, pesticides, herbicides, and organic pollutants), sanitary waste and associated pathogens, and general water quality characteristics

DRAFT FINAL

(e.g., water temperature, pH, dissolved oxygen, suspended sediments, and organic carbon). The program routinely modifies its analysis regimen to identify emerging pollutants of concern.

By collecting samples throughout the year and under varying weather conditions, the Sacramento CMP partnering agencies identify water quality conditions, trends, and influences that are important for defining the health of the river system. One of the primary data uses is to examine correlation between changes in pollutant concentrations and river flows or other seasonal factors. Data from the program are shared with a wide group of stakeholders that includes regulatory and other public agencies, nonprofit organizations, the general public, and private companies to enhance other environmental efforts in the region. A technical report of Sacramento CMP sampling results is published annually and all data are archived for historical reference.

The Central Valley Water Board conducts two ongoing regional efforts that extend to the Delta. The SWAMP Seasonal Trend Monitoring at Central Valley Integrator sites will monitor DOC/TOC, water chemistry, pathogens, and water toxicity at Hood and Vernalis four times per year. The Agricultural Subsurface Drainage Program collects data on six lower San Joaquin River sites, including Vernalis, to support the Salt and Boron and Selenium TMDLs and provide general water quality trend information. The program samples weekly for selenium, boron, specific conductivity (SC), pH, temperature and DO; monthly for molybdenum; and twice a month for *Escherichia coli* (*E.coli*).

Statewide monitoring: SWAMP Stream Contaminant Trend Monitoring collects depositional sediments from Integrator Sites at Sacramento River at Hood and San Joaquin River at Airport Way once per year (spring into summer) and measures concentrations of trace metals, pesticides, polychlorinated biphenyls (PCBs), total phosphorus, TOC, and sediment grain size. In addition, sediment toxicity is measured using a representative benthic invertebrate (the amphipod *Hyaella azteca*).

National monitoring includes two USGS programs, NAWQA and the Trend Network for Streams. NAWQA implements a nationally consistent study design which allows comparisons among river basins and comprehensive national evaluations of pesticides, nutrients, and trace elements. The Trend Network for Streams focuses on the chemical and physical quality of stream ecosystems. Typical parameters include general water quality (DO, EC, pH), mercury, nutrients, and pesticides.

DRAFT FINAL

Table 4. Monitoring approaches and parameters. See text for details and explanation of terms.

Program	Approach (No of sites)	Scale	Area	Parameters ^A																
				Bioassessment	Bulk organics	Disinfection Byproducts	DOC/TOC	Flow	General Water Quality	Major Ions	Mercury	Metals & Trace Elements	New & Emerging Contaminants	Nutrients	Organic Contaminants	Pathogens	Pesticides	Sediment Chemistry	Sediment Toxicity	Tissue Chemistry
Continuous Monitoring																				
IEP EMP – Continuous multi-parameter monitoring	Delta network (7)	Regional	Delta					✓	✓	✓										
Continuous Recorders ^B	Delta network (16)	Delta	Delta					✓	✓											
Delta Flows Network (USGS)	Delta network (30)	Delta	Delta	✓				✓	✓											
DMC WQ Monitoring Program (Reclamation)	Water conveyance (1)	Delta	Delta					✓	✓			✓								
Surface Water Monitoring (DWR) ^C	Delta network (49)	Delta	Delta					✓	✓											
SWP WQ Monitoring (Continuous Sites) (DWR)	Supply (3)	State	SWP						✓											
MWQI – Real-time Sampling (DWR)	Delta network (4)	Delta	Delta				✓			✓				✓						
Receiving Water Monitoring																				
ILRP – Sac Valley Coalition	Source (5)	Targeted	North Delta				✓	✓	✓	✓				✓		✓	✓		✓	
ILRP – SJ Co. & Delta Coalition	Source (4)	Targeted	Central and South Delta				✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓
ILRP – South San Joaquin ID	Source (1)	Targeted	South Delta				✓		✓	✓				✓			✓			
NPDES Stormwater – City of Stockton/San Joaquin Co.	Source (23)	Regional	Stockton urban		✓		✓		✓		✓	✓		✓		✓	✓		✓	✓

^B This includes continuous recorders associated with D-1641 and maintained by DWR and Reclamation.

^C This includes DWR Central District stations and the continuous station at New Jerusalem Drain funded by the San Joaquin Valley Drainage Authority.

DRAFT FINAL

Program	Approach (No of sites)	Scale	Area	Parameters ^A																	
				Bioassessment	Bulk organics	Disinfection Byproducts	DOC/TOC	Flow	General Water Quality	Major Ions	Mercury	Metals & Trace Elements	New & Emerging Contaminants	Nutrients	Organic Contaminants	Pathogens	Pesticides	Sediment Chemistry	Sediment Toxicity	Tissue Chemistry	Water Toxicity
NPDES Stormwater – Stockton Port District	Source (5)	Regional	Stockton urban		✓				✓	✓	✓	✓		✓	✓						
NPDES Stormwater – County of Sacramento, Cities of Citrus Heights, Elk Grove, Folsom, Galt, and Sacramento	Source (1)	Regional	Sac R	✓			✓		✓	✓	✓	✓		✓	✓	✓	✓				✓
NPDES – City of Brentwood	Source (3)	Local	Marsh Creek					✓	✓	✓	✓	✓		✓	✓						✓
NPDES – City of Lodi	Source (5)	Local	Sac R			✓	✓		✓	✓	✓	✓		✓	✓	✓	✓				✓
NPDES – City of Manteca	Source (4)	Local	SJR					✓	✓	✓	✓	✓		✓	✓	✓	✓				✓
NPDES – City of Rio Vista, Trilogy / Northwest	Source (4)	Local	Sac R					✓	✓	✓		✓		✓	✓						✓
NPDES – City of Rio Vista, Beach	Source (3)	Local	Sac R					✓	✓	✓	✓	✓		✓	✓						✓
NPDES – City of Sacramento CSS	Source (4)	Local	Sac R						✓												
NPDES – City of Stockton WWTP	Source (5)	Local	SJR	✓		✓		✓	✓	✓	✓	✓		✓	✓	✓	✓				✓
NPDES – City of Tracy	Source (6)	Local	Old R			✓	✓		✓	✓	✓	✓		✓	✓	✓	✓				✓
NPDES – Deuel Vocational Inst.	Source (2)	Local	SJR						✓	✓				✓		✓					✓
NPDES – GWF Power Systems	Source (2)	Local	SJR						✓	✓		✓			✓		✓				✓
NPDES – Mountain House CSD	Source (4)	Local	Old R			✓	✓		✓	✓	✓	✓		✓	✓		✓				✓
NPDES – Oakwood Lake Water District (Brown Sand, Inc.)	Source (2)	Local	SJR						✓	✓		✓		✓							
NPDES – Sacramento RCSD	Source (2)	Local	Sac R					✓	✓	✓	✓	✓		✓	✓						✓
NPDES – Town of Discovery Bay	Source (2)	Local	Old R					✓	✓	✓						✓					✓
Sacramento WWTP P4	Source (3)	Local	Sac R				✓		✓	✓	✓	✓		✓	✓		✓				
Water Supply Monitoring																					
CCWD Source Water	Supply (4)	Regional	West, Central & South Delta	✓			✓		✓	✓		✓		✓		✓					
SWP WQ Monitoring Program (DWR)	Supply (3)	State	SWP				✓		✓	✓	✓	✓		✓	✓		✓				

DRAFT FINAL

^A Examples for parameters in each parameter group:

Bioassessment: chlorophyll a, algae, bacteria, viruses, macroinvertebrates, fish

Bulk organics: oil and grease, humic and fulvic acids

Disinfection byproducts: trihalomethanes, trihalomethane-forming potential (THMFP)

DOC/TOC: dissolved and total organic carbon

Flow: magnitude and direction of streamflow, tide height, water currents, wind

General Water Quality: temperature, pH, dissolved oxygen, EC, turbidity, color, alkalinity

Major ions: calcium, chloride, magnesium, potassium, silica, sodium, sulfate

Mercury: methyl mercury

Metals & Trace Elements: aluminum, arsenic, cadmium, chromium, copper, iron, lead, mercury, selenium, zinc

New and emerging contaminants: pharmaceuticals and personal care products, antibiotics, flame retardants, stain repellents, lubricants, industrial detergents

Nutrients: biological oxygen demand (BOD), nitrate, nitrite, ammonium, organic nitrogen, phosphorus

Organic Contaminants: volatile organic compounds (VOCs), PCBs dioxins, furans, PAHs

Pathogens: fecal coliforms, total coliforms, Cryptosporidium, E. coli, Giardia, fecal Streptococcus

Pesticides: carbamates, organophosphates (chlorpyrifos, diazinon), pyrethroids, legacy pesticides (chlordane, DDT, dieldrin)

Sediment Chemistry: contaminant concentrations in sediment cores

Sediment Toxicity: chronic and acute toxicity testing

Tissue Chemistry: contaminant concentrations in fish tissue

Water Toxicity: chronic and acute toxicity testing

Data Availability

There is currently no single online access point for Delta surface water data. Main online data access points for Delta surface water information are BDAT, the SWAMP databases/CEDEN, CDEC, WDL, and NWIS.

Surface water monitoring programs in the Delta collect data for various purposes and uses, and there are also variations in data management protocols, storage, availability, and access points. Although most data are probably stored electronically by now, not all data are readily available online. Table 5 provides a condensed overview of data products by program.

Public Databases

Many but not all Delta water quality data are available online in one of the five primary databases: BDAT, the SWAMP databases/CEDEN, CDEC, WDL, and NWIS. All of these databases are public.

BDAT contains environmental data (i.e., water quality, biological, and meteorological) concerning the San Francisco Bay-Delta and provides public access to that data. *BDAT* is a DWR maintained application. Data currently available for download through the *BDAT* web interface include both discrete and continuous monitoring data collected by IEP EMP, MWQI, SWP, USGS, and others. Data are posted in *BDAT* after being checked by DWR staff for accuracy and completeness.

SWAMP/CEDEN data centers. There are currently three SWAMP databases storing Delta water quality data hosted by the Regional Data Centers (RDCs) at University of California at Davis (UC Davis), SFEI, and Moss Landing Marine Laboratories (MLML). Only the SWAMP datasets stored by SFEI and MLML are currently available online, although SWAMP data for the San Joaquin River Basin are posted on the Central Valley Water Board SWAMP website. ILRP data for the Central Valley region are managed by the UC Davis RDC, which currently has no online access capabilities⁸. Once the coordinated RDC network called *CEDEN* comes online, all SWAMP databases will be accessible for online data retrieval. Data managed and made available to the public by SWAMP/CEDEN must meet SWAMP database comparability and quality assurance comparability requirements.

CDEC is DWR's main access point for real-time hydrological data and also includes some real-time water quality data. Users can retrieve real-time monitoring data by entering the site code of a station of interest. *CDEC* includes continuous surface monitoring data collected by Central District, the SWP Water Quality Monitoring Program, and MWQI. It also includes a subset of continuous IEP EMP data. *CDEC* data are "real-time" data and become available immediately as they are being recorded. Most real-time posted on *CDEC* are reported and stored without any filtering or back-calibrating.

WDL is the main database for DWR's water quality monitoring programs, including IEP EMP, MWQI, and SWP Water Quality Monitoring Program. Data are posted in *WDL* after being checked for accuracy and completeness.

⁸ ILRP data are currently available on-line at the Regional Board's Irrigated Lands Regulatory Program – Monitoring Activity webpage (http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/monitoring/index.shtml)

DRAFT FINAL

Table 5. Data products and online access of Delta monitoring programs.

Program	Data Access/Products	Online database
Continuous Monitoring		
Continuous Multiparameter Monitoring (IEP EMP)	Multi-year reports, newsletter updates, online access	BDAT, CDEC, WDL
Continuous Recorder Sites	Online access	BDAT, CDEC
Delta Flows Network	Online access	CDEC, NWIS
Delta-Mendota Canal Water Quality Monitoring	Monthly reports	no
Surface Water Monitoring (DWR)	Online access	CDEC
Receiving Water Monitoring		
Irrigated Lands Regulatory Program	EDDs ⁹ , reports to CV Water Board	CV Water Board ILRP website
NPDES Self Monitoring Program	Discharger Self-Monitoring and Annual Reports to Central Valley Water Board	no
Sacramento Regional WWTP P4	By request	no
Water Supply Monitoring		
Municipal Water Quality Investigations	Online access, summary reports	CDEC, WDL
Source Water Monitoring (CCWD)	By request	CDEC (daily chloride measurements)
State Water Project Water Quality Monitoring Program	annual report, online access	CDEC, O&M website
Regional and Watershed Monitoring		
Agricultural Subsurface Drainage Program	Online access, summary reports	CV Water Board SWAMP website
Discrete Physical/Chemical Water Quality Sampling (IEP EMP)	Multi-year reports, newsletter updates, online access	BDAT, CDEC, WDL
National Water Quality Assessment Program	Online access, USGS reports	NWIS
Sacramento CMP	Annual report (on-line), data by request	no
San Francisco Bay RMP	Annual report, newsletter, online access, synthesis report	SFEI SWAMP database
Surface Water Ambient Monitoring Program	Annual interpretive report, newsletters, factsheets, online access, web links	SWAMP database, Central Valley Water Board SWAMP website

⁹ Electronic Data Deliverables

DRAFT FINAL

NWIS is the USGS Water-Quality Web Service and provides access to water data collected by USGS, including Delta flow and water quality. On NWIS, the unit values are available for 31 days only and then taken offline. Historical long-term monitoring records are maintained as daily values and are updated daily. Data sharing capabilities between NWIS and U.S. EPA's STORET data warehouse have been recently developed, as a result of a collaboration to provide water-quality station and result information in the same format. California's SWAMP is also currently collaborating with U.S. EPA on an exchangeable data format. Most USGS data (except for data made available in real-time through CDEC) are thoroughly screened before public release according to the agency's quality assurance programs.

Reporting, Availability, and Uses of Delta Monitoring Data

A comprehensive search for Delta water quality data will require accessing several databases and making specific requests for additional data sources that are not available online. Some programs have strong public outreach components and prioritize making data broadly available through public databases and synthesis reports, including MWQI, SFEI, NAWQA, and SWAMP. Receiving water monitoring data from stormwater programs and wastewater dischargers are currently not available online. ILRP data are available on the Central Valley Water Board's ILRP website. Primary uses for data collected in the Delta are to assess regulatory compliance and inform 305[b] reporting and 303[d] listing as required by the Clean Water Act, guide water operations, and evaluate the success of specific pollution control efforts. Inconsistencies in the way data are collected, formatted, and stored make it difficult to obtain timely access to monitoring data results and combine data for broader analyses.

The DWR Central District provides continuous data on surface water conditions for the broad purpose of informing water management and planning activities within its boundaries. Some but not all stations are accessible real-time through CDEC. For those that are, data are telemetered hourly (every fifteen minutes during events).

The Delta Flows Network provides continuous flow information to inform water operations and provide a hydrological data framework for water quality and supply studies in the Delta. Real-time data from the USGS Flows Network are available through NWIS and for some but not all stations through CDEC. Daily values are updated daily on NWIS and CDEC. Special studies records are available by request from Jon Burau (jrburau@usgs.gov) or Cathy Ruhl (caruhl@usgs.gov).

The DMC Water Quality Monitoring Program produces monthly data reports of flows, concentrations, and loads that are available by request. Data are reviewed by a quality assurance team and typically made available within 6 weeks from the end of data collection.

MWQI and the SWP Water Quality Monitoring Program inform water supply agencies and project operations on Delta water supply quality. Daily results (and hourly results during events) of continuous monitoring data from the SWP Water Quality Monitoring Program and MWQI are available on CDEC. MWQI posts monthly results of discrete sampling within two months on WDL and also provides a weekly report available at their website or by subscription that synthesizes and summarizes their monitoring and modeling data. In addition, MWQI publishes a biennial report interpreting the results of their grab sample data. The SWP Water Quality Monitoring Program posts monthly grab sample summaries within four to six weeks on the DWR Operations & Maintenance website. Both programs also summarize results in periodic DWR reports, and the SWP Water Quality Monitoring Program publishes an annual water quality report within four to five years of data collection.

DRAFT FINAL

CCWD source water monitoring provides daily chloride measurements for access on CDEC; additional data are available upon request. Recent drinking water quality results and annual drinking water quality reports are available on the CCWD website. However, the treated drinking water quality is not indicative of Delta water quality, because CCWD blends water from a variety of sources in an effort to provide the highest quality drinking water to its customers.

IEP EMP provides necessary information for compliance with flow-related water quality standards specified in the water right permits. In addition, the EMP also provides baseline information on a wide range of chemical, physical and biological variables. All IEP EMP discrete water quality data are made available through BDAT, after they have been reviewed for completeness and accuracy. All continuous water quality data are available on a near real-time basis on-line through CDEC and, once checked, sent to BDAT. The most recent data from IEP EMP that are publicly available through BDAT are currently from January 2007. Monitoring results are analyzed and summarized in annual and occasional multi-year reports and in brief updates in the IEP newsletter. Monitoring results are also occasionally published in peer-reviewed journals. With the exception of real-time data posted on CDEC, all DWR water quality data are reviewed according to DWR's data quality assurance manuals before being made public.

ILRP monitoring data provide a baseline of water quality information to guide day-to-day implementation of the ILRP and inform future decision-making efforts. The coalitions electronically submit data tables and also file reports with the Central Valley Water Board. Data are used to develop water quality management plans and best management practices to protect waters of the State. When elevated levels of farm inputs are identified, steps can be taken to remedy any problems by focusing on specific waterways and the surrounding farm properties. SWAMP-compatible data in EXCEL format are available on the Central Valley Water Board's ILRP website through 2007.

NPDES self-monitoring data are submitted as data tables to the Central Valley Water Board, in the form of Discharger Self-Monitoring Reports. They are primarily used for assessing compliance with discharge requirements in permit orders.

Stormwater program data are submitted to the Central Valley Water Board in an Annual Report and used to assess compliance with permit conditions. This includes 1) estimating the annual pollutant load of the cumulative discharges from all identified outfalls to receiving waters, 2) estimating reductions in loadings of pollutants from discharges of municipal storm sewer constituents from municipal storm sewer systems expected as the result of stormwater program implementation, and 3) monitoring urban runoff as a performance standard to monitor long-term trends in urban storm water quality.

NPDES receiving water compliance data from wastewater facilities and stormwater programs are not available online, but the Discharger Self-Monitoring Reports (wastewater) and Annual Reports (stormwater) are available for review at the Central Valley Water Board offices.

The San Francisco Bay RMP provides information targeted at the highest priority questions faced by managers of the Bay. Program implementation fulfills a NPDES permit requirement for Bay Area dischargers. The RMP produces an Annual Monitoring Report that summarizes the current state of the Estuary with regard to contamination, a summary report (Pulse of The Estuary), a quarterly newsletter, and journal publications that disseminate RMP results to the scientific community. The RMP web site provides access to RMP products and links to other sources of information about water quality in San Francisco Bay. Data collection is completed in August and data are usually made available to the public

DRAFT FINAL

at the annual meeting in October of the following year. San Francisco Bay RMP data are SWAMP compatible with respect to data management and quality assurance procedures

The Sacramento CMP produces an annual report that entails summary statistics, data validation, and time series plots. The annual report is submitted to the Central Valley Water Board as an attachment to the stormwater report. Data undergo a thorough data quality review and are used to demonstrate compliance, assess the effectiveness of control measures, and develop regional policies with regards to TMDLs and NPDES permits. SRCSD does not provide public access to its database but responds to requests for Sacramento CMP and other data. The annual report is released in September, three months after the end of the annual sampling period (July – June).

NAWQA uses data from study units for interpretations in a national context. The data are synthesized and published in USGS reports and are made available online through NAWQA's data warehouse (<http://infotrek.er.usgs.gov/traverse/?p=NAWQA:HOME:0>) and NWIS/STORET. The NAWQA website also features a web mapper and provides access to NAWQA publications. NAWQA data are uploaded to NWIS twice per year. NAWQA reports are available online for downloading free of charge through the USGS Publications Warehouse. Hard copies can be purchased.

The SWAMP Stream Contaminant Monitoring at Integrator Sites program will generate two key products that provide data and information to program clients, an annual interpretive report and downloadable monitoring data through the SWAMP data base.

Annual interpretive reports will be delivered within four months of receipt of all program data from participating laboratories. The report will be completed by the end of February 2011, 16 months after data collection. A fact sheet describing field sampling and toxicity testing will be available within four months of sample collection. Data will be available in the SWAMP data base as soon as it is received from the laboratories and is processed by the data management team.

The data of the SWAMP Seasonal Trends program are being entered into the SWAMP database (therefore will eventually be available through CEDEN) and will be posted annually on the Central Valley Water Board SWAMP website (http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/index.shtml). The data will be assessed in the next cycle of the Integrated Report and published in annual fact sheets summarizing findings. The first fact sheets are planned for next summer.

Data from the Agricultural Subsurface Drainage Program are also available annually on the Central Valley Water Board SWAMP website and have been entered into the SWAMP database so will eventually be available on CEDEN.

It is apparent that monitoring data are dispersed across multiple programs with different data storage approaches. This makes it difficult to identify, locate, access, and use relevant monitoring data for broader analyses. In addition, there are potential issues associated with inconsistencies in the way data are formatted and stored (e.g., lack of conventions for parameter names, site names, and methods). In addition, the geospatial reference systems and basin or watershed boundaries used may vary across programs. In certain instances, these issues make it difficult, if not impossible, for users who are not directly involved in a particular program to obtain timely access to monitoring data and results.

Monitoring Costs

Total annual cost of surface water monitoring in the Delta is estimated to be in the range of \$8 to \$12M.

Approximate costs were obtained as a first step in the process of determining what is currently being spent and seeking opportunities to reduce costs through improved coordination, efficiency, and reduction of redundancies. Table 6 provides a summary of available information on estimated annual costs of the various long-term monitoring activities in the Delta. DWR and Reclamation maintain the largest monitoring efforts in the Delta with annual expenditures exceeding \$5M for water right permit and water supply related monitoring alone. This includes expenditures associated with the IEP, EMP, D-1641 Continuous Recorders, MWQI, and the SWP Water Quality Monitoring Program. It does not include monitoring conducted by DWR's Central District at 48 sites in the Delta, for which there weren't any numbers available. The largest monitoring programs in the Delta are the IEP EMP (approximately \$2.95M annually for 22 sites, with 12 sites in the Delta) and the MWQI (\$3.1 M in fiscal year 2009-2010) for monitoring of 12 sites, with 9 sites in the Delta). IEP EMP is a subset of the total monitoring coordinated and conducted by IEP. The total monitoring costs of all the smaller efforts combined probably range somewhere between \$2 and \$5M annually. Due to the lack of available cost information, it is difficult to estimate the total amount of money spent on monitoring per year. Based on the numbers that were available to us, monitoring expenditures easily exceed \$7M and are most likely considerably higher than that, and including cost estimates for programs spending unknown amounts as well as the reported costs of ongoing multi-year projects (see Appendix D), are more likely in the range of \$8 to \$12M.

DRAFT FINAL

Table 6. Estimate of current monitoring expenditures in the Delta.

Program	Funding Source	Estimated annual monitoring budget (Delta only*)
Agricultural Subsurface Drainage Program	State Water Board	unknown
Continuous Recorder Sites	DWR, Reclamation, SJVDA	\$0.22M (Reclamation sites)
Delta Flows Network	DWR, IEP, Sacramento County, CCWD, City of Stockton	\$2.1M*
Delta-Mendota Canal Water Quality Monitoring Program	Reclamation	\$0.125M (station MP3.5)
DWR Central District - Surface Water Monitoring	DWR	unknown
IEP EMP - Continuous Multiparameter Monitoring & Discrete Physical/Chemical Sampling combined	DWR, Reclamation	\$2.09M**
Irrigated Lands Regulatory Program	Ag coalitions: landowner membership fees	Sacramento Valley WQ Coalition: \$0.12M*** San Joaquin Co. & Delta WQ Coalition: \$0.27M South San Joaquin Irrigation District: unknown
Municipal Water Quality Investigations	State Water Contractors, CCWD	\$2.33M**
National Water Quality Assessment Program	USGS	unknown
NPDES Self Monitoring Program	Delta dischargers	Estimated cost range: \$0.3-0.7M
Sacramento Coordinated Monitoring Program	SRCS D, Sacramento area stormwater agencies	\$0.2-0.25M
Sacramento Regional WWTP P4	SRCS D	unknown
San Francisco Bay RMP	Bay Area dischargers	\$0.261M**
Source Water Monitoring	CCWD	\$0.05M
State Water Project Water Quality Monitoring Program	DWR	\$0.98M
Surface Water Ambient Monitoring Program	State Water Board	\$0.03M

DRAFT FINAL

*Estimate: ~\$70K/station/yr x 30; ** For programs sampling both inside and outside the Delta, this number was estimated by dividing the number of sites sampled in the Delta by the total number of sites sampled, and multiplying the resulting factor with the total annual monitoring budget: (Delta sites/total sites) x total annual monitoring budget; *** This estimate excludes general program management and reporting costs.

Ongoing Multi-Year Studies

In addition to the routine monitoring described above, a number of special studies with a focus on water quality are carried out in the Delta. These are briefly summarized in the following overview (see the project summaries in Appendix D for additional detail). Not included in this description are ecological monitoring studies (e.g. the various fish monitoring programs conducted by the Department of Fish and Game [DFG] and other agencies) or recent short-term studies where data collection has already been completed (such as the pyrethroid work by Don Weston's Group at UC Berkeley, the Fish Mercury Project, etc.). Ongoing multi-year projects involving continuing data collection include:

- Studies of oxygen-demanding substances that flow into the Deep Water Ship Channel (DWSC). These ongoing studies are part of the phased TMDL for low DO in the Lower San Joaquin River. The studies aim to quantify sources of oxygen-demanding substances and other factors contributing to the low DO problem within the DWSC.
- UC Davis Aquatic Toxicology Laboratory is conducting a multiyear study initiated in 2005 which investigates the toxicity of Delta water samples to invertebrates (*Hyaella azteca*) and early life stages of delta smelt (*Hypomesus transpacificus*). If toxicity is detected, toxicity identification evaluations (TIEs) and chemical analysis are used to identify toxicants. Toxicity data obtained to date suggest that water quality is at times compromised in the lower Sacramento River/DWSC and that insecticides (e.g., pyrethroids) were likely contributing to the observed toxicity to *H. azteca*.
- The U.S. Geological Survey has several research projects underway related to water quality including studies looking at water quality impacts of carbon capture and rice production as methods to reverse or slow land subsidence, decomposition dynamics in re-established wetlands on subsided islands, the remobilization of mercury (Hg) sorbed to local intertidal zone sediment due to local Bay-Delta weather events, and the feasibility of using coagulation to remove DOC from island drainage water prior to release into Delta channels.
- A research team led by S.J. Teh at the UC Davis School of Veterinary Medicine, in collaboration with the DWR, has developed a molecular marker tool to assess toxicity caused by blooms of the blue-green alga *Microcystis*. Provided that their planned studies will receive funding support from an agency, the molecular marker techniques will be used to determine potential relationships between *Microcystis* toxicity, trophic transfer, and pelagic fish population dynamics in the Delta.

Synopsis

We provided an overview of ongoing surface water quality monitoring programs in the Delta from several perspectives: 1) monitoring drivers; 2) program function; 3) types of monitoring sites; 4) approaches; 5) data availability; and 6) size of effort (in terms of amounts of dollars spent). This approach provides a means of summarizing the full range of the gathered information in a form that allows focused topical discussions and provides an organizational framework for the next working step of identifying specific opportunities for improving coordination and cost effectiveness of water quality monitoring in the Delta. Table 7 integrates the multiple perspectives on ongoing monitoring in the Delta into a summary overview.

DRAFT FINAL

Table 7. Summary overview of existing Delta monitoring efforts.

Program	Main Function	Main Driver	Funding level	Approach (# of sites in Delta)	Parameters	Public data access
Continuous Monitoring						
Continuous Multiparameter Monitoring (IEP Environmental Monitoring Program)	Regional, Watershed,	Regulatory compliance	<\$1M	Delta network, regional (7)	Bioassessment, flow, general water quality, major ions, nutrients	BDAT, CDEC, WDL
Continuous Recorders (DWR/Reclamation)	Continuous	Regulatory compliance	<\$1M	Delta network, regional (16)	Flow, general water quality	BDAT, CDEC
Delta Flows Network (USGS)	Continuous	Management and policy support	<\$1M	Delta network, regional (30)	Bioassessment, flow, general water quality	CDEC, NWIS
Delta-Mendota Canal Water Quality Monitoring (Reclamation)	Continuous	Source water protection	<\$1M	Supply, water conveyance (1)	Flow, general water quality, metals & trace elements	-
Municipal Water Quality Investigations (Real-time Sampling) (DWR)	Water supply	Source water protection	>\$1M (total MWQI program)	Delta network, regional (4)	DOC/TOC, major ions, nutrients	CDEC, WDL
Surface Water Monitoring (DWR)	Continuous	Management and policy support	<\$1M	Delta network, regional (49)	Flow, general water quality	CDEC
Receiving Water Monitoring						
Irrigated Lands Regulatory Program (Agricultural Water Quality Coalitions)	Receiving water	Regulatory compliance	<\$1M	Source, targeted (10)	DOC/TOC, flow, general water quality, major ions, metals & trace elements, nutrients, pathogens, pesticides, sediment chemistry, sediment toxicity, water toxicity	Central Valley Water Board Irrigated Lands Regulatory Program Website

DRAFT FINAL

Program	Main Function	Main Driver	Funding level	Approach (# of sites in Delta)	Parameters	Public data access
NPDES (Stormwater Dischargers)	Receiving water	Regulatory compliance	<\$1M	Source, regional (25)	Bulk Organics, DOC/TOC, bioassessment, general water quality, mercury, metals & trace elements, nutrients, organic contaminants, pathogens, pesticides, sediment toxicity, water toxicity	-
NPDES (Wastewater Dischargers)	Receiving water	Regulatory compliance	<\$1M	Source, local (52)	Bioassessment, Disinfection byproducts, DOC/TOC, flow, general water quality, major ions, mercury, metals & trace elements, nutrients, organic contaminants, pathogens, pesticides, water toxicity	-
Sacramento RCSD WWTP Priority Pollutant Prevention Program (Sacramento RCSD)	Receiving water	Regulatory compliance	<\$1M	Source, local (3)	DOC/TOC, general water quality, major ions, mercury, metals & trace elements, nutrients, organic contaminants, pesticides	-
Water Supply Monitoring						
Municipal Water Quality Investigations (DWR)	Water supply	Source water protection	>\$1M	Delta network, regional (9)	DOC/TOC, general water quality, major ions, nutrients	CDEC, WDL
Source Water (CCWD)	Water supply	Source water protection	<\$1M	Supply, regional (4)	Bioassessment, DOC/TOC, general water quality, major ions, metals & trace elements, nutrients, pathogens	-

DRAFT FINAL

Program	Main Function	Main Driver	Funding level	Approach (# of sites in Delta)	Parameters	Public data access
State Water Project Water Quality Monitoring Program (DWR Operations & Maintenance)	Water supply	Source water protection	<\$1M	Supply, statewide (3)	DOC/TOC, general water quality, major ions, mercury, metals & trace elements, nutrients, organic contaminants, pesticides	CDEC, WDL
Regional and Watershed Monitoring						
Agricultural Subsurface Drainage Program (Central Valley Water Board)	Regional, Watershed	Management and policy support	<\$1M	Integrator , regional (1)	General water quality, metals & trace elements	Central Valley Water Board SWAMP Website
Discrete Physical/Chemical Monitoring (IEP Environmental Monitoring Program)	Regional, Watershed,	Regulatory compliance	>\$1M	Delta network, regional (12)	Bioassessment, flow, general water quality, major ions, nutrients	BDAT, CDEC, WDL
National Water Quality Assessment Program (USGS)	Regional, Watershed	Management and policy support	<\$1M	Integrator , nationwide (2)	DOC/TOC, flow, general water quality, major ions, metals & trace elements, nutrients, pesticides	NWIS
San Francisco Bay RMP (SFEI)	Regional, Watershed	Management and policy support	<\$1M	Integrator, regional (2)	Bioassessment, general water chemistry, major ions, mercury, metals & trace elements, new & emerging contaminants, nutrients, pesticides, sediment chemistry, sediment toxicity, tissue chemistry	SWAMP database (SFEI)
Sacramento Coordinated Monitoring Program (Sacramento RCSD and SSQP)	Regional, Watershed	Regulatory compliance	<\$1M	Source, regional (2)	DOC/TOC, general water quality, major ions, mercury, metals & trace elements, nutrients, organic contaminants, pathogens, pesticides	-

DRAFT FINAL

Program	Main Function	Main Driver	Funding level	Approach (# of sites in Delta)	Parameters	Public data access
Surface Water Ambient Monitoring Program (Central Valley Water Board)	Regional, Watershed	Management and policy support	<\$1M	Integrator, regional & statewide (2)	DOC/TOC, general water chemistry, pathogens, sediment chemistry, sediment toxicity, water toxicity	SWAMP database (MLML), Central Valley Water Board SWAMP Website

DRAFT FINAL

Continuous monitoring is an important monitoring function in the Delta. A major part of Delta water quality data collection consists of continuous monitoring. The main drivers for continuous monitoring are water right permit-related monitoring requirements (D-1641) and information needs of water operations and supply managers. Continuous monitoring focuses on flow and general water quality characteristics such as salinity and temperature, with limited coverage of other parameters such as chlorophyll florescence, organic carbon, and nutrients. This type of monitoring is relatively “low cost”; for example, maintaining and operating the USGS Delta Flows Network costs approximately \$70K per station per year (analysis and reporting are not included in this estimate). Continuous monitoring is performed by several, coordinated networks of monitoring stations maintained by DWR, Reclamation, and USGS. Real-time data are available through CDEC from most continuous monitoring stations. Following checks for accuracy and completeness, all of the continuous data are made available through BDAT.

Receiving water monitoring is a second major monitoring function in the Delta. Some twenty-plus entities are involved in receiving water monitoring in the Delta. The main drivers for these monitoring activities are compliance monitoring requirements associated with NPDES discharge permits (including stormwater permits) and ILRP requirements. In terms of funding levels, the individual compliance monitoring efforts are small compared to some of the larger programs, such as IEP EMP and MWQI. However, the sum of these efforts amounts to a significant contribution that likely exceeds \$1M annually. All compliance monitoring sites in the Delta can be considered as sources indicator sites, since they were selected to characterize water quality issues from a specific source, such as monitoring the effects of a specific type of land use or discharge. Non-point source indicator sites (stormwater and agricultural sites) are typically located in stream and river segments upstream of major confluences and in-Delta sloughs and drains discharging to major waterways in the Delta. Point-source indicator sites (wastewater treatment plants etc.) are in receiving waters upstream and downstream of the point of discharge. Approaches may vary considerably among stormwater, point-discharge, and agricultural discharge monitoring: stormwater programs in the Sacramento and Stockton urban areas use coordinated regional approaches with representative urban discharge and receiving water sites, point dischargers focus on a few selected fixed sites up- and downstream of the discharge point(s), and agricultural groups apply a targeted monitoring approach that characterizes agriculture-derived discharges and evaluates BMP effectiveness at selected sites representative of agricultural discharges but not necessarily of impacts from specific agricultural areas. Compliance monitoring requirements can vary from a few general water quality parameters for some small wastewater dischargers to analyses of an extensive suite of priority pollutants in the case for agricultural, stormwater, and large wastewater dischargers. NPDES compliance monitoring data for the Delta are currently not available through public databases. Although not in a database, the ILRP data is available on-line through the Central Valley Water Board’s website.

A third major monitoring function in the Delta is water supply monitoring. The main driver for water supply monitoring is source water protection. Water supply monitoring includes MWQI, the SWP Water Quality Monitoring Program, and CCWD Source Water Monitoring. All water supply programs monitor a wide range of parameters from general water quality to pesticides, nutrients, pathogens, and disinfection byproducts. MWQI is one of the largest ongoing monitoring programs. The total MWQI program budget for fiscal year 2009-2010 is \$3.1 M. Nine of the 12 MWQI stations are in the Delta. The SWP Water Quality Monitoring Program and CCWD Source Water Monitoring conduct monitoring at several water supply sites in the Delta. SWP water quality monitoring extend throughout the entire SWP, CCWD is a regional effort in the West, Central, and South Delta. MWQI and the SWP Water Quality

DRAFT FINAL

Monitoring Program make their continuous monitoring data available in real-time on CDEC, and both continuous and discrete data on BDAT and WDL after review for accuracy and completeness. CCWD measurements of daily chloride concentration are available on CDEC; other source water quality data are available upon request.

A number of monitoring efforts in the Delta conduct comprehensive regional and/or watershed studies to establish baseline conditions and trends; assess aquatic resources; or investigate issues and processes (e.g., impacts of water export on Delta transport). A major driver for these efforts can be characterized as providing information to inform and support environmental management and policy decisions. The cumulative investment in such monitoring efforts is considerable and easily exceeds \$3M, but in the overall picture, this driver is secondary to other main drivers such as regulatory compliance: IEP EMP, for example, the most comprehensive Delta-wide monitoring program, is ultimately driven by water right permit-related monitoring requirements. The IEP EMP is the only comprehensive monitoring program in the Delta with a specific focus on the Delta and a Delta-wide network of monitoring sites. The other regional or watershed-wide efforts only maintain one or several integrator sites at major in- and outflows of the Delta that are components of national networks (NAWQA), State networks (SWAMP), or overlapping regional monitoring programs (San Francisco Bay RMP, Sacramento CMP). Parameters measured may vary considerably among these different regional studies, depending on the specific program objectives. Data of national efforts (USGS) are available through NWIS and those of State efforts either through BDAT and WDL (IEP EMP) or through the SWAMP databases (SFEI or MLML).

Conclusions and Next Steps

An initial step can be to develop a set of regional monitoring objectives, and then proceed with identifying opportunities for improving coordination and cost effectiveness by focusing on one or more specific questions.

At the Delta RMP kick-off workshop in September 2008, stakeholders recognized two major challenges to a better understanding of aquatic resources in the Delta: 1) we are largely unable to address cross-cutting issues, such as the POD, with the current, more tightly focused, approach to monitoring and assessment; and 2) the existing programs are not organized to facilitate integration of data across different programs, which is a prerequisite for conducting the types of analyses that would allow for a more comprehensive view.

Development of a Delta RMP that would address these challenges will proceed in a two-phased approach, consisting of a pilot phase (Phase I) and the long-term implementation of the program (Phase II). Although the planning team is providing a general planning framework and timeline, the final program framework and implementation options will be developed cooperatively by stakeholder working groups and the Delta RMP Planning Team. The 2-3 year pilot phase (Phase I) would have the following general goals:

1. Build interest, involvement, and momentum by answering interesting and important questions that require a comprehensive, regional view
2. Develop capabilities for regularly compiling and synthesizing data from existing, ongoing monitoring efforts, and subsequently reporting and disseminating information relevant to stakeholders, and

DRAFT FINAL

3. Use this effort as a proof-of-concept that sets the stage and creates capabilities needed for the longer-term regional monitoring.

Phase II will then build on this foundation to define the long-term structure and goals of the Delta RMP. We expect that the long-term program will strive for integration across different programs based on results of the pilot.

One outcome of the Delta RMP stakeholder kick-off meeting was formation of stakeholder working groups to plan various aspects of the RMP framework: governance, monitoring questions, data integration, funding, and coordination among other programs. At the first working group meeting in November 2008, meeting participants felt their input and discussion of governance options, monitoring questions and indicators, data integration and other relevant topics would be better informed once this report summarizing existing water quality monitoring programs in the Delta and the contaminants synthesis report prepared by UC Davis researchers were available for review.

The working approach will depend on context, for example preliminary monitoring questions. A general observation based on a review of monitoring drivers and objectives is that probably all reviewed programs would benefit (in terms of achieving their stated objectives) from a better picture of system-wide baseline conditions and trends. However, looking at the main forces driving current monitoring, gaining a system-wide understanding to better inform management and policy decisions currently plays a secondary role compared to regulatory compliance, water supply safety, or continuous baseline data generation with very generic purposes.

Since regulatory and source water protection requirements, as well as the day-to-day decisions of water managers, depend on the success of the broader management and policy approaches affecting the entire system, it may make sense to brainstorm approaches to how an overall shift of monitoring resources toward more broad-based environmental management and decision support might be accomplished.

An initial step will be to develop a set of shared, regional monitoring objectives. This will be done in parallel by a monitoring objectives working group that has been established specifically for that purpose. With a set of preliminary objectives, the working group could then proceed with identifying opportunities for improving coordination and cost effectiveness by focusing on one or more specific monitoring questions.

For example, a proposed monitoring question for the Delta RMP is: Are water quality conditions and associated impacts in the Delta getting better or worse? The working group may want to focus on coordination and integration of monitoring sites that are part of the Delta networks and the integrator sites. It may become evident that the scope of parameters measured, variability in sampling frequencies, and issues with inter-comparability of results impede our ability to develop a satisfactory answer. Data comparability will most likely emerge as one of the most prominent issues to resolve for improving the ability to assess water quality conditions in the Delta. Data integration has been identified as a key topic at the kick-off meeting and will be addressed by a designated stakeholder working group.

Next steps could involve evaluating how monitoring at the integrator sites could be systematized to address the specific question(s), evaluate whether the locations of integrator and Delta network sites are adequate for an initial effort of integrated trends monitoring, decide on a list of parameters, and examine how and where resources could be freed up or traded and shifted.

DRAFT FINAL

Another overarching candidate question is what are the sources, pathways, loadings, and processes leading to water quality impacts in the Delta? This may warrant a focus on current compliance monitoring efforts (source indicator sites) and integrator sites at the bottom of the major rivers and Delta tributaries. Again, one would need to prioritize parameters, see to what extent the current monitoring is useful to answer the question, identify data gaps, and determine how existing resources might be shifted or better coordinated to be able to better address the question.

Appendices

- A. Inventory of Existing Delta Water Quality Monitoring Programs
 - A.1. Continuous Monitoring
 - A.2. Receiving Water Monitoring
 - A.3. Water Supply Monitoring
 - A.4. Regional and Watershed Monitoring
- B. Overview Maps of Existing Delta Water Quality Monitoring – by Program Category
- C. Overview Maps of Existing Delta Water Quality Monitoring – Selected Parameters Organized by Monitoring Program Overview
- D. Ongoing multi-year studies

A. *Inventory of Existing Delta Water Quality Monitoring Programs*

A.1 Continuous Monitoring

Continuous Multiparameter Monitoring (IEP Environmental Monitoring Program)

Department of Water Resources

Continuous Recorder Sites

Department of Water Resources, U.S. Bureau of Reclamation

Delta Flows Network

U.S. Geological Survey

Delta-Mendota Canal Water Quality Monitoring Program

U.S. Bureau of Reclamation

Municipal Water Quality Investigations (real-time sampling)

Department of Water Resources

State Water Project Water Quality Monitoring (continuous sites)

Department of Water Resources

Surface Water Monitoring

Department of Water Resources

DRAFT FINAL

DRAFT FINAL

Continuous Multiparameter Monitoring (IEP Environmental Monitoring Program)

<http://www.baydelta.water.ca.gov/emp/index.html>

Agency/Organization

Department of Water Resources
Environmental Water Quality and
Estuarine Studies Branch

Contact

Mike Dempsey and Karen
Gehrts
(916) 375-4825
mdempsey@water.ca.gov
kagehrts@water.ca.gov

Start Date

1971

End Date

ongoing

Monitoring Objectives

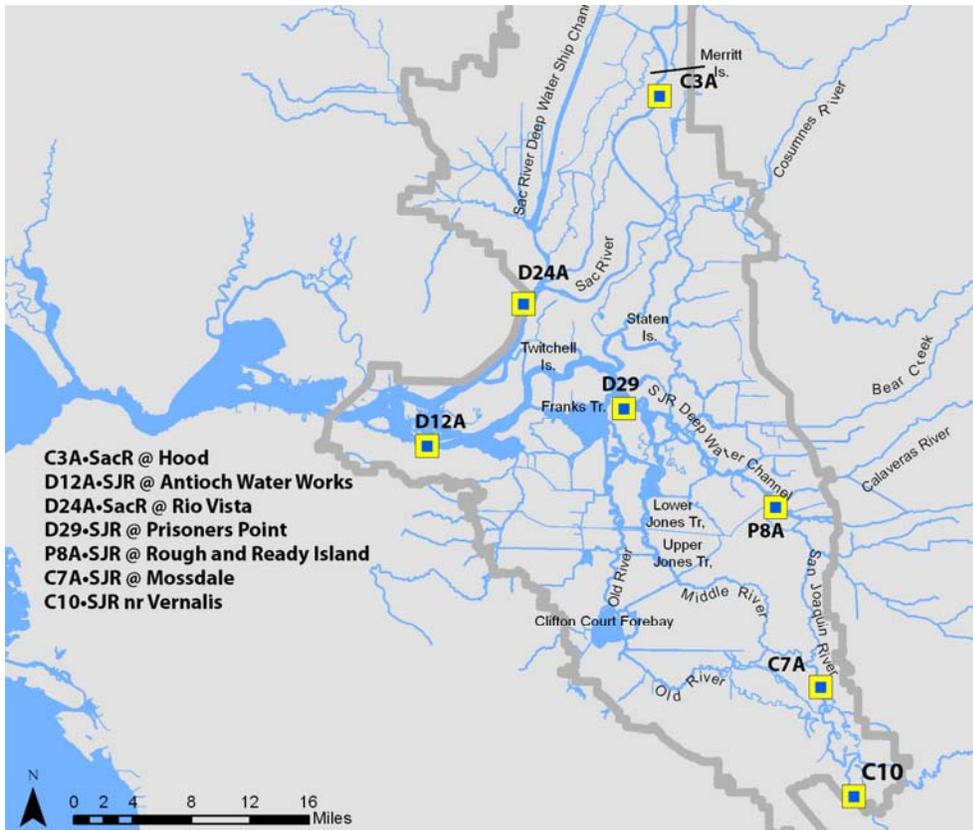
Provide necessary information for compliance with flow-related water quality standards specified in the water right permits.

Annual Budget

\$2.95M (includes IEP EMP's
Discrete Sampling Program)

Sampling Locations

Number of active sites: 7



DRAFT FINAL

**Continuous Multiparameter Monitoring
(IEP Environmental Monitoring Program)**

Parameters	Sample Type	Frequency
Bioassessment: chlorophyll fluorescence	Water Quality	continuous
General Water Quality: EC, DO, pH, temperature, turbidity,	Water Quality	continuous
Hydrology: tidal elevation	Hydrology	continuous
Major Ions and Minerals: chloride	Water Quality	continuous

Data Availability	URL
Downloadable data	http://bdat.ca.gov/index.html

DRAFT FINAL

Continuous Recorder Sites

Agency/Organization	Contact	Start Date	End Date
Department of Water Resources Environmental Water Quality and Estuarine Studies Branch	Mike Dempsey mdempsey@water.ca.gov	2006	ongoing
U.S. Bureau Of Reclamation	Joe Pennino 209-836-6212	1950s	ongoing

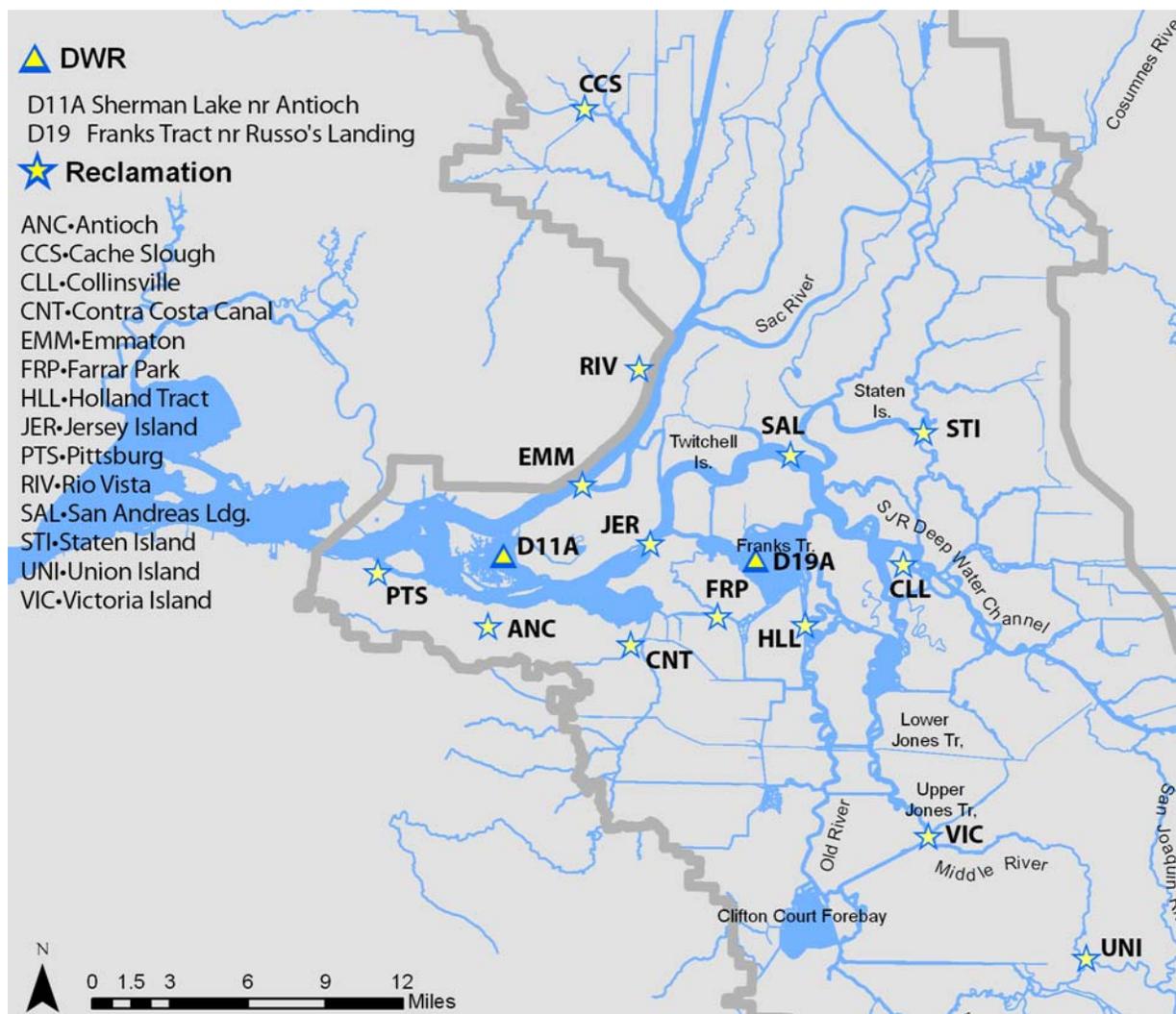
Monitoring Objectives

Annual Budget

Sampling Locations

Number of active sites (total in legal Delta): 16
Department of Water Resources: 2
U.S. Bureau Of Reclamation: 14

Continuous Recorder Sites



Parameters	Sample Type	Frequency
General Water Quality: EC, Temperature	Water Quality	continuous

Data Availability	URL
Downloadable data:	
- BDAT: verified long term data	http://bdat.ca.gov/Php/Data_Retrieval/data_retrieval_closed.php
- CDEC: unchecked real-time data	http://cdec.water.ca.gov
IEP newsletter (brief updates)	http://www.water.ca.gov/iep/products/newsletter.cfm
Annual and occasional multi-year	http://www.water.ca.gov/iep/products/reports.cfm

Delta Flows Network

Agency/Organization

U.S. Geological Survey

Contact

Jon Burau
(916) 278-3000

Start Date

1987

End Date

ongoing

Monitoring Objectives

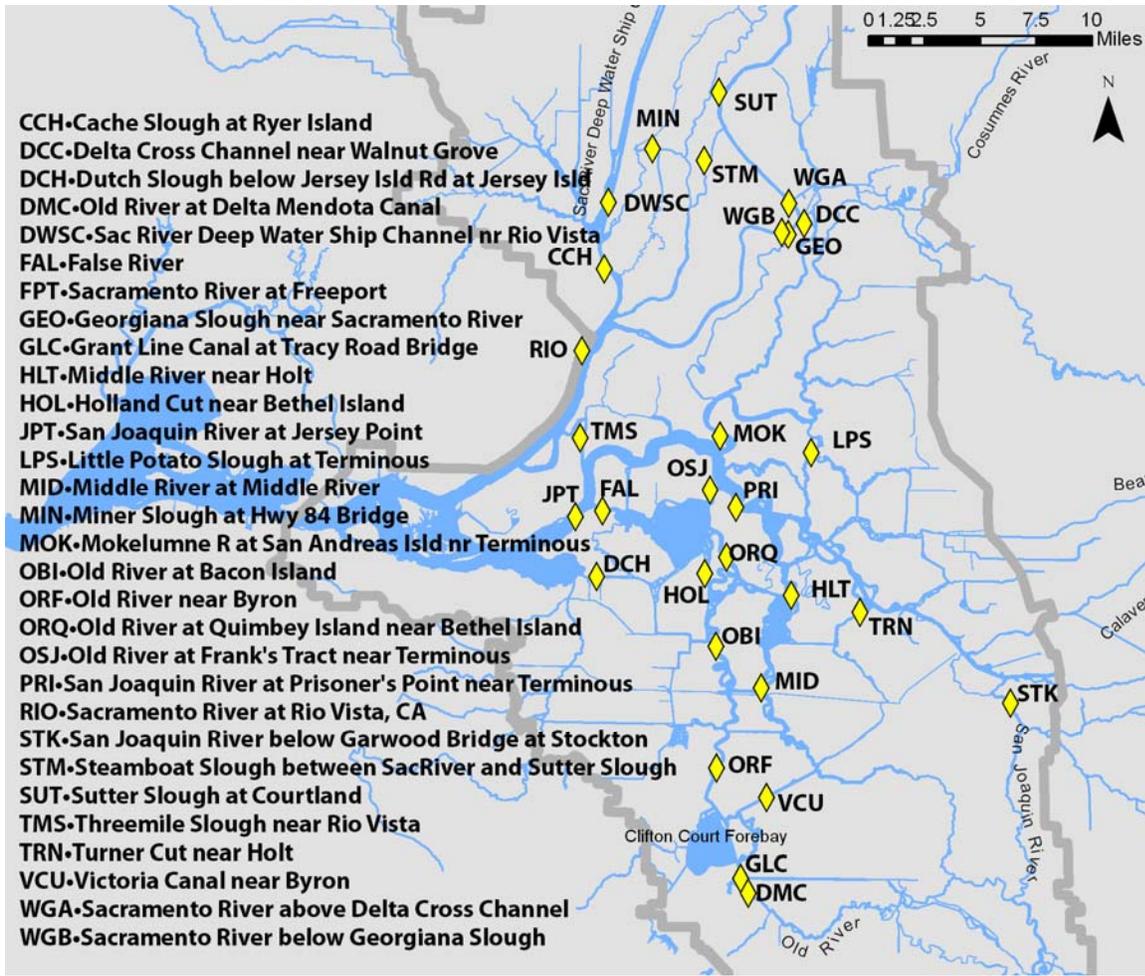
Provide the fundamental hydrodynamic information necessary to explore critical questions that are currently facing water managers.

Annual Budget

\$2.1M

Sampling Locations

Number of active sites: 30



DRAFT FINAL

Delta Flows Network

Parameters	Sample Type	Frequency
Bioassessment: chlorophyll a	Community	continuous
General Water Quality: EC, DO, pH, Temperature, Turbidity	Water Quality	continuous
Hydrology: Flow	Hydrology	continuous

Data Availability	URL
NWIS	http://waterdata.usgs.gov/nwis/
CDEC	http://cdec.water.ca.gov

DRAFT FINAL

Delta-Mendota Canal Water Quality Monitoring Program

Agency/Organization
U.S. Bureau of Reclamation

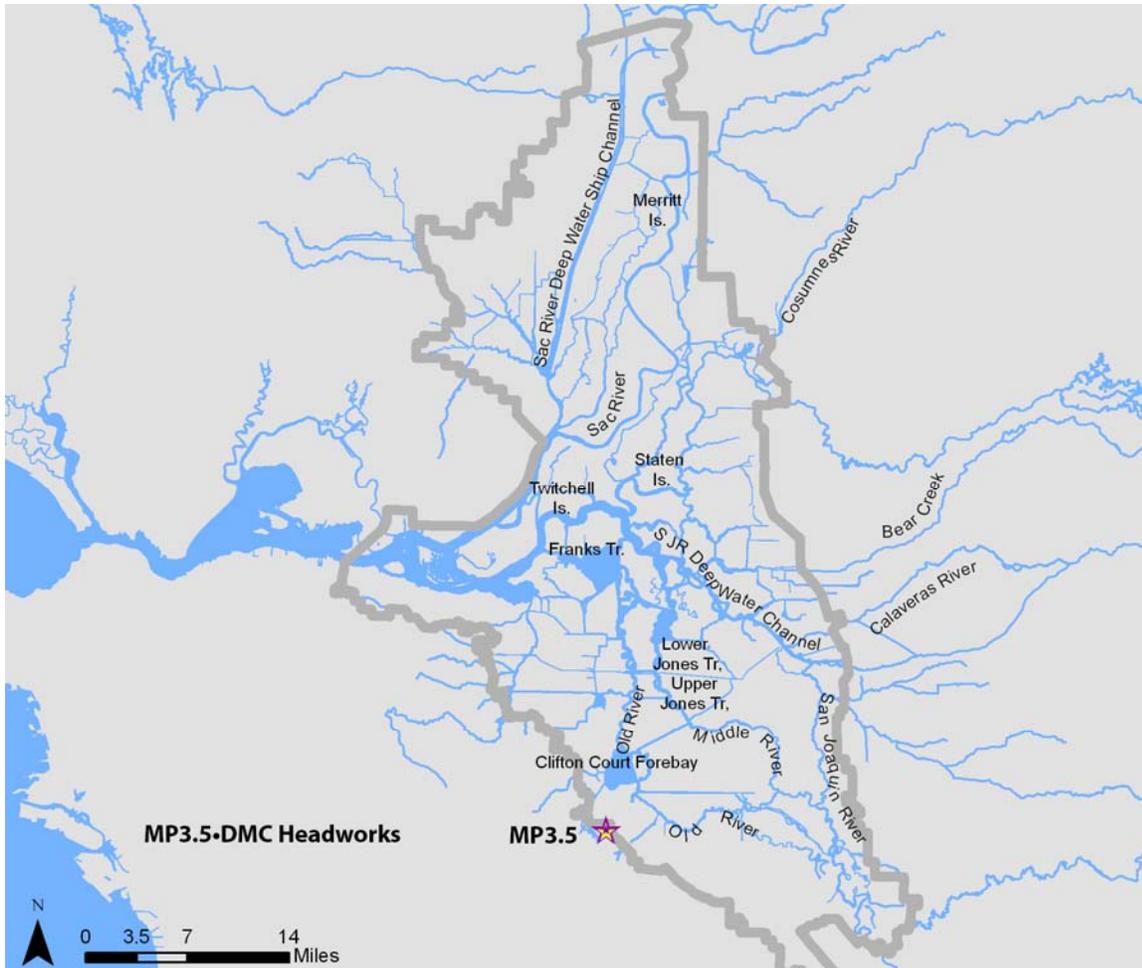
Contact
Michael C. S. Eacock
South-Central California Area
Office
(559) 487-5133
ceacock@mp.usbr.gov

Start Date
2002
End Date
ongoing

Monitoring Objectives

Annual Budget
\$125,000

Sampling Locations
Number of active sites: 1



DRAFT FINAL

Delta-Mendota Canal Water Quality Monitoring Program

Parameters	Sample Type	Frequency
General Water Quality: EC, TDS	Water Quality	continuous
Hydrology: Flow	Hydrology	continuous
Metals & Trace Elements: Selenium	Water Quality	continuous

Data Availability	URL	Available by Request
Monthly Report	n/a	yes

DRAFT FINAL

Municipal Water Quality Investigations (real-time sampling)

http://www.wq.water.ca.gov/mwqi/mwqi_index.cfm

Agency/Organization
Department of Water Resources

Contact
Joe Christen
(916) 376-9710
jchriste@water.ca.gov

Start Date
1982
End Date
ongoing

Monitoring Objectives

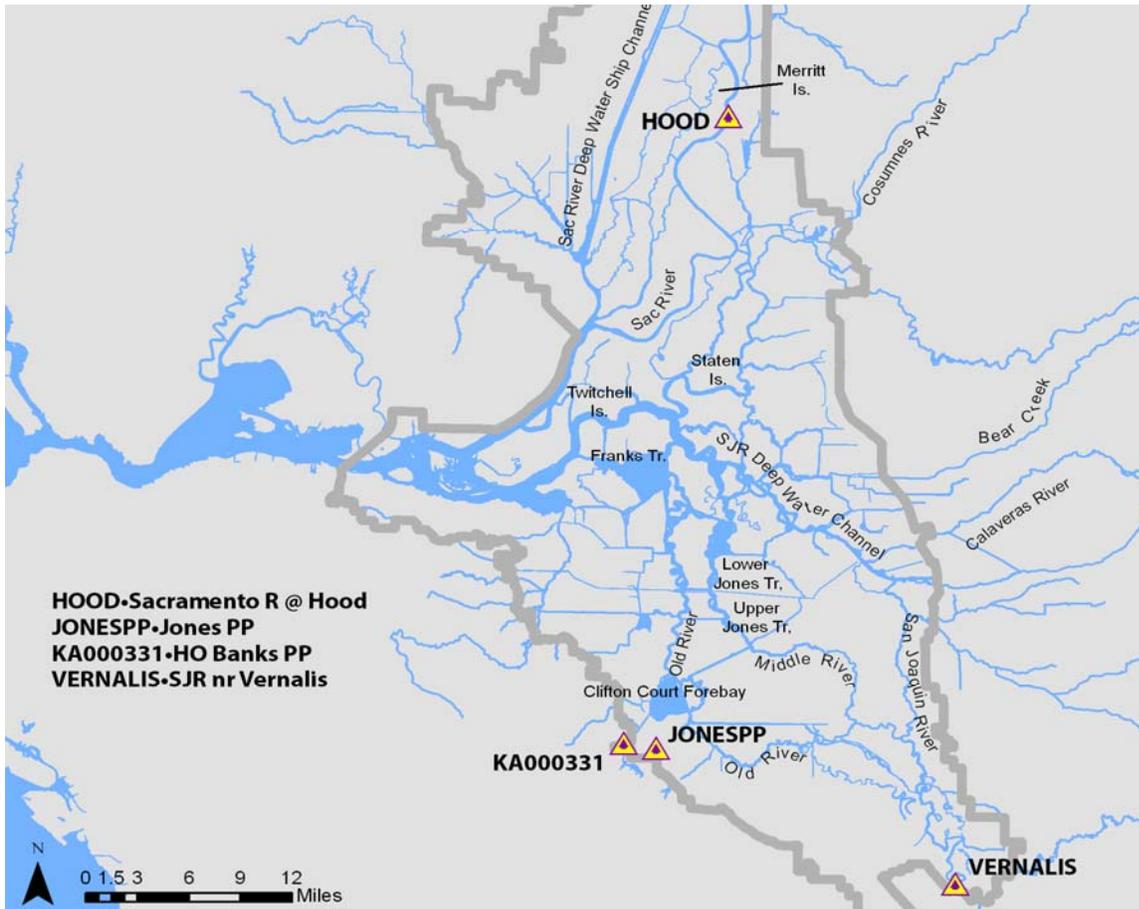
Provide monitoring data to MWQI Program participants and other identified stakeholders, such as CALFED, on key constituents of concern.

Annual Budget

\$3.1M for fiscal year
2009-2010 (total MWQI program)

Sampling Locations

Number of active sites (continuous only): 4



DRAFT FINAL

Municipal Water Quality Investigations (real-time sampling)

Parameters	Sample Type	Frequency
Organic Carbon: DOC/TOC		
Major Ions & Minerals: Bromide, Chloride, Sulfate, Fluoride (only at San Joaquin River near Vernalis and Delta PP Headworks [Banks])	Water Quality	continuous
Nutrients: Nitrate		

Data Availability	URL	Available by request
Downloadable data	http://wdl.water.ca.gov/wq-gst/	Yes

DRAFT FINAL

State Water Project Water Quality Monitoring (continuous sites)

<http://www.omwq.water.ca.gov/>

Agency/Organization
Department of Water Resources
Operations & Maintenance

Contact
Barry Montoya
(916) 653-4383
bmontoya@water.ca.gov

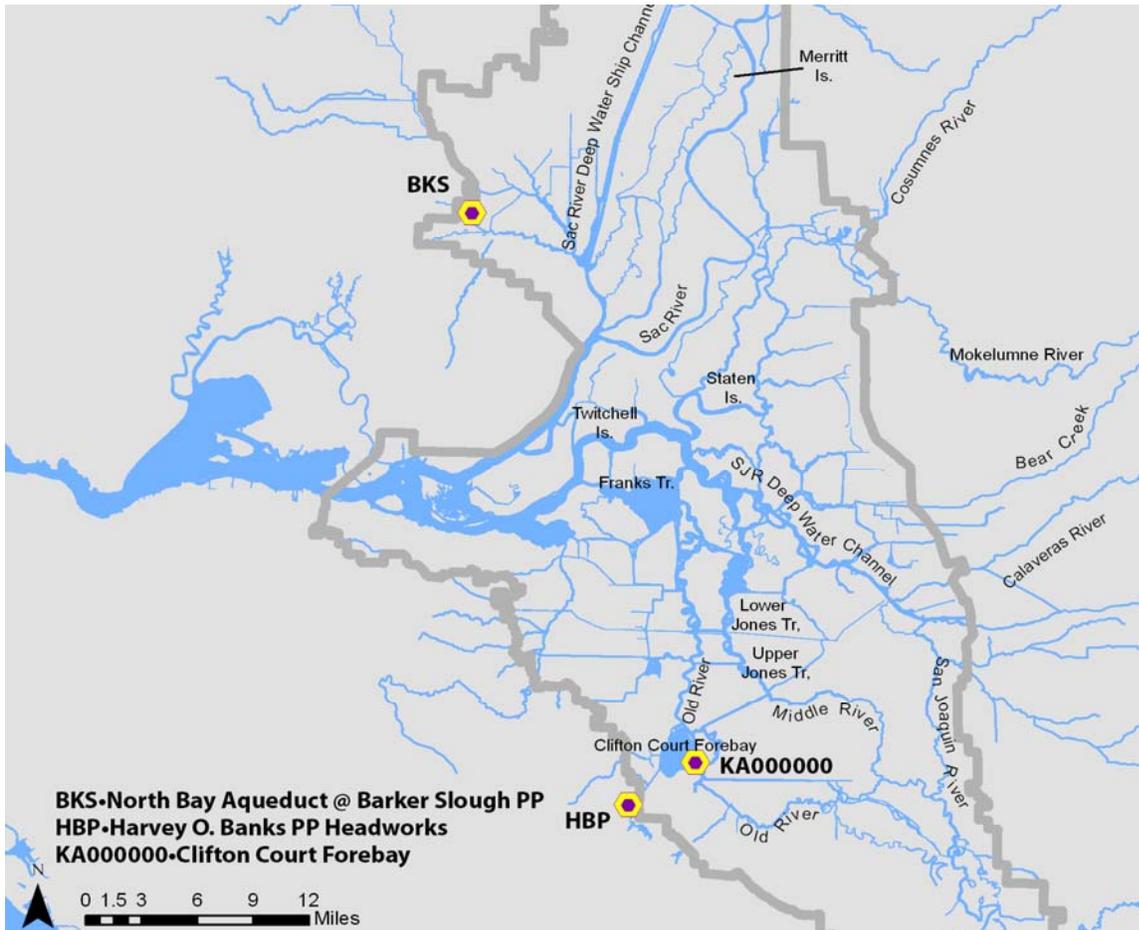
Start Date
1960s
End Date
ongoing

Monitoring Objectives

1.) Document spatial and temporal changes in SWP water quality; 2.) Plan water treatment operational changes; 3.) Identify and respond to pollution or other water quality episodes; 4.) Compare SWP water quality to drinking water standards, Article 19 contractual requirements, or other criteria.

Annual Budget
\$0.98M

Sampling Locations
Number of active sites (continuous): 3



DRAFT FINAL

State Water Project Water Quality Monitoring (continuous sites)

Parameters	Sample Type	Frequency
General Water Quality: EC, pH, Fluorescence, Temperature, Turbidity, UV (abs 254 nm)	Water Quality	varies by parameter/site

Data Availability	URL
Annual Report	http://www.womwq.water.ca.gov/PublicationsPage/index.cfm
Grab sample data	http://wdl.water.ca.gov/
Autostation data	http://cdec.water.ca.gov/cgi-progs/staSearch

DRAFT FINAL

Surface Water Monitoring

Parameters	Sample Type	Frequency
General Water Quality: EC, Temperature, Turbidity	Water Quality	continuous
Hydrology: Flow, Rainfall, Stage	Hydrology	continuous

Data Availability	URL
Downloadable data : BDAT: verified long term data CDEC: unchecked real-time data	http://bdat.ca.gov/Php/Data_Retrieval/data_retrieval_closed.php http://cdec.water.ca.gov

A.2. Receiving Water Monitoring

Irrigated Lands Regulatory Program

Central Valley Regional Water Quality Control Board, San Joaquin County and Delta Water Quality Coalition, Sacramento Valley Water Quality Coalition, and South San Joaquin Irrigation District

NPDES Self Monitoring Program

Central Valley Regional Water Quality Control Board

Sacramento Regional Wastewater Treatment Plant Priority Pollutant Prevention Program

Sacramento Regional County Sanitation District

DRAFT FINAL

Irrigated Lands Regulatory Program

http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/index.shtml

Agency/Organization	Contact	Start Date	End Date
Central Valley Regional Water Quality Control Board	Susan Fregien (916) 464-4813 Chris Jimmerson (916) 464-4859	05/12/02 (adoption of the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands within the Central Valley Region (Conditional Waiver)	ongoing
Sacramento Valley Water Quality Coalition	Bruce Houdesheldt Northern California Water Association (916) 442-8333	2009 (revised and conditionally approved Monitoring and Reporting Program Plan)	ongoing
San Joaquin County & Delta Water Quality Coalition	Mike Wackman San Joaquin County Resource Conservation District (916) 716-1358	2008 (current Monitoring and Reporting Program Plan)	ongoing
South San Joaquin Irrigation District	Jim Atherstone South San Joaquin Irrigation District (209) 993-7971 jima@ssjid.com	October 2004 (begin of monitoring activities to meet compliance with Conditional Waiver)	ongoing

Irrigated Lands Regulatory Program

Monitoring Objectives

Sacramento Valley Water Quality Coalition:

Monitoring data are used to characterize discharges from irrigated lands to surface waters and to evaluate the effectiveness of management practice implementation efforts. The Coalition is comprised of 10 subwatersheds that are by design nested within the Regional Boards Region 5a. As its primary function, the Coalition addresses agricultural and managed wetlands runoff throughout a predominantly rural area. Ambient water and sediment quality monitoring for agricultural discharge will occur using three types of monitoring: Core Monitoring, Assessment Monitoring, and Management Plan Monitoring.

San Joaquin County & Delta Water Quality Coalition:

Monitoring data are used to characterize discharges from irrigated lands to surface waters and to evaluate the effectiveness of management practice implementation efforts. Ambient water and sediment quality monitoring for agricultural discharge will occur with three types of monitoring: Core Monitoring, Assessment Monitoring, and Management Plan Monitoring. Combined, these three levels of monitoring are designed to characterize the discharge from irrigated agriculture as a result of irrigation and storm water runoff. Core Monitoring will occur at sites that have undergone intensive monitoring in the past to assess general water quality trends over time. Assessment Monitoring will occur at sites that have not been well characterized by previous monitoring. Samples collected from Assessment Monitoring locations will be analyzed for a large suite of constituents to adequately characterize water quality at those sites. This monitoring strategy allows for comprehensive monitoring in the short term and general trend monitoring over successive years. Special project monitoring will occur for the purpose of constituent-specific monitoring or targeted source identification studies as needed. This supplementary monitoring may include, but is not limited to, specific targeted studies to source exceedances or monitoring to provide information about conditions of a water body that predate agricultural inputs that occurred prior to the formation of the Coalition.

South San Joaquin Irrigation District:

a) Assess the impacts of waste discharges from irrigated lands to surface water; b) Determine degree of implementation of management practices to reduce discharge of specific wastes that impact water quality; c) Determine the effectiveness of management practices and strategies to reduce discharges of wastes that impact water quality; d) Determine concentration and load of waste in these discharges to surface waters; and e) Evaluate compliance with existing narrative and numeric water quality objectives to determine if additional implementation of management practices is necessary to improve and/or protect water quality.

Annual Budget

>\$0.39M

Sampling Locations

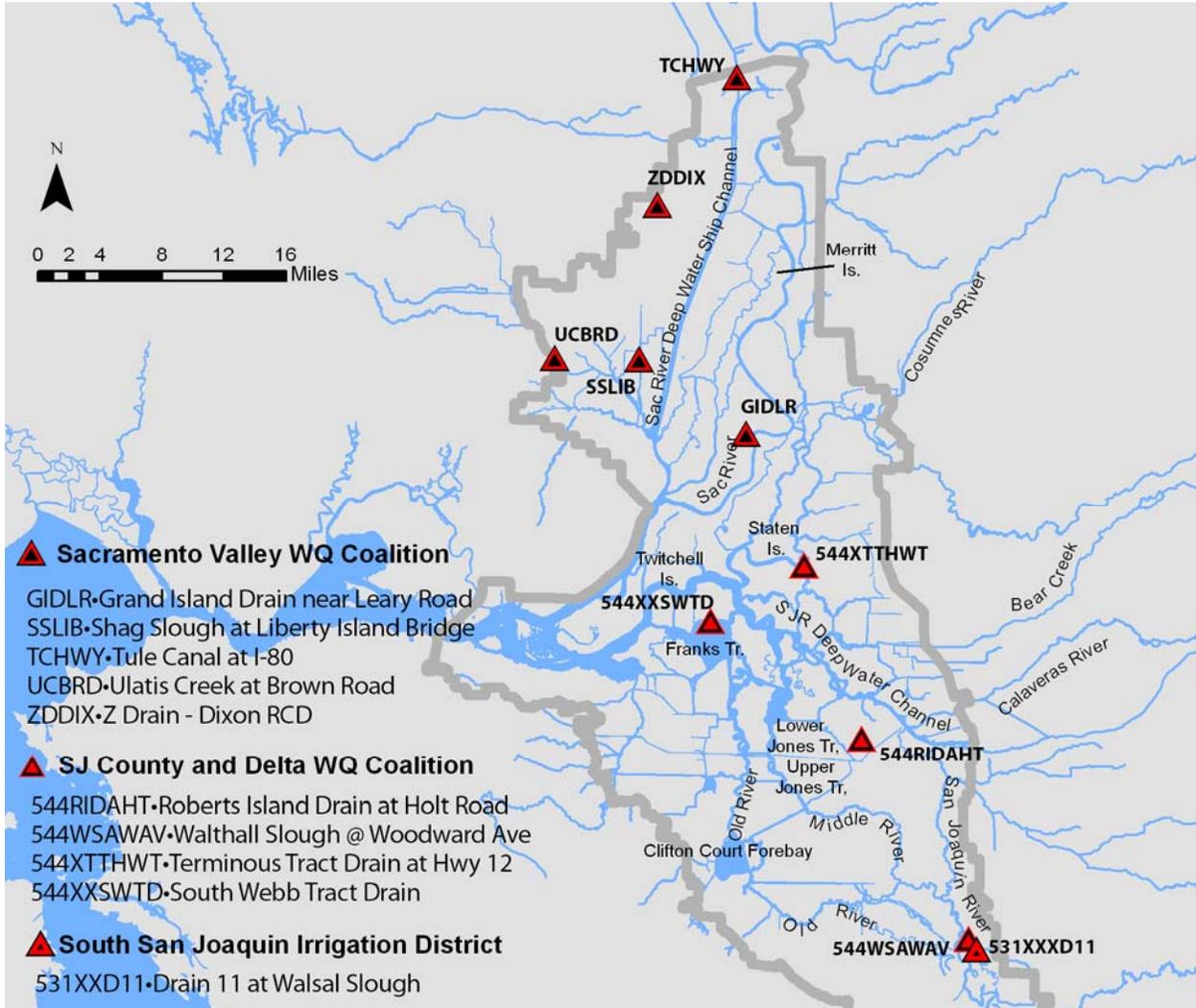
Number of active sites (total): 10

Sacramento Valley Water Quality Coalition: 5

San Joaquin County & Delta Water Quality Coalition: 4

South San Joaquin Irrigation District: 1

Irrigated Lands Regulatory Program



DRAFT FINAL

Irrigated Lands Regulatory Program

Parameters	Sample Type	Frequency
<u>Sacramento Valley Water Quality Coalition</u>		
General Water Quality: EC, DO, pH, TDS, TSS, Temperature, Turbidity	Water Quality	monthly
Hydrology: Flow	Hydrology	monthly
Major Ions and Minerals: Boron, Hardness	Water Quality	monthly
Nutrients: Nitrate plus Nitrite as Nitrogen, Ortho-PO ₄ , Phosphorus, Total NH ₃ , Total Nitrogen, Unionized NH ₃	Water Quality	monthly
Organic Carbon: TOC	Water Quality	monthly
Other: Digital photo monitoring, Photo Monitoring	Other	monthly
Pathogens & Bacteria: Fecal Coliforms, E. coli	Water Quality	monthly
Pesticides: Organophosphates, Methoxychlor	Water Quality	varies by parameter/site
Sediment Toxicity: <i>Hyaella azteca</i>	Toxicity	
Water Toxicity: Toxicity (acute) - Ceriodaphnia, Fathead minnow, Selenastrum capricornutum	Toxicity	
<u>San Joaquin County & Delta Water Quality Coalition</u>		
General Water Quality: EC, DO, pH, Grain Size, TDS, TSS, Temperature, Turbidity	Water Quality	monthly
Hydrology: Flow	Hydrology	monthly
Major Ions and Minerals: Boron, Hardness	Water Quality	monthly
Metals & Trace Elements: Arsenic (Total), Cadmium (Dissolved), Copper (Dissolved), Lead (Dissolved), Molybdenum (Total), Nickel (Dissolved), Selenium (Total), Zinc (Dissolved)	Water Quality	monthly
Nutrients: Nitrate plus Nitrite as Nitrogen, Ortho-PO ₄ , Phosphorus, Total NH ₃ , Total Nitrogen, Unionized NH ₃	Water Quality	monthly
Organic Carbon: TOC	Water Quality	monthly
Other: Digital photo monitoring, Photo Monitoring	Other	monthly

DRAFT FINAL

Pathogens & Bacteria: E. coli	Water Quality	monthly
Sediment Chemistry: Carbamates, Herbicides, Organochlorine Pesticides, Organophosphates, Pyrethroids, TOC	Sediment Quality	monthly
Sediment Toxicity: <i>Hyaella azteca</i>	Toxicity	biannual
Water Toxicity: Toxicity (acute) - Ceriodaphnia, Fathead minnow, Selenastrum capricornutum	Toxicity	monthly

South San Joaquin Irrigation District

General Water Quality: EC, DO, pH, Temperature, Turbidity	Water Quality
Major Ions and Minerals: Potassium	Water Quality
Nutrients: Phosphorus, Total Nitrogen	Water Quality
Organic Carbon: TOC	Water Quality
Sediment Chemistry: Herbicides	Water Quality

Data Availability URL

Downloadable data http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/index.shtml

DRAFT FINAL

NPDES Self-Monitoring Program

Agency/Organization	Contact	Start Date	End Date
City of Brentwood	Jacquelyn Paulline Regulatory Compliance Supervisor Public Works Department (925) 516-6074	March 1999	ongoing
City of Lodi	Del Kerlin Public Works Department (209) 333-6869	2000	ongoing
City of Manteca	Warren Shannon Public Works Department (209) 239-8433	2004	ongoing
City of Rio Vista			
City of Rio Vista and Eco Resources, Inc. Trilogy WWTP, Northwest WWTF	Chris McAuliffe Public Works (707) 374-2930	July 9, 2004	July 1, 2009
Beach WWTF	Kirt Hunter Public Works (707) 374-6747	2001	September 30, 2013
City of Sacramento, Combined Sewer System	City of Sacramento Department of Utilities (916) 808-5454	1996	ongoing
City of Stockton			
City of Stockton and County of San Joaquin Storm Water Discharges from Municipal Separate Storm Sewer System	Courtney Vasquez City of Stockton, Municipal Utilities Department (209) 937-8705 Leilani Chua San Joaquin County Public Works, Water Resource Div. (209) 468-3531	December 6, 2007	December 12, 2012
WWTF	Steve Gittings Municipal Utilities Department (209) 937-8707 steve.gittings@ci.stockton. ca.us	April 2, 1999	ongoing

DRAFT FINAL

NPDES Self-Monitoring Program

Agency/Organization (continued)	Contact	Start Date	End Date
City of Tracy	Steve Bayley Public Works Water Quality (209) 831-4434 publicworks@ci.tracy.ca.us	1996	ongoing
County of Sacramento & Cities of Citrus Heights, Elk Grove, Folsom, Galt, Rancho Cordova, and Sacramento	Dalia Fadl (916) 874-1321 fadld@SacCounty.NET	2007	ongoing
Deuel Vocational Institution	Jeffrey Palumbo Correctional Plant Manager II (209) 835-4141	2003	ongoing
GWF Power Systems Company	Rick Volger Wilbur Avenue East Plant Supervisor (925) 778-8637 rvogler@gwfpower.com	2002	ongoing
Mountain House CSD	Paul Sensibaugh General Manager (209) 468-9997	June 23, 2007	May 1, 2012
Oakwood Lake Water District	Mike Gilton District Engineer (209) 652-5351	1998	ongoing
Port of Stockton	Jeff Wingfield 209-946-0246 jwingfield@stocktonport.com	2009	ongoing
Sacramento Regional County Sanitation District	Vyomini Pandya (916) 876-6677 pandyav@sacsewer.com		
Town of Discovery Bay CSD	Virgil Koehne General Manager (925) 634-1131	1999	ongoing

Monitoring Objectives

Ensure compliance with receiving water limits

NPDES Self-Monitoring Program

Sampling Locations

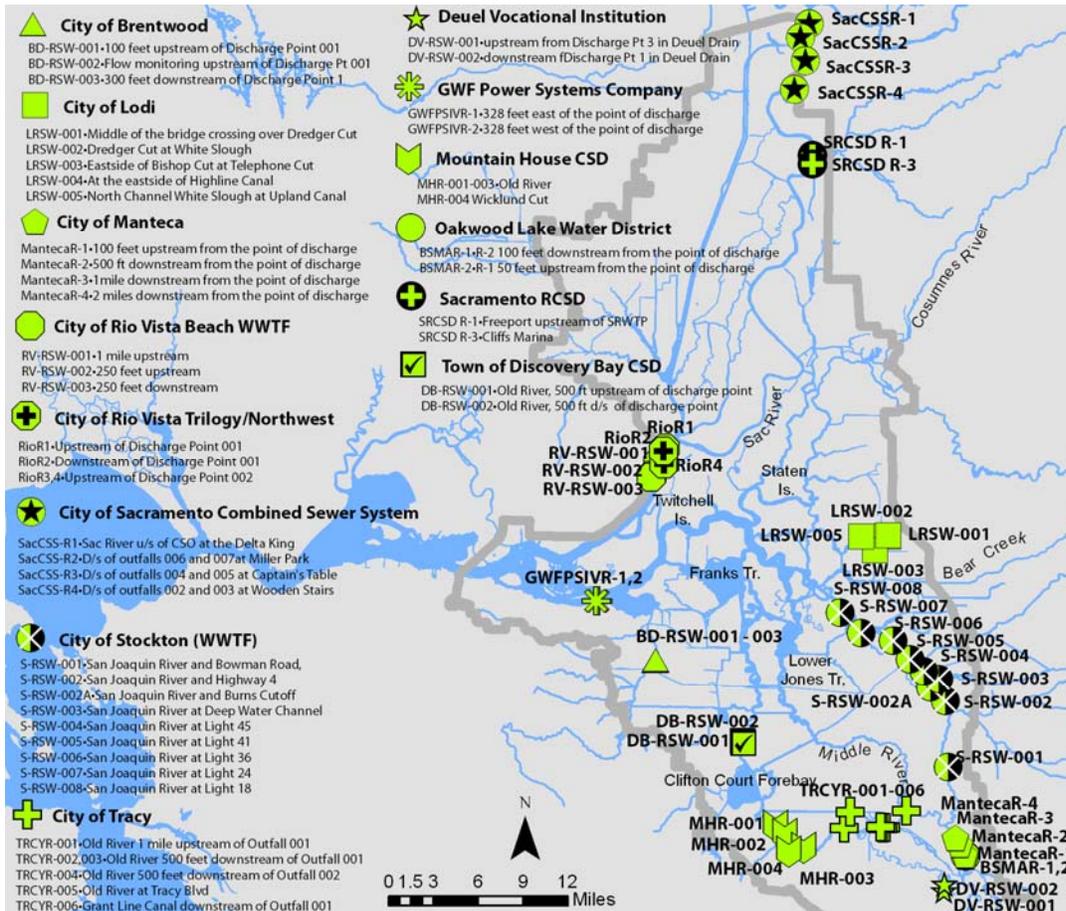
Number of active sites (total): 77

- Wastewater monitoring (total): 52
- Stormwater monitoring (total): 25

Wastewater receiving water monitoring:

- City of Brentwood: 3
- City of Lodi: 5
- City of Manteca: 4
- City of Rio Vista and Eco Resources, Inc.: 4
- City of Rio Vista, Beach WWTF: 3
- City of Sacramento CSS: 4
- City of Stockton: 9
- City of Tracy: 6
- Deuel Vocational Institution: 2
- GWF Power Systems Company: 2
- Mountain House Community Services District: 4
- Sacramento Regional County Sanitation District: 2
- Oakwood Lake Water District (Brown Sand, Inc.): 2
- Town of Discovery Bay Community Services District: 2

Wastewater receiving water monitoring



NPDES Self-Monitoring Program

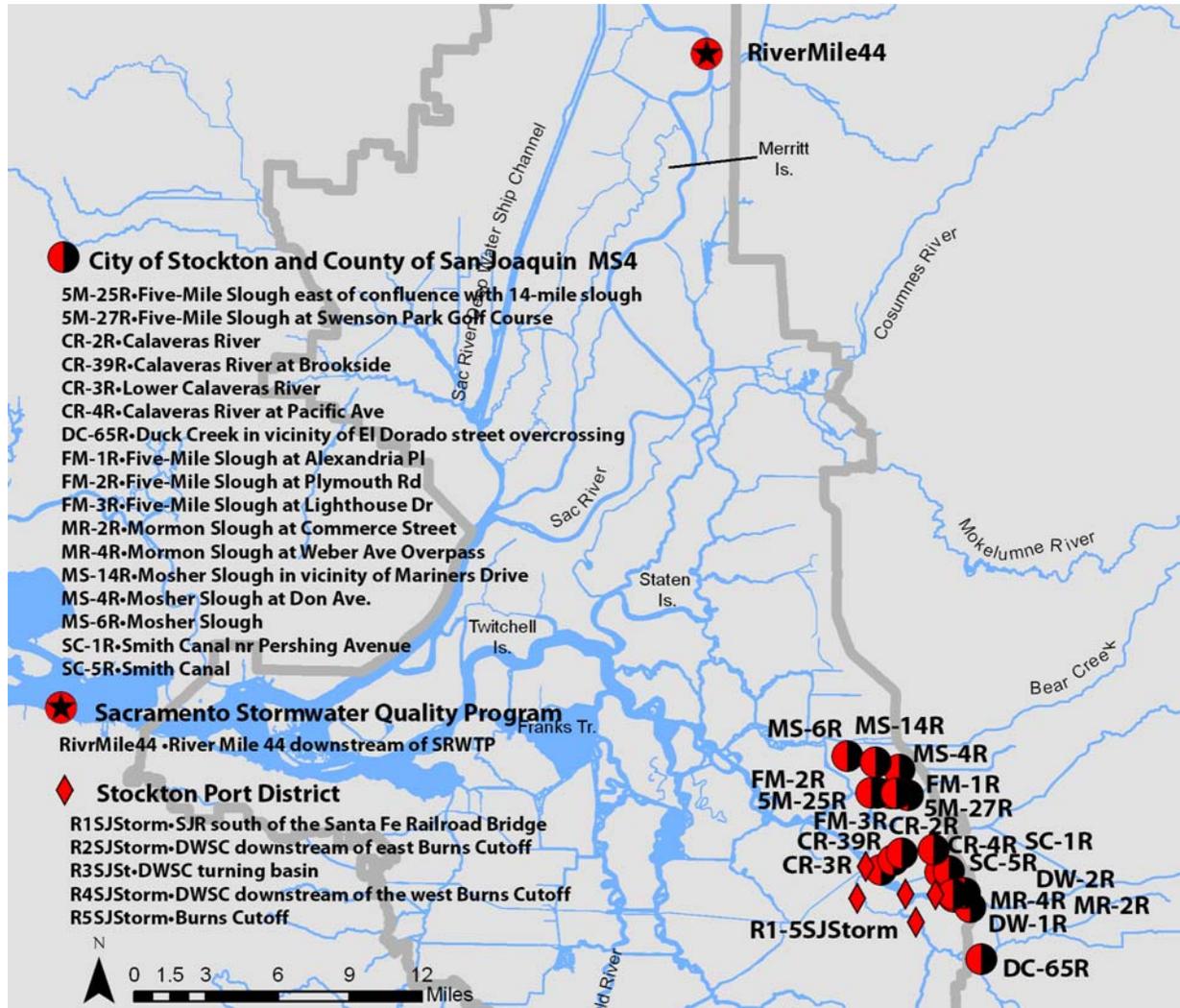
Stormwater receiving water monitoring:

County of Sacramento & Cities of Citrus Heights, Elk Grove, Folsom, Galt, Rancho Cordova, and Sacramento: 1

City of Stockton & County of San Joaquin: 19

Port of Stockton: 5

Stormwater receiving water monitoring:



DRAFT FINAL

NPDES Self-Monitoring Program

Parameters	Sample Type	Frequency
<u>STORMWATER RECEIVING WATER MONITORING</u>		
<u>City of Stockton & County of San Joaquin</u>		
Bulk Organics: Oil & Grease	Water Quality	varies by site
General Sediment Quality: Grain Size, Sediment Oxygen Demand (SOD), TOC	Sediment Quality	varies by site
General Water Quality: Alkalinity, DO, EC, Oxidation Reduction Potential, pH, Resistivity, Salinity, Temperature, TDS, TSS, Turbidity, Volatile Suspended Solids (VSS)	Water Quality	varies by parameter/site
Major Ions and Minerals: Hardness,	Water Quality	varies by site
Mercury: Mercury (Total), Methyl mercury	Water Quality	varies by parameter/site
Metals: Aluminum (Dissolved), Copper (Dissolved), Iron, Lead (Dissolved), Zinc	Water Quality	varies by parameter/site
Nutrients: Ammonia, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Nitrate, Nitrite, Total Ammonia-Nitrogen, Total Kjeldahl Nitrogen (TKN), Ortho-PO ₄ , Phosphorus (Dissolved)	Water Quality	varies by parameter/site
Organic Carbon: TOC	Water Quality	varies by parameter/site
Pathogens & Bacteria: E. coli, Fecal Coliforms	Water Quality	varies by parameter/site
Pesticides: Organophosphates, Pyrethroids	Water Quality	varies by parameter/site
Water Toxicity: Toxicity (acute) - Ceriodaphnia, Fathead Minnow	Toxicity	varies by parameter/site
<u>Sacramento Stormwater Quality Program</u>		
Bioassessment: Benthic Macroinvertebrates, Macrophytes, Periphyton, Pheophytin, Physical Habitat	Community	
General Sediment Quality: Particle Size	Sediment Quality	varies by parameter/site
General Water Quality: DO, EC, pH, Temperature, TDS, TSS, Turbidity	Water Quality	varies by parameter/site
Hydrology: Flow Direction, Velocity, Velocity/Depth Regime, Width	Hydrology	varies by parameter/site
Major Ions and Minerals: Chloride, Cyanide, Fluoride, Hardness	Water Quality	varies by parameter/site
Mercury: Mercury (Dissolved), Methyl mercury	Water Quality	varies by parameter/site

DRAFT FINAL

NPDES Self-Monitoring Program

Parameters (continued)	Sample Type	Frequency
Metals: Aluminum, Antimony, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead (Dissolved), Molybdenum, Nickel, Selenium, Silver, Thallium, Zinc	Sediment Quality Water Quality	varies by parameter/site
Nutrients: BOD, COD, Nitrate, Nitrite, TKN, Phosphorus (Dissolved)	Water Quality	varies by parameter/site
Organic Carbon: DOC	Water Quality	varies by parameter/site
Organic Contaminants: 1,3-Dichlorobenzene, 2-Methyl-4,6-dinitrophenol, Azobenzene, Methylene Blue Activated Substances, Methyl-tert-butyl Ether (MTBE), PAHs, Priority Pollutants, Total Petroleum Hydrocarbon, VOCs	Water Quality	varies by parameter/site
Pathogens & Bacteria: E. coli, Fecal Coliforms, Total Coliforms	Water Quality	varies by parameter/site
Pesticides: Carbamates, Herbicides, Fungicides, Organochlorine Pesticides, Organophosphates, Pyrethroids	Water Quality	varies by parameter/site
<u>Stockton Port District</u>		
Bulk Organics: Oil & Grease	Water Quality	varies by site
General Water Quality: DO, EC, pH, Temperature, TDS, TSS, Turbidity	Water Quality	storms only
Major Ions and Minerals: Hardness, Sulfide, Sulfate, Sulfur	Water Quality	storms only
Mercury: Mercury	Water Quality	storms only
Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Cobalt, Chromium (Total), Chromium VI, Copper, Iron, Lead, Manganese (Dissolved), Hex Chromium, Hexavalent Chromium, Molybdenum, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc	Water Quality	varies by parameter/site
Nutrients: Ammonia, BOD, Nitrate, Nitrite, Phosphorus, Total Ammonia-Nitrogen, Total Kjeldahl Nitrogen (TKN), Total NH ₃	Water Quality	varies by parameter/site
Organic Contaminants: Diesel Range Organics, Gasoline Range Organics, MTBE, Oil & Grease, PCBs, Polynuclear Aromatics, Semivolatile Organic Compounds (SVOCs), VOCs	Water Quality	varies by parameter/site
Pesticides: Carbamates, Herbicides, Fungicides, Organochlorine Pesticides, Organophosphates	Water Quality	storms only

DRAFT FINAL

NPDES Self-Monitoring Program

Parameters (continued)	Sample Type	Frequency
<u>WASTEWATER RECEIVING WATER MONITORING</u>		
<u>City of Brentwood WWTP</u>		
Disinfection Byproducts: Priority Pollutants	Water Quality	varies by parameter/site
General Water Quality: DO, EC, pH, Temperature, Turbidity	Water Quality	weekly
Hydrology: Flow	Hydrology	weekly
Major Ions and Minerals: Hardness, Priority Pollutants	Water Quality	quarterly
Mercury: Priority Pollutants	Water Quality	varies by parameter/site
Metals: Priority Pollutants	Water Quality	varies by parameter/site
Organic Contaminants: Priority Pollutants	Water Quality	varies by parameter/site
Pesticides: Priority Pollutants	Water Quality	varies by parameter/site
Water Toxicity: Toxicity (chronic) - Ceriodaphnia, Fathead Minnow, Algae (Selenastrum capricornutum)	Toxicity	quarterly
<u>City of Lodi, White Slough Water Pollution Control Plant</u>		
Disinfection Byproducts: Priority Pollutants, Trihalomethanes	Water Quality	quarterly
General Water Quality: Alkalinity, DO, EC, pH, Temperature, TSS, Turbidity	Water Quality	varies by parameter/site
Major Ions and Minerals: Boron, Bromide, Calcium, Chloride, Fluoride, Hardness, Magnesium, Potassium, Priority Pollutants, Sodium, Sulfate	Water Quality	varies by parameter/site
Mercury: Mercury (Total), Methyl mercury	Water Quality	quarterly
Metals: Iron, Priority Pollutants	Water Quality	annual
Nutrients: Ammonia, Nitrate, Nitrite, TKN, Total Phosphorus	Water Quality	monthly
Organic Carbon: TOC	Water Quality	monthly
Organic Contaminants: Priority Pollutants	Water Quality	
Pesticides: Priority Pollutants	Water Quality	
<u>City of Manteca, Lathrop and Dutra Farms, WWTF</u>		
Disinfection Byproducts: Priority Pollutants, Total Chlorine Residual	Water Quality	varies by parameter/site
General Water Quality: Alkalinity, DO, EC, pH, Temperature, Turbidity	Water Quality	varies by parameter/site
Hydrology: Flow	Hydrology	varies by site

DRAFT FINAL

NPDES Self-Monitoring Program

Parameters (continued)	Sample Type	Frequency
Major Ions and Minerals: Boron, Calcium, Chloride, Hardness, Magnesium, Potassium, Priority Pollutants, Sodium	Water Quality	varies by parameter/site
Mercury: Priority Pollutants	Water Quality	varies by site
Metals: Priority Pollutants	Water Quality	varies by parameter/site
Nutrients: Ammonia, Nitrate (Dissolved), Nitrite (Dissolved), Phosphorus	Water Quality	varies by parameter/site
Organic Contaminants: Priority Pollutants	Water Quality	varies by parameter/site
Pathogens & Bacteria: Fecal Coliforms	Water Quality	Biweekly
Pesticides: Priority Pollutants	Water Quality	varies by parameter/site

City of Rio Vista and Eco Resources, Inc. Trilogy WWTP, Northwest WWTF

Disinfection Byproducts: Priority Pollutants	Water Quality	
General Water Quality: Alkalinity, DO, EC, pH, Temperature, Turbidity	Water Quality	varies by parameter/site
Hydrology: Flow	Hydrology	weekly
Major Ions and Minerals: Priority Pollutants	Water Quality	weekly
Mercury: Priority Pollutants	Water Quality	weekly
Metals: Priority Pollutants	Water Quality	weekly
Organic Contaminants: Priority Pollutants	Water Quality	varies by parameter/site
Pesticides: Priority Pollutants	Water Quality	varies by parameter/site
Water Toxicity: Toxicity (chronic) - Ceriodaphnia, Fathead Minnow, Algae (Selenastrum capricornutum)	Toxicity	quarterly

City of Rio Vista, Beach WWTF

Disinfection Byproducts: Priority Pollutants	Water Quality	quarterly
General Water Quality: DO, EC, pH, Temperature, TDS, Turbidity	Water Quality	quarterly
Major Ions and Minerals: Priority Pollutants	Water Quality	quarterly
Mercury: Priority Pollutants	Water Quality	quarterly
Metals: Priority Pollutants	Water Quality	quarterly
Organic Contaminants: Priority Pollutants	Water Quality	quarterly
Pesticides: Priority Pollutants	Water Quality	quarterly
Water Toxicity: Toxicity (chronic) - Ceriodaphnia, Fathead Minnow, Algae (Selenastrum capricornutum)	Toxicity	annual

DRAFT FINAL

NPDES Self-Monitoring Program

Parameters (continued)	Sample Type	Frequency
<u>City of Sacramento Combined Sewer System</u>		
General Water Quality: DO, pH, Temperature, Turbidity	Water Quality	varies by parameter/site
<u>City of Stockton WWTF</u>		
Bioassessment: Chlorophyll, Phaeophytin	Water Quality	weekly
Disinfection Byproducts: Priority Pollutants, Trihalomethanes	Water Quality	weekly
General Water Quality: DO, EC, pH, Temperature, TDS, TSS, Turbidity, VSS	Water Quality	weekly
Hydrology: Flow	Hydrology	weekly
Major Ions and Minerals: Hardness, Priority Pollutants	Water Quality	monthly
Mercury: Priority Pollutants	Water Quality	varies by parameter/site
Metals: Priority Pollutants	Water Quality	varies by parameter/site
Organic Contaminants: Priority Pollutants	Water Quality	varies by parameter/site
Pesticides: Priority Pollutants	Water Quality	varies by parameter/site
Nutrients: Ammonia, BOD, Nitrate, Nitrite, Total Nitrogen, TKN	Water Quality	weekly
Pathogens & Bacteria: Fecal Coliforms	Water Quality	weekly
Water Toxicity: Toxicity (chronic) - Ceriodaphnia, Fathead Minnow, Algae (Selenastrum capricornutum)	Toxicity	quarterly
<u>City of Tracy WWTF</u>		
Disinfection Byproducts: Trihalomethanes, Total Chlorine Residual	Water Quality	varies by parameter/site
General Water Quality: Alkalinity, DO, EC, pH, Temperature, Turbidity	Water Quality	varies by parameter/site
Major Ions and Minerals: Boron, Calcium, Chloride, Hardness, Magnesium, Potassium, Priority Pollutants, Sodium	Water Quality	varies by parameter/site
Mercury: Mercury (Total), Methyl mercury	Water Quality	quarterly
Metals: Priority Pollutants	Water Quality	varies by parameter/site
Nutrients: Ammonia, Nitrate, Nitrite, Pheophytin, TKN	Water Quality	varies by parameter/site
Organic Carbon: TOC	Water Quality	monthly
Organic Contaminants: Priority Pollutants	Water Quality	varies by parameter/site
Pathogens & Bacteria: Fecal Coliforms	Water Quality	Weekly

DRAFT FINAL

NPDES Self-Monitoring Program

Parameters (continued)	Sample Type	Frequency
<u>Deuel Vocational Institution</u>		
Disinfection Byproducts: Total Chlorine Residual	Water Quality	varies by site
General Water Quality: Alkalinity, DO, EC, pH, Temperature, TDS, Turbidity	Water Quality	varies by parameter/site
Major Ions and Minerals: Boron, Calcium, Chloride, Hardness, Magnesium, Potassium, Sodium	Water Quality	annual
Metals: Iron, Manganese	Water Quality	annual
Nutrients: Phosphorus, Total Nitrite, Total Nitrogen, Unionized NH ₃	Water Quality	varies by parameter/site
Pathogens: Fecal coliforms	Water Quality	varies by parameter/site
Water Toxicity: Toxicity (chronic) - Ceriodaphnia, Fathead Minnow, Algae (Selenastrum capricornutum)	Toxicity	quarterly
<u>GWF Power System, L.P., Wilbur Ave East PP, Antioch (Site IV)</u>		
Disinfection Byproducts: Priority Pollutants	Water Quality	quarterly
General Water Quality: DO, EC, pH, Temperature, Turbidity	Water Quality	quarterly
Major Ions and Minerals: Chloride, Hardness, Priority Pollutants	Water Quality	varies by parameter/site
Mercury: Priority Pollutants	Water Quality	varies by parameter/site
Metals: Priority Pollutants	Water Quality	varies by parameter/site
Organic Contaminants: Priority Pollutants	Water Quality	varies by parameter/site
Pesticides: Priority Pollutants	Water Quality	varies by parameter/site
Water Toxicity: Toxicity (chronic) - Ceriodaphnia, Fathead Minnow, Algae (Selenastrum capricornutum)	Toxicity	semiannual
<u>Mountain House WWTP</u>		
Disinfection Byproducts: Priority Pollutants	Water Quality	varies by parameter/site
General Water Quality: Alkalinity, DO, EC, pH, Temperature	Water Quality	varies by parameter/site
Hydrology: Flow Direction, Velocity, Velocity/Depth Regime, Width	Hydrology	varies by parameter/site
Major Ions and Minerals: Boron, Calcium, Chloride, Hardness, Magnesium, Potassium, Priority Pollutants, Sodium, Standard Minerals	Water Quality	varies by parameter/site

DRAFT FINAL

NPDES Self-Monitoring Program

Parameters (continued)	Sample Type	Frequency
Mercury: Priority Pollutants	Water Quality	varies by parameter/site
Metals: Priority Pollutants	Water Quality	varies by parameter/site
Nutrients: TKN, Total Phosphorus	Water Quality	varies by parameter/site
Organic Carbon: TOC	Water Quality	Monthly
Organic Contaminants: Priority Pollutants	Water Quality	varies by parameter/site
<u>Oakwood Lake Water District</u>		
General Water Quality: DO, EC, pH, Temperature, Turbidity	Water Quality	monthly
Major Ions and Minerals: Standard Minerals	Water Quality	annual
Nutrients: COD	Water Quality	annual
<u>Sacramento Regional County Sanitation District, Sacramento Regional WWTP</u>		
Disinfection Byproducts: Chlorine Residual, Chloroform, Dichlorobromomethane, Dichloromethane	Water Quality	weekly
General Water Quality: DO, EC, pH, Temperature, Turbidity	Water Quality	varies by parameter/site
Hydrology: Flow	Hydrology	varies by site
Major Ions and Minerals: Cyanide	Water Quality	weekly
Mercury: Mercury	Water Quality	varies by parameter/site
Metals: Copper, Lead, Silver, Zinc	Water Quality	varies by parameter/site
Nutrients: Total Ammonia-Nitrogen, Total Nitrogen	Water Quality	varies by parameter/site
Organic Contaminants: Bis(2-ethylhexyl)phthalate, PBDEs, Tetrachloroethylene	Water Quality	varies by parameter/site
Pathogens & Bacteria: Bacteria, E. coli, Fecal Coliforms, Total Coliforms	Water Quality	varies by parameter/site
Water Toxicity: Toxicity (chronic) - Ceriodaphnia, Fathead Minnow, Algae (Selenastrum capricornutum)	Toxicity	quarterly

DRAFT FINAL

NPDES Self-Monitoring Program

Parameters (continued)	Sample Type	Frequency
<u>Town of Discovery Bay</u>		
General Water Quality: DO, EC, pH, Temperature, TDS, Turbidity	Water Quality	varies by parameter/site
Hydrology: Flow	Hydrology	varies by site
Major Ions and Minerals: Chloride, Hardness	Water Quality	bimonthly
Organic Carbon: DOC, TOC	Water Quality	varies by parameter/site
Pathogens & Bacteria: Fecal Coliforms	Water Quality	quarterly
Water Toxicity: Toxicity (chronic) - Ceriodaphnia, Fathead Minnow, Algae (Selenastrum capricornutum)	Toxicity	quarterly
<hr/>		
Data Availability	URL	Available by request
Discharger Self-Monitoring Reports	n/a	yes

DRAFT FINAL

Sacramento Regional Wastewater Treatment Plant Priority Pollutant Prevention Program

Agency/Organization
Sacramento Regional County
Sanitation District

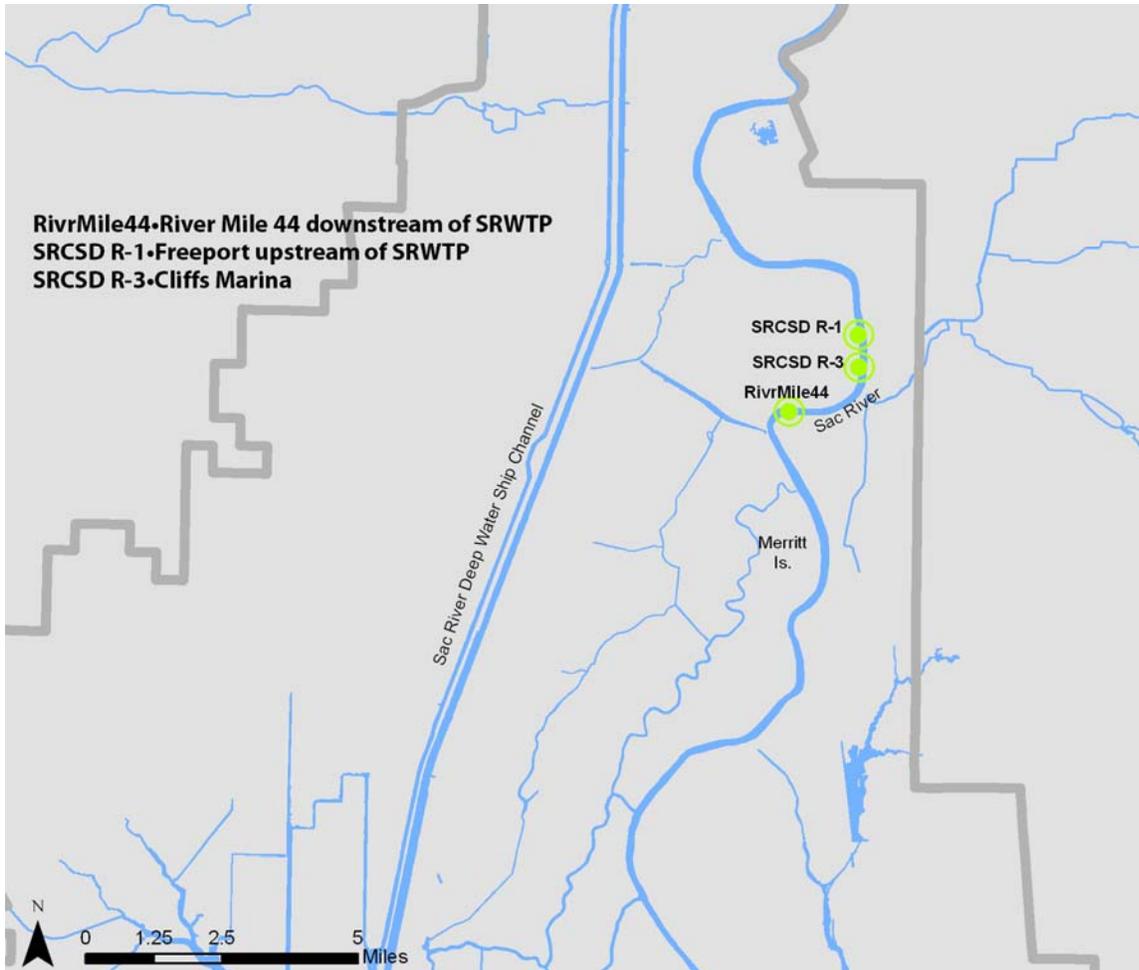
Project Contact
Glen Del Sarto
delsartog@sacsewer.com

Start Date
1990
End Date
ongoing

Monitoring Objectives

Annual Budget

Sampling Locations
Number of active sites: 3



DRAFT FINAL

Sacramento Regional Wastewater Treatment Plant Priority Pollutant Prevention Program

Parameters	Sample Type	Frequency
Disinfection Byproducts: Bromomethane, Trihalomethanes	Water Quality	varies by parameter/site
General Water Quality: Alkalinity, DO, EC, pH, Temperature, TSS, TDS	Water Quality	varies by parameter/site
Major Ions and Minerals: Calcium, Chloride, , Hardness, Magnesium, Mercury, Potassium, Sodium, Sulfate	Water Quality	varies by parameter/site
Mercury: Mercury	Water Quality	monthly
Nutrients: BOD, Ammonia, Nitrate + Nitrite, Phosphorus, Total Nitrogen	Water Quality	varies by parameter/site
Organic Carbon: TOC	Water Quality	varies by parameter/site
Organic Contaminants: 1,1,2,2-Tetrachloroethene, 2-Methyl-4,6-dinitrophenol, 4-Chloro-3-methyphenol, Benzo(k)fluoranthene, Benzyl butyl phthalate, cis-1,3-Dichloropropene, Dichlorodifluoromethane, Di-isopropyl ether, Ethyl tert-butyl ether (ETBE), MTBE, Priority Pollutants. trans-1,3-Dichloropropene, Trichlorofluoromethane	Water Quality	varies by parameter/site
Pesticides: Herbicides, Organochlorine Pesticides, Organophosphates	Water Quality	varies by parameter/site
Trace Elements & Metals: Aluminum, Antimony, Arsenic, Beryllium, Cadmium, Chromium, Copper, Cyanide, Lead, Molybdenum, Nickel, Selenium, Silver, Thallium, Zinc	Water Quality	varies by parameter/site

Data Availability

Database; Data available by request from SRCSD

A.3. Water Supply Monitoring

Municipal Water Quality Investigations

Department of Water Resources

Source Water Monitoring

Contra Costa Water District

State Water Project Water Quality Monitoring

Department of Water Resources – Operations & Maintenance

DRAFT FINAL

DRAFT FINAL

Municipal Water Quality Investigations

http://www.wq.water.ca.gov/mwqi/mwqi_index.cfm

Agency/Organization
Department of Water Resources

Project Contact
Carol DiGiorgio
Office of Water Quality
(916) 376-9711
caroldi@water.ca.gov

Start Date
1982
End Date
ongoing

Monitoring Objectives

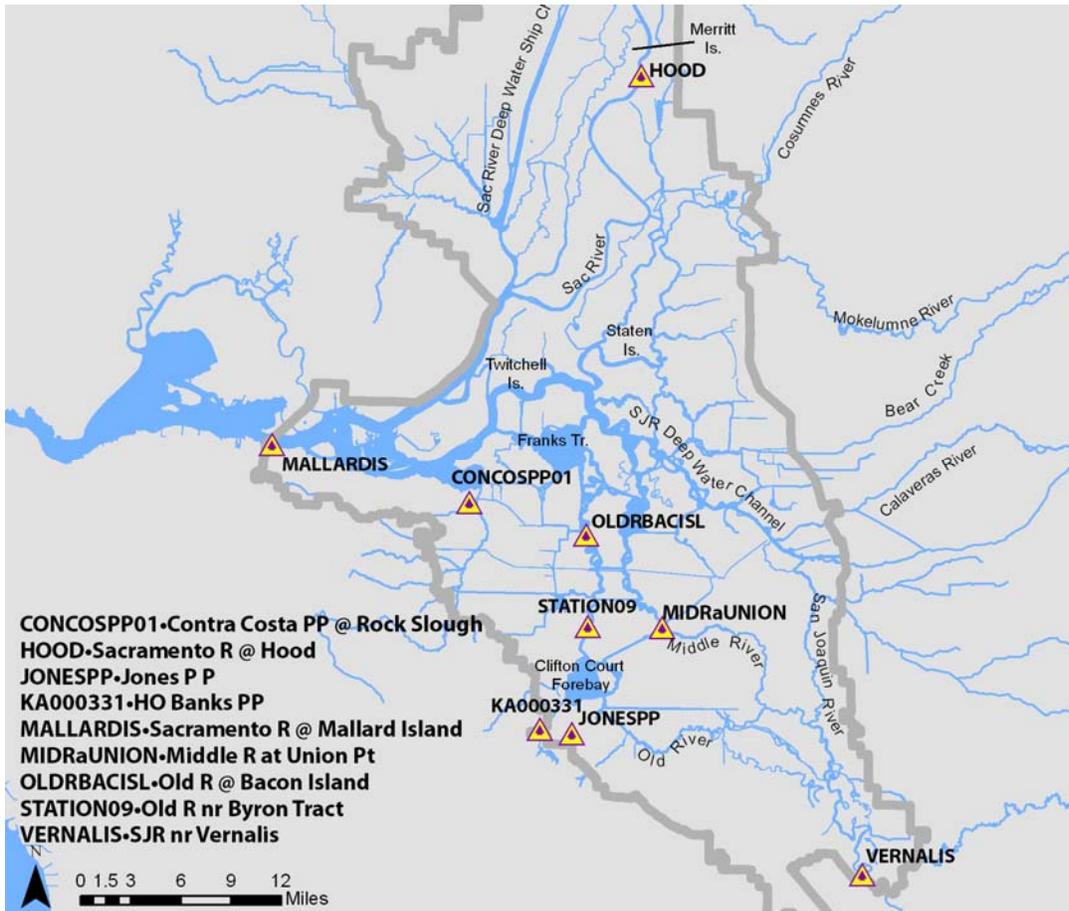
Provide monitoring data to MWQI Program participants and other identified stakeholders, such as CALFED, on key constituents of concern.

Annual Budget

\$3.1M (total MWQI program budget)

Sampling Locations

Number of active sites (in the Delta): 9*
*real-time and discrete sampling are conducted at Hood, Vernalis, Banks, and Jones



DRAFT FINAL

Municipal Water Quality Investigations

Parameters	Sample Type	Frequency
General Water Quality: DO, EC, pH, TDS, Temperature, Turbidity, UV (abs 254 nm)	Water Quality	monthly or bi-weekly - varies by site*
Major Ions and Minerals: Bromide, Chloride, Hardness	Water Quality	monthly or bi-weekly - varies by site*
Nutrients: Ortho-PO ₄ (Dissolved), Total NH ₃ , Total NO ₃	Water Quality	monthly or bi-weekly - varies by site*
Organic Carbon: DOC, TOC	Water Quality	monthly or bi-weekly - varies by site*

*Bi-weekly basis at the stations with continuous monitoring capabilities, and monthly at all others

Data Availability	URL
Downloadable data (grab samples)	http://wdl.water.ca.gov/wq-gst/
Biennial reports	http://www.wq.water.ca.gov/mwqi/pubs.cfm#program_reports
Autostation Data	http://wdl.water.ca.gov/wq-gst/

DRAFT FINAL

Source Water Monitoring

<http://www.ccwater.com/>

Agency/Organization
Contra Costa Water District

Project Contact
Jessica Edwards-Brandt

(925) 688-8183
jedwards@ccwater.com

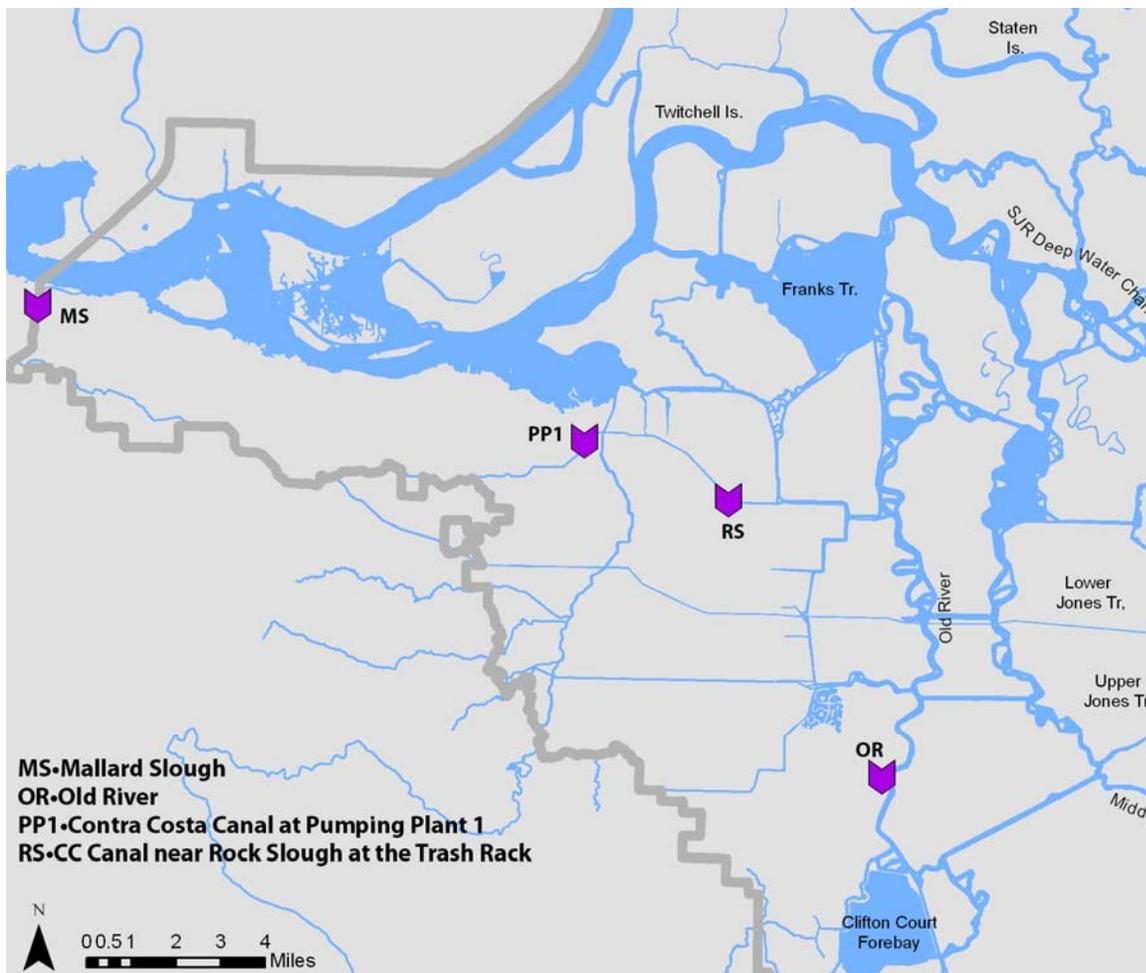
Start Date
1940s
End Date
ongoing

Monitoring Objectives

To monitor source water for treated water supply.

Annual Budget
\$50,000

Sampling Locations
Number of active sites: 4



DRAFT FINAL

Source Water Monitoring

Parameters	Sample Type	Frequency
Bioassessment: Dominant organism, Phytoplankton, Taste and odor producer	Community	weekly
General Water Quality: Alkalinity, EC, pH, TDS, Temperature, Turbidity	Water Quality	varies by parameter/site
Metals & Trace Elements: Iron , Manganese	Water Quality	monthly
Major Ions and Minerals: Bromide, Chloride, Fluoride, Hardness, Sodium , Sulfate	Water Quality	varies by parameter/site
Nutrients: Ortho-PO ₄ , TKN, Total Nitrogen (N), Total NH ₃ , Total NH ₄ , Total NO ₃ , Total Phosphorous,	Water Quality	varies by parameter/site
Organic Carbon: TOC	Water Quality	monthly
Pathogens & Bacteria: E. coli, Total Coliforms	Water Quality	monthly

Data Availability

CDEC (daily chloride concentration – CDEC stations: IDB and INB)

<http://cdec.water.ca.gov>

Other data available by request.

DRAFT FINAL

State Water Project Water Quality Monitoring

<http://www.omwq.water.ca.gov/>

Agency/Organization Department of Water Resources	Project Contact Barry Montoya (916) 653-4383 bmontoya@water.ca.gov	Start Date 1960's End Date ongoing
---	--	---

Monitoring Objectives

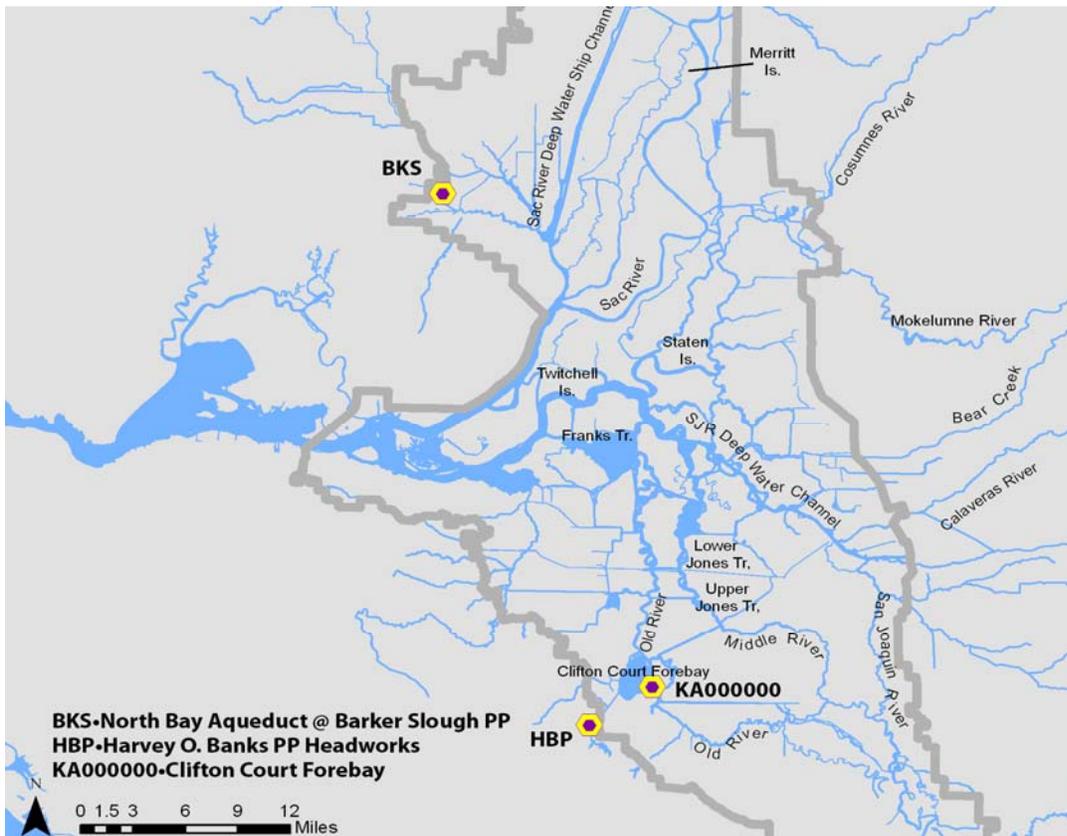
1.) Document spatial and temporal changes in SWP water quality; 2.) Plan water treatment operational changes; 3.) Identify and respond to pollution or other water quality episodes; 4.) Compare SWP water quality to drinking water standards, Article 19 contractual requirements, or other criteria.

Annual Budget

\$0.98M (total program budget)

Sampling Locations

Number of active sites in the legal Delta: 3



State Water Project Water Quality Monitoring

Parameters	Sample Type	Frequency
General Water Quality: EC, pH, TDS, Temperature, Turbidity, UV (abs 254 nm)	Water Quality	varies by parameter/site
Major Ions & Minerals: Boron (Dissolved), Calcium (Dissolved), Chloride (Dissolved), Fluoride (Dissolved), Magnesium (Dissolved), Sodium (Dissolved), Sulfate (Dissolved)	Water Quality	varies by parameter/site
Mercury: Mercury (Dissolved)	Water Quality	varies by parameter/site
Metals & Trace Elements: Aluminum (Dissolved), Arsenic (Dissolved), Barium (Dissolved), Beryllium (Dissolved), Cadmium (Dissolved), Chromium (Dissolved), Copper (Dissolved), Iron (Dissolved), Lead (Dissolved), Manganese (Dissolved), Nickel (Dissolved), Selenium (Dissolved), Silver (Dissolved), Zinc (Dissolved)	Water Quality	varies by parameter/site
Nutrients: Dissolved NO ₃ , Dissolved Nitrite + Nitrate, Ortho-PO ₄ (Dissolved), Total Nitrogen, Total Phosphorus	Water Quality	varies by parameter/site
Organic Carbon: DOC, TOC	Water Quality	monthly
Organics: Purgeable Organics, Organochlorine compounds	Water Quality	monthly
Pesticides: Carbamates, Herbicides, Organophosphates	Water Quality	varies by parameter/site

Data Availability	URL
Annual Report	http://www.womwq.water.ca.gov/PublicationsPage/index.cfm
Grab sample data	http://wdl.water.ca.gov/
Autostation data	http://cdec.water.ca.gov/cgi-progs/staSearch

A.4. Regional and Watershed Monitoring

Agricultural Subsurface Drainage Program

Central Valley Water Board

IEP Environmental Monitoring Program – Discrete Physical/Chemical Water Quality Sampling

Department of Water Resources

National Water Quality Assessment Program (NAWQA)

U.S. Geological Survey

Sacramento Coordinated Monitoring Program (CMP)

Sacramento Regional County Sanitation District

San Francisco Bay Regional Monitoring Program (RMP)

San Francisco Estuary Institute

Surface Water Ambient Monitoring Program (SWAMP)

Central Valley Water Board

DRAFT FINAL

DRAFT FINAL

Agricultural Subsurface Drainage Program

Agency/Organization
Central Valley Water Board

Project Contact

Start Date

End Date
ongoing

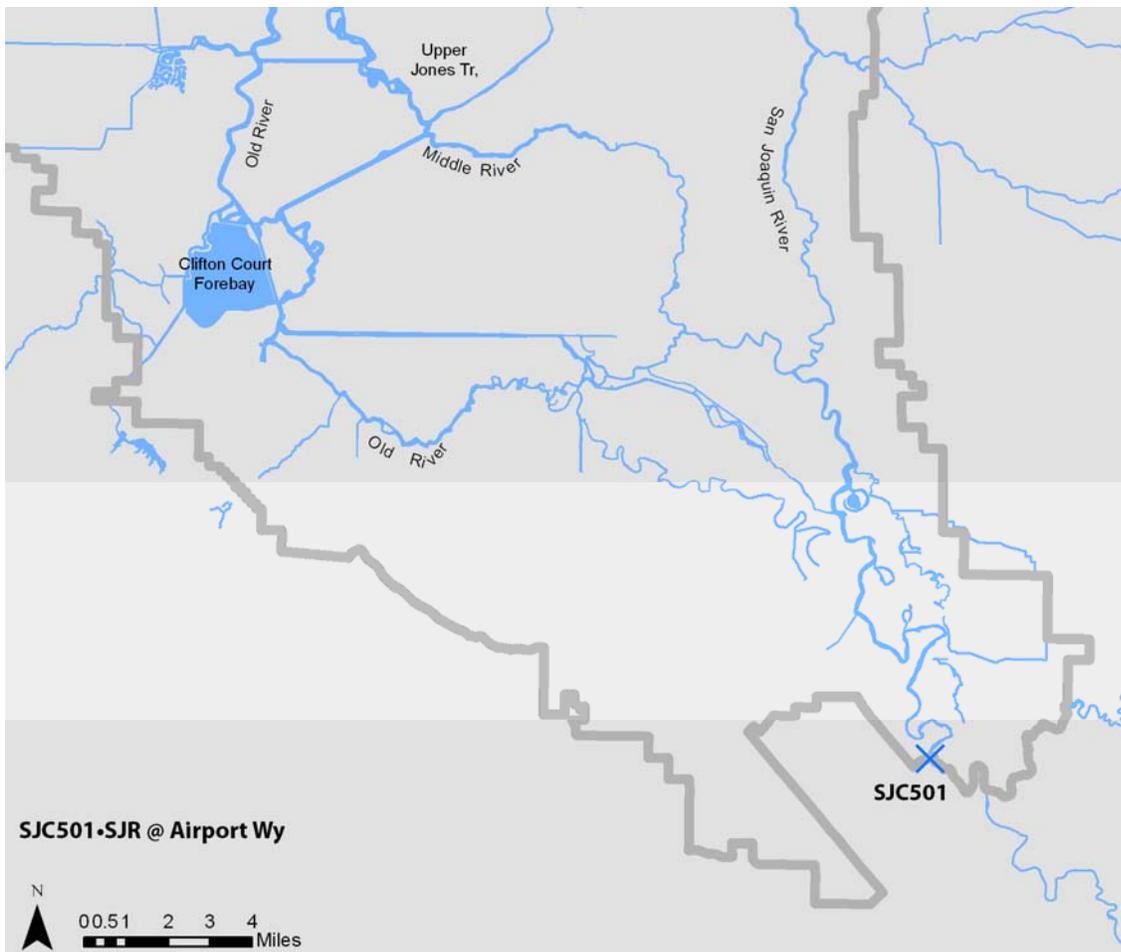
Monitoring Objectives

Data is used to support the Salt and Boron and Selenium TMDL programs.

Annual Budget

Sampling Locations

Number of active sites (Delta only): 1



DRAFT FINAL

Agricultural Subsurface Drainage Program

Parameters	Sample Type	Frequency
General Water Quality: DO, EC, pH, Temperature	Water Quality	weekly
Metals and Trace Elements: Boron, Molybdenum, Selenium	Water Quality	varies by parameter

Data Availability	URL
Central Valley Water Board SWAMP Website	http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/index.shtml

DRAFT FINAL

IEP Environmental Monitoring Program - Discrete Physical/Chemical Water Quality Sampling

<http://www.baydelta.water.ca.gov/emp/index.html>

Agency/Organization
Department of Water Resources

Project Contact
Brienne Noble and Karen Gehrts
(916) 375-4825
bnoble@water.ca.gov
kagehrts@water.ca.gov

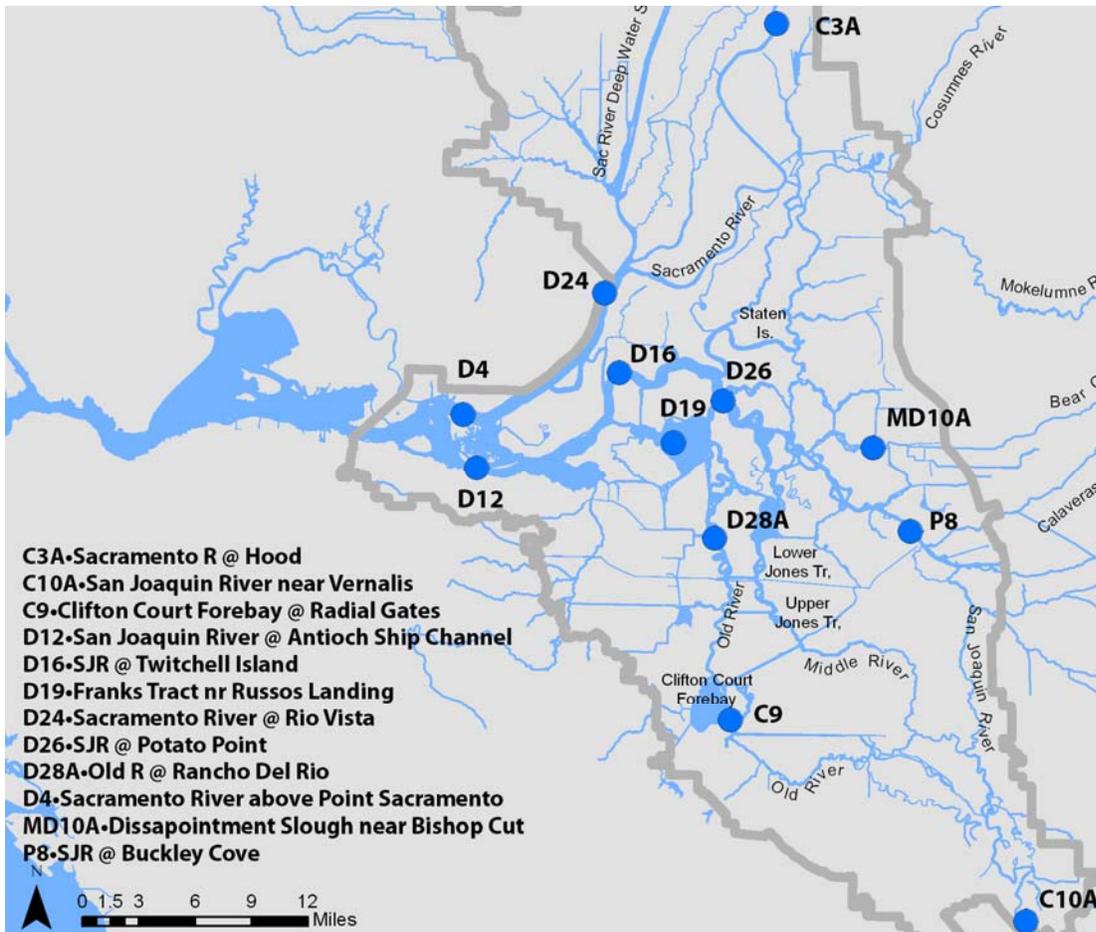
Start Date
1972
End Date
ongoing

Monitoring Objectives

Gauging the environmental health of the estuary.

Annual Budget
\$2.95 M

Sampling Locations
Number of active sites: 12



DRAFT FINAL

IEP Environmental Monitoring Program – Discrete Physical/Chemical Water Quality Sampling

Parameters	Sample Type	Frequency
Bioassessment: Chlorophyll a, Chlorophyll a Fluorescence, Phytoplankton Species Compositions and Abundances	Community	monthly
General Water Quality: DO, EC, pH, Secchi depth, TDS, Temperature, TSS, Turbidity, VSS	Water Quality	monthly
Hydrology: Depth	Water	monthly
Major Ions and Minerals: Chloride, Silica Dioxide	Water Quality	monthly
Nutrients: Dissolved Ammonia, Dissolved Organic N, Inorganic N, Kjeldahl N, Ortho-PO ₄ , Total Phosphorus	Water Quality	monthly

Data Availability	URL
BDAT	http://baydelta.water.ca.gov/
Annual Report, Newsletters	http://www.iep.ca.gov/

DRAFT FINAL

National Water Quality Assessment Program

<http://water.usgs.gov/nawqa/about.html>

Agency/Organization

U.S. Geological Survey

Project Contact

Start Date

1991

End Date

ongoing

Monitoring Objectives

The NAWQA program provides an understanding of water quality conditions and how those conditions may vary locally, regionally, and nationally; whether conditions are getting better or worse over time; and how natural features and human activities affect those conditions.

Sacramento Basin

To assess the quality of surface water and groundwater in the Sacramento River Basin as part of a national study.

San Joaquin-Tulare Basins

To assess water quality in the San Joaquin Basin, especially with respect to pesticides and nutrients.

Trend Network for Streams

Provide baseline information on water quality (inorganic parameters) and select contaminants such as nutrients and pesticides.

Annual Budget

Sampling Locations

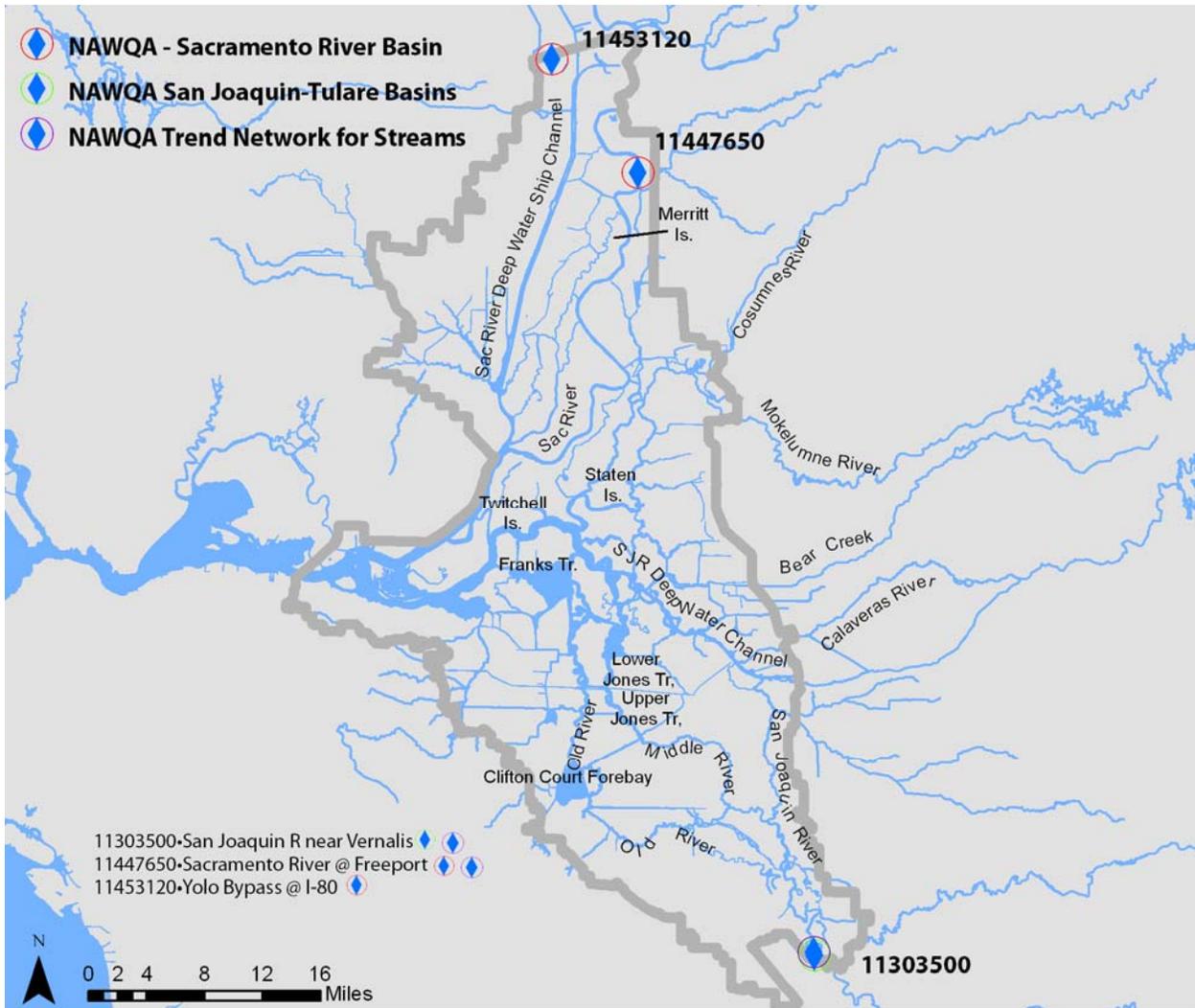
Number of active sites in the Delta (total): 3

Sacramento River Basin: 2

San Joaquin-Tulare Basins: 1

Trend Network for Streams: 2

National Water Quality Assessment Program



DRAFT FINAL

National Water Quality Assessment Program

Parameters	Sample Type	Frequency
<u>Sacramento Basin:</u>		
General Water Quality: DO, EC, Floating Matter, pH, Temperature, TDS, TSS, Turbidity	Water Quality	
General Sediment Quality: Particle Size	Sediment Quality	
Hydrology: Flow	Hydrology	
Major Ions and Minerals: Chloride, Hardness	Water Quality	
Metals & Trace Elements: Arsenic	Water Quality	
Mercury: Mercury, Methylmercury	Water Quality	
Nutrients: Ammonia as N, Phosphorus (Dissolved), Ortho-PO ₄ (Dissolved), Total NH ₃	Water Quality	
Organic Carbon: DOC, Particulate Organic Carbon (POC)	Water Quality	
Organic Contaminants: PCBs, Semivolatile Organic Compounds (SVOCs), VOCs	Water Quality	
Pesticides: Carbamates, Herbicides, Organochlorine Pesticides, Organophosphates, Pyrethroids	Water Quality	
<u>San Joaquin-Tulare Basins:</u>		
General Water Quality: DO, EC, Floating Matter, pH, Temperature, TDS, TSS, Turbidity	Water Quality	
General Sediment Quality: Particle Size	Sediment Quality	
Hydrology: Flow	Hydrology	
Major Ions and Minerals: Chloride, Hardness	Water Quality	
Metals & Trace Elements: Arsenic	Water Quality	
Mercury: Mercury, Methylmercury	Water Quality	
Nutrients: Ammonia as N, Phosphorus (Dissolved), Ortho-PO ₄ (Dissolved)	Water Quality	
Organic Carbon: DOC, Particulate Organic Carbon (POC)	Water Quality	
Organic Contaminants: PCBs, Semivolatile Organic Compounds (SVOCs), VOCs	Water Quality	
Pesticides: Carbamates, Herbicides, Organochlorine Pesticides, Organophosphates, Pyrethroids	Water Quality	

DRAFT FINAL

National Water Quality Assessment Program

Parameters (continued)	Sample Type	Frequency
<u>Trend Network for Streams</u>		
Bioassessment: Benthic Macroinvertebrates, Fish	Community	
General Water Quality: Alkalinity, DO, pH	Water Quality	
Nutrients: Ammonia as N, Nitrite + Nitrate, Ortho-PO ₄ , Total N, Total NO ₂ , Phosphorus	Water Quality	
Pesticides: Carbamates, cis-Propiconazole, Desulfinylfipronil, Desulfinylfipronil amide, Fipronil, Fipronil sulfide, Fipronil sulfone, Herbicides, Metalaxyl, Myclobutanil, Organochlorine Pesticides, Organophosphates, Propargite, Pyrethroids, Tebuconazole, trans-Propiconazole	Water Quality	
<hr/>		
Data Availability	URL	
Downloadable data at NAWQA Data Warehouse	http://infotrek.er.usgs.gov/traverse/f?p=NAWQA:HOME:0	
Data downloaded 2x/year to National Water Information System (NWIS)	http://waterdata.usgs.gov/nwis	
Available by request		

DRAFT FINAL

Sacramento Coordinated Monitoring Program

<http://srcsd.com/cmp.php>

Agency/Organization
Sacramento Regional County
Sanitation District

Project Contact
Steve Nebozuk
nebozucs@sacsewer.com

Start Date
December 1992
End Date
ongoing

Monitoring Objectives

To characterize ambient levels of pollutants of concern in the Sacramento and American Rivers.

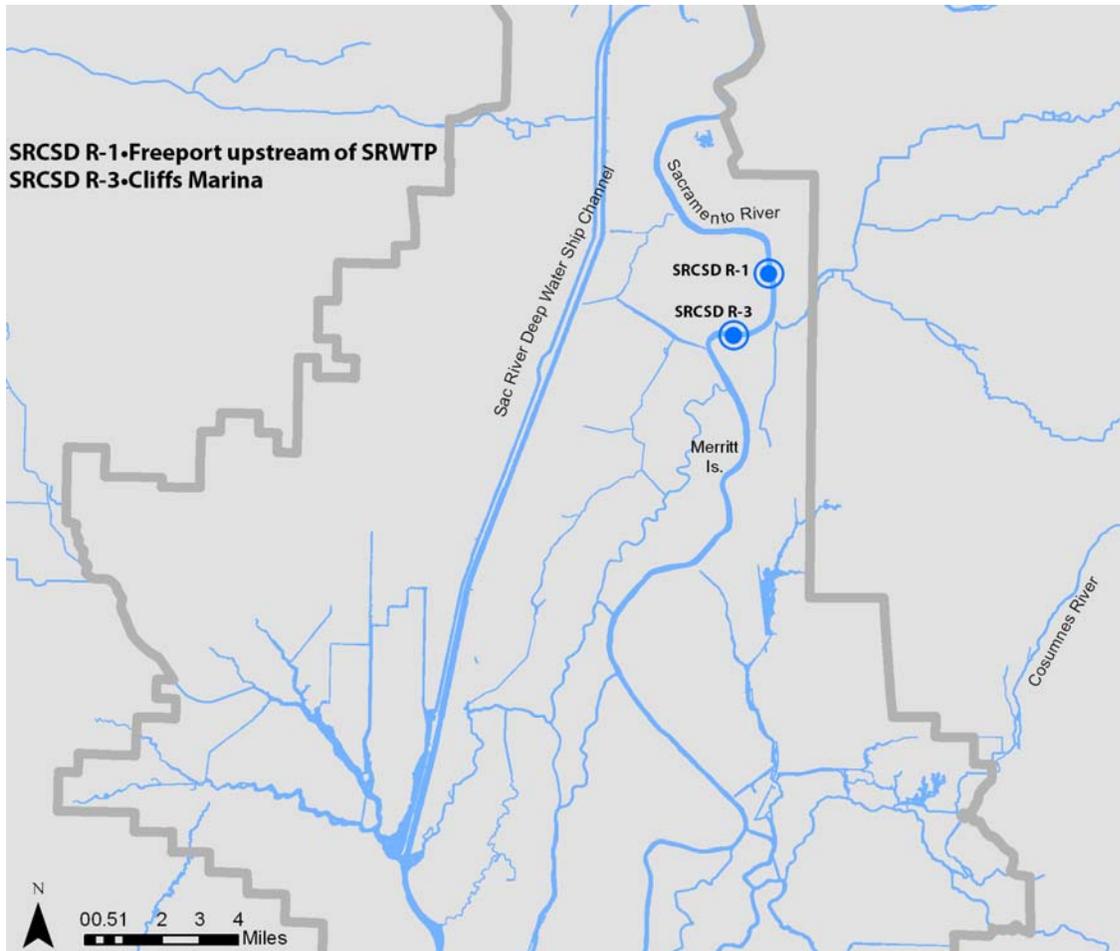
Annual Budget

\$200,000 - \$250,000*

*(total annual budget; includes
stations located outside of the legal
Delta)

Sampling Locations

Number of active sites (Delta only): 2



DRAFT FINAL

Sacramento Coordinated Monitoring Program

Parameters	Sample Type	Frequency
General Water Quality: DO, EC, pH, TDS, Temperature, TSS, Turbidity, UV (abs 254 nm)	Water Quality	6-8 times/year
Major Ions & Minerals: Chloride, Cyanide, Hardness	Water Quality	6-8 times/year
Mercury: Mercury (Dissolved), Methylmercury (Dissolved),	Water Quality	6-8 times/year
Metals & Trace Elements: Arsenic (Dissolved), Cadmium (Dissolved), Chromium (Dissolved), Copper (Dissolved), Lead (Dissolved), Nickel (Dissolved), , Silver (Dissolved), Zinc (Dissolved)	Water Quality	6-8 times/year
Nutrients: Ammonia as N, Dissolved Ortho-PO ₄ , Nitrate, Total N, Total P	Water Quality	6-8 times/year
Organic Carbon: DOC, TOC	Water Quality	6-8 times/year
Organic Contaminants: Acid extractable, Base-neutral extractable, Bis(2-ethylhexyl)phthalate, Hexachlorobenzene, N-Nitroso-din-propylamine, Pentachlorophenol, PAHs, VOCs	Water Quality	6-8 times/year
Pathogens & Bacteria: E. coli, Fecal Coliforms, Total Coliforms	Water Quality	6-8 times/year
Pesticides: Carbamates, Herbicides, Organophosphates	Water Quality	6-8 times/year

Data Availability	URL	Available by request
Annual Report	http://srcsd.com/cmp.php	Yes
In an electronic form (Excel)		Yes

DRAFT FINAL

San Francisco Bay Regional Monitoring Program

<http://www.sfei.org/rmp/index.html>

Agency/Organization
San Francisco Estuary Institute

Project Contact
Meg Sedlak
(510) 746-7345
meg@sfei.org

Start Date
1993

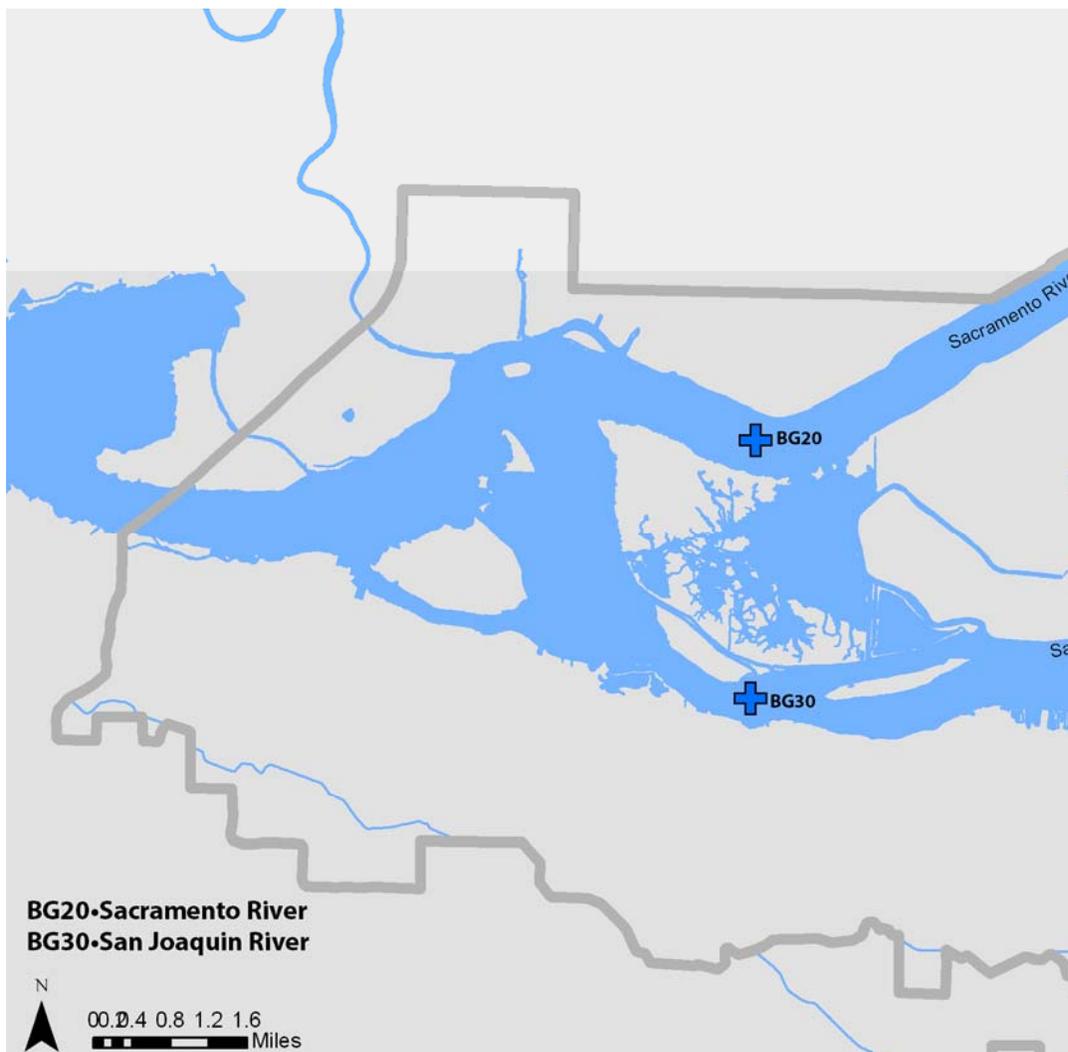
End Date
ongoing

Monitoring Objectives

Collect data and communicate information about water quality in the San Francisco Estuary to support management decisions.

Annual Budget
\$3M(entire program)

Sampling Locations
Number of active sites (Delta only): 2



DRAFT FINAL

San Francisco Bay Regional Monitoring Program

Parameters	Sample Type
Bioassessment: Chlorophyll a, Phaeophytin a	Community
General Sediment Quality: Particle Size	Sediment Quality
General Water Quality: DO, EC, pH, Temperature, TSS	Water Quality
Hydrology: Depth	Water Quality
Major Ions and Minerals: Hardness, Silica	Water Quality
Trace Elements & Metals: Arsenic (Dissolved), Cadmium (Dissolved), Copper (Dissolved), Iron (Dissolved), Lead (Dissolved), Manganese (Dissolved), Cobalt (Dissolved), Nickel (Dissolved), Selenium (Dissolved), Silver (Dissolved), Zinc (Dissolved)	Water Quality
Mercury: Mercury (dissolved), Methylmercury (dissolved)	Water Quality
Pesticides: Herbicides, Organochlorine Pesticides, Organophosphates	Water Quality
Sediment Chemistry: Aluminum (Total), Ammonium as N, DOC, Mercury (dissolved), Methylmercury (dissolved), Nitrate as N, Nitrite as N, PAHs, PBDEs, PCBs, TOC, Phosphate as P, Total Nitrogen,	Sediment Quality
Tissue Chemistry: Aluminum (Total), Mercury (dissolved), Methylmercury (dissolved)	Bioaccumulation
Sediment Toxicity: (Amphipod) % Survival; (Bivalve) % Normal Development	Toxicity
Water Toxicity: (Amphipod) % Survival; (Bivalve) % Normal Alive	Toxicity

Data Availability	URL
Annual Report	http://www.sfei.org/rmp/rmp_docs.html
Downloadable data	http://www.sfei.org/rmp/rmp_data_access.html
	http://www.sfei.org/rmp/rmp_news.htm
	http://www.sfei.org/sfeireports.htm#RMP

DRAFT FINAL

Surface Water Ambient Monitoring Program (SWAMP)

http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/index.shtml

Agency/Organization	Contact	Start Date	End Date
Central Valley Water Board	Jeanne Chilcott San Joaquin Unit (916) 464-4788 jchilcott@waterboard s.ca.gov	1999	ongoing
Seasonal Trend Monitoring at Central Valley Integrator Sites		2009	ongoing
Stream Contaminant Trend Monitoring at Integrator Sites		2009	ongoing

Monitoring Objectives

1) To evaluate whether the most limiting beneficial uses in a specific water body are being protected and help identify sources of potential impairment. 2) Determine, over time, if implementation efforts are improving water quality. Data collected is also used to support the Salt & Boron and Selenium TMDL programs.

Seasonal Trend Monitoring at Central Valley Integrator Sites:

Monitoring is designed to answer the following questions: (1) What is the spatial variability of ambient water quality in the Central Valley? (2) What is the seasonal variability of ambient water quality in the Central Valley? (3) Is there evidence beneficial uses are not being protected? The sites that comprise this project are intended to serve as a long-term framework for a Central Valley trend monitoring program.

Stream Contaminant Trend Monitoring at Integrator Sites:

The overall goal of this long-term trends component of the SWAMP statewide assessment of California streams is to detect meaningful change in the concentrations of stream-borne contaminants and their effects in large watersheds at time scales appropriate to management decision making. Three specific goals are: (1) Determine long-term trends in stream contaminant concentrations and effects; (2) Relate water quality indicators to land-use characteristics and management effort; and (3) Establish a network of sites throughout the state to serve as a backbone for collaboration with local, regional, & federal monitoring.

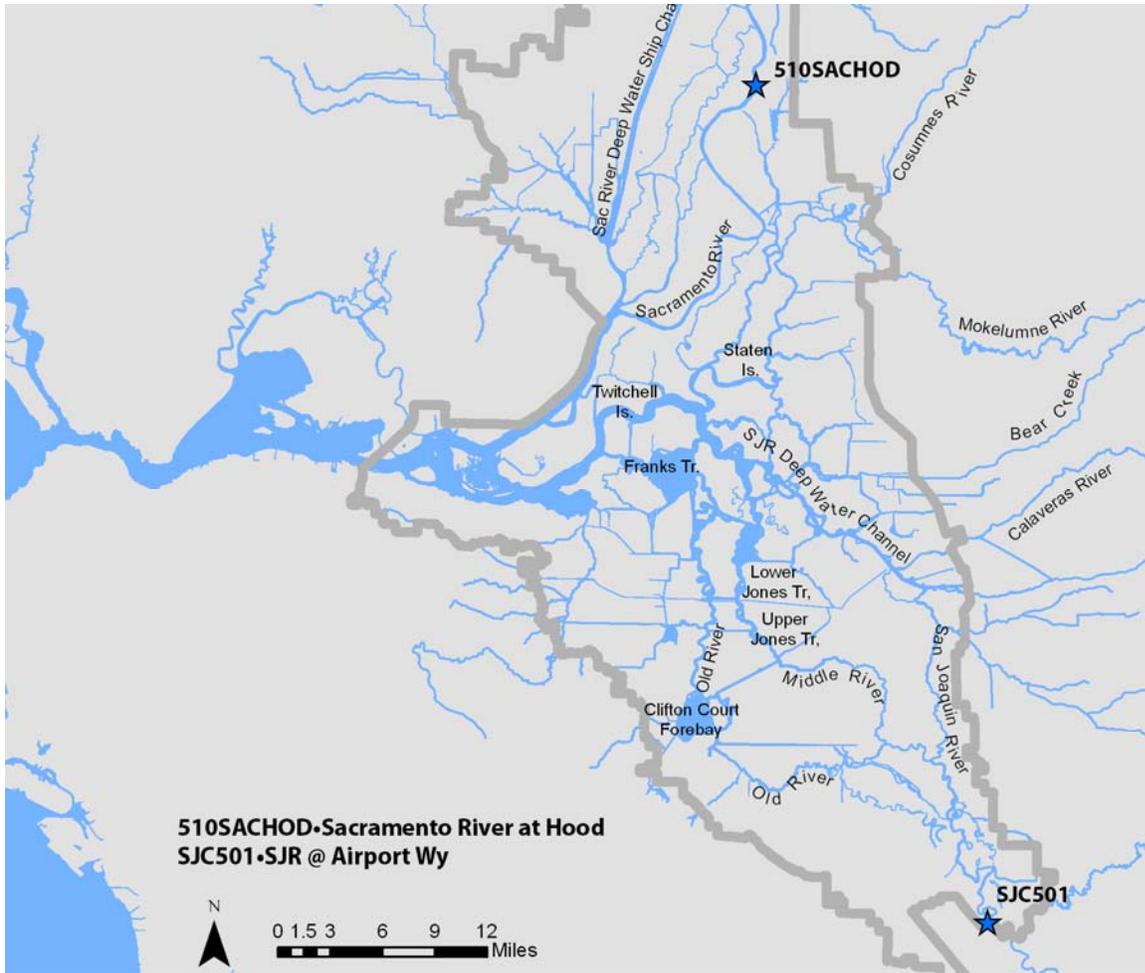
Annual Budget

\$27,000

Sampling Locations

Number of active sites: 2

DRAFT FINAL



DRAFT FINAL

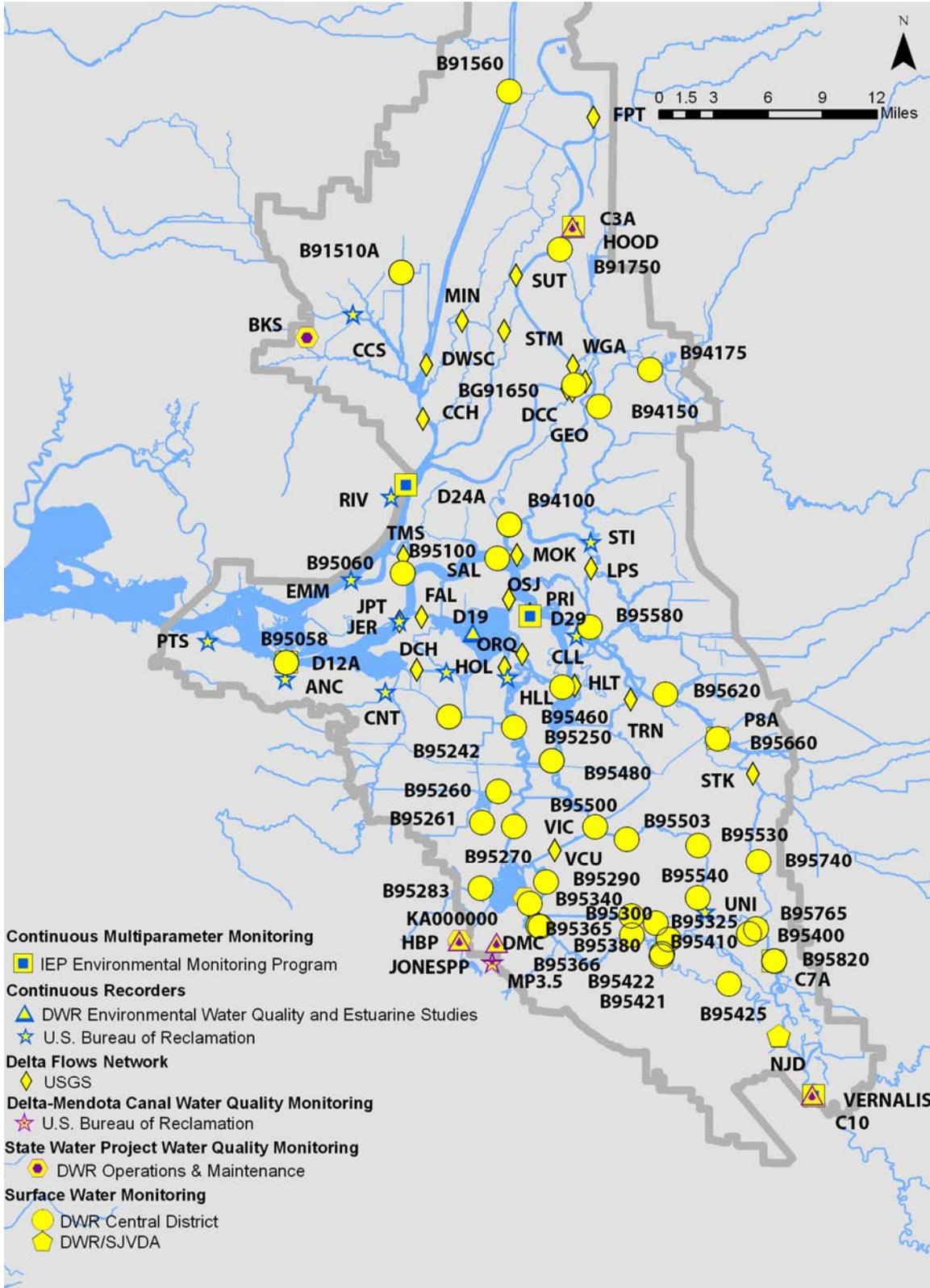
Parameters	Sample Type	Frequency
<u>Seasonal Trend Monitoring at Central Valley Integrator Sites</u>		
General Water Quality: DO, EC, pH, Temperature, Turbidity	Water Quality	quarterly
Organic Carbon: DOC, TOC	Water Quality	quarterly
Pathogens: E. coli, total coliforms	Water Quality	quarterly
Water Toxicity: Ceriodaphnia, Hyalella azteca	Toxicity	quarterly
<u>Stream Contaminant Trend Monitoring at Integrator Sites</u>		
General Sediment Quality: Particle Size	Sediment Quality	annual
Sediment Chemistry: Organochlorine Pesticides, Organophosphates, PCBs, Pyrethroids, Total P, TOC, Trace Metals	Sediment Quality	annual
Sediment Toxicity: Hyalella azteca	Toxicity	annual

Data Availability	URL
Downloadable data	http://www.waterboards.ca.gov/centralvalley/programs/agunit/swamp/sjr_swamp.html
Factsheets	http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_studies/surface_water_ambient_monitoring/sjr_swamp.shtml

B. Overview Maps of Existing Delta Water Quality Monitoring – by Program Category

- B.1. Continuous Monitoring
- B.2. Receiving Water Monitoring
- B.3. Water Supply Monitoring
- B.4. Regional and Watershed Monitoring

B.1. Continuous Monitoring



DRAFT FINAL

Continuous Monitoring Sites

Continuous Multiparameter Monitoring (IEP EMP)

C3A SacR @ Hood
D24A SacR @ Rio Vista
D12A SJR @ Antioch Water Works
P7 SJR @ Mossdale
D29 SJR @ Prisoners Point
P8A SJR @ Rough and Ready Island
C10 SJR nr Vernalis

Continuous Recorders (DWR)

D19 Franks Tract nr Russos Landing
D11A Sherman Lake nr Antioch

Continuous Recorders (Reclamation)

ANC Antioch
CCS Cache Slough
CLL Collinsville
CNT Contra Costa Canal
EMM Emmaton
FRP Farrar Park
HLL Holland Tract
JER Jersey Island
PTS Pittsburg
RIV Rio Vista
SAL San Andreas Ldg.
STI Staten Island
UNI Union Island
VIC Victoria Island

Delta Flows Network

CCH Cache Slough at Ryer Island
DCC Delta Cross Channel near Walnut Grove
DCH Dutch Slough at Jersey Island
FAL False River
GEO Georgiana Slough near Sacramento River
GLC Grant Line Canal at Tracy Road Bridge
HOL Holland Cut near Bethel Island
LPS Little Potato Slough at Terminous
MID Middle River at Middle River, CA
HLT Middle River near Holt
MIN Miner Slough at Hwy 84 Bridge, CA
MOK Mokelumne River at San Andreas Island
OBI Old River at Bacon Island
DMC Old River at Delta Mendota Canal
OSJ Old River at Frank's Tract near Terminous
ORQ Old River at Quimbey Island near Bethel Island
ORF Old River near Byron, CA
WGA Sacramento River above Delta Cross Channel
FPT Sacramento River at Freeport
WGB Sacramento River below Georgiana Slough
DWSC Sac R Deep Water Ship Channel nr Rio Vista
JPT San Joaquin River at Jersey Point
PRI San Joaquin River at Prisoner's Point
STK San Joaquin River below Garwood Bridge
STM Steamboat Slough
SUT Sutter Slough at Courtland
TMS Threemile Slough near Rio Vista
TRN Turner Cut near Holt
VCU Victoria Canal near Byron

Delta-Mendota Canal Water Quality Monitoring

MP3.5 DMC Headworks

Municipal Water Quality Investigations

JONESPP Jones PP
HOOD Sacramento R @ Hood
VERNALIS SJR nr Vernalis
HBP Harvey O. Banks PP Headworks

State Water Project Water Quality Monitoring

KA000000 Clifton Court Forebay
HBP Harvey O. Banks PP Headworks
BKS North Bay Aqueduct @ Barker Slough PP

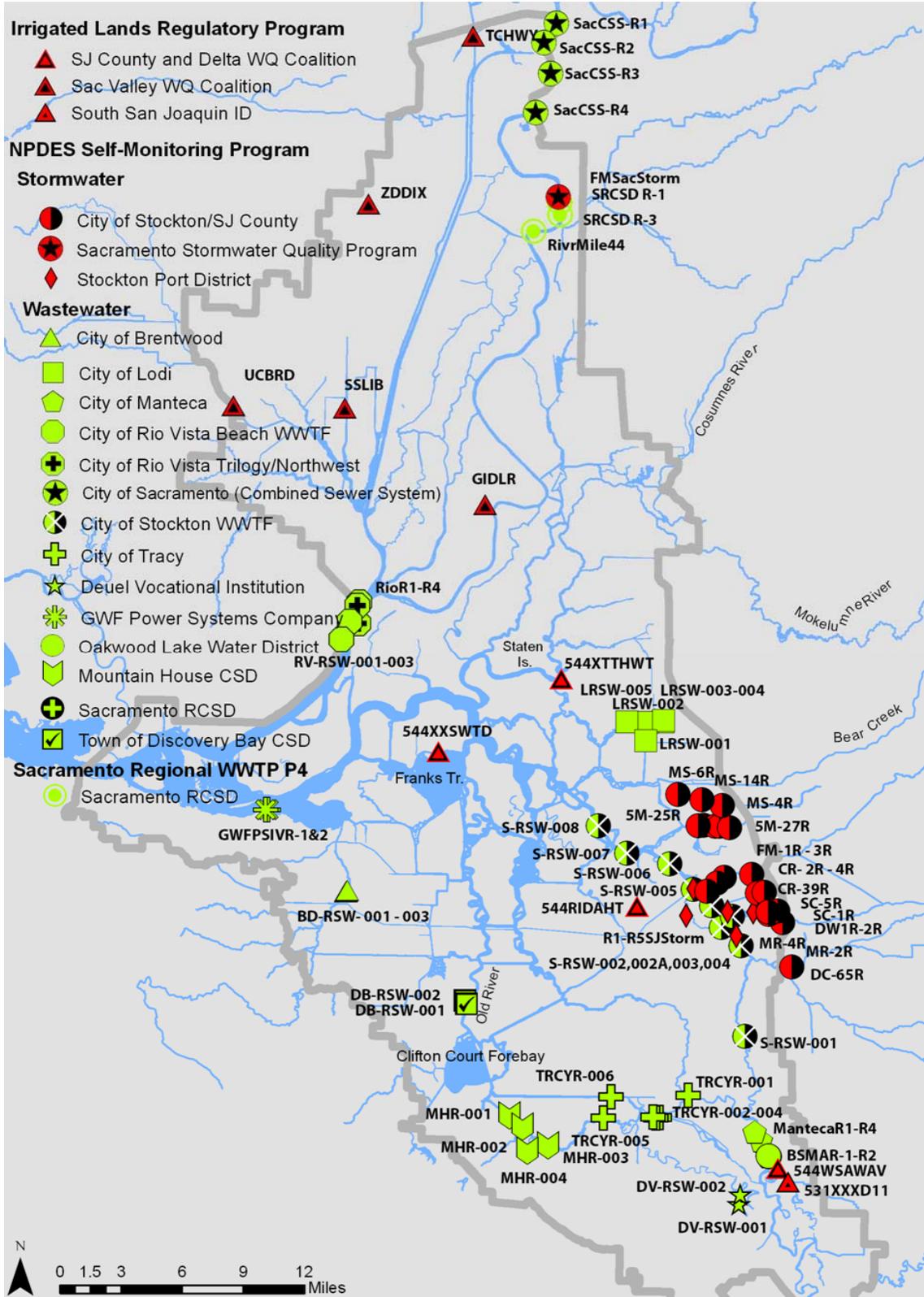
Surface Water Monitoring

B95261 Discovery Bay at Discovery Bay Blvd.
B95260 Discovery Bay at Indian Slough
B95325 Doughty Cut near Grantline Canal
B95242 East Contra Costa I.D.
B94100 Georgiana Slough at Mokelumne River
B95300 Grantline Canal at Tracy Road
B95283 Italian Slough Headwater near Byron
B95480 Jones Tract
B95460 Middle River at Bacon Island
B95500 Middle River at Borden Highway (Hwy 4)
B95530 Middle River at Howard Road Bridge
B95468 Middle River at Middle River
B95540 Middle River at Mowry Bridge
B95503 Middle River at Tracy Road Bridge
B94175 Mokelumne River near Thornton
B94133 Mokelumne River, N.F., below Snodgrass
B94150 Mokelumne River, S.F., at New Hope
B95250 Old River at Bacon Island
B95340 Old River at Clifton Court Ferry
B95290 Old River at Coney Island
B95400 Old River at Head
B95380 Old River at Tracy Road Bridge
B95270 Old River near Byron
B95366 Old River near DMC (above dam)
B95365 Old River near DMC (below dam)
B95410 Paradise Cut above Old River
B95058 Piper Slough at Bethal Tract
B95218 Rock Slough at Contra Costa Canal
B91750 Sacramento River at Snodgrass Slough
B91650 Sacramento River at Walnut Grove
B95820 San Joaquin River @ Mossdale Bridge
B95020 San Joaquin River at Antioch
B95740 San Joaquin River at Brandt Bridge
B95880 San Joaquin River at D.V.I. Pump
B95620 San Joaquin River at Rindge Pump
B95100 San Joaquin River at San Andreas
B95580 San Joaquin River at Venice Island
B95765 San Joaquin River below O.R., near Lathrop
B95850 San Joaquin River below Paradise Dam
B95660 Stockton Ship Channel at Burn's Cutoff
B95422 Sugar Cut
B95060 Three Mile Slough at San Joaquin River
B95421 Tom Paine Slough above Intake Structure
B95420 Tom Paine Slough above Mouth
B95425 Tom Paine Slough at Pescadero Pump Plant 6
B91510B Yolo Bypass at Liberty Island - West
B91510A Yolo Bypass at Liberty Island -East
B91560 Yolo Bypass near Lisbon

Surface Water Monitoring (SJVDA)

NJD New Jerusalem Drain

B.2. Receiving Water Monitoring



DRAFT FINAL

Receiving Water Monitoring Sites

City of Brentwood

BD-RSW-001 100 feet upstream of Discharge Point No. 001
BD-RSW-002 Flow monitoring u/s. of Discharge Pt No. 001.
BD-RSW-003 300 feet downstream of Discharge Point 001.

City of Lodi

LRSW-001 Middle of the bridge crossing over Dredger
LRSW-002 Dredger Cut at White Slough
LRSW-003 Eastside of Bishop Cut at Telephone Cut
LRSW-004 Eastside of Highline Canal
LRSW-005 North Channel White Slough at Upland Canal

City of Manteca

MantecaR-1 100 feet upstream of discharge point
MantecaR-2 500 feet of discharge point
MantecaR-3 1 mile downstream of discharge point
MantecaR-4 2 miles downstream of discharge point

City of Rio Vista Beach WWTF

RV-RSW-001 Sac R ~ 1 mile u/s of Discharge Point No. 1
RV-RSW-002 Sac R ~ 250 ft u/s of Discharge Point No. 1

City of Rio Vista Trilogy/Northwest

RioR1 ~ 100 feet upstream of Discharge Point 001
RioR2 ~ 100 feet downstream of Discharge Point 001
RioR3 Sac R, ~ 500 feet upstream of Discharge Point 002
RioR4 Sac R, ~ 500 feet downstream of Discharge Point 002

City of Sacramento (Combined Sewer System)

SacCSS-R1 Sac River upstream of CSO outfalls, at the Delta King
SacCSS-R2 Downstream of outfalls 006 and 007, at Miller Park
SacCSS-R3 Sac R d/s of outfalls 004 and 005, at Captains Table
SacCSS-R4 Sac R d/s of outfalls 002 and 003, at Wooden Stairs

City of Stockton

S-RSW-001 San Joaquin River and Bowman Road
S-RSW-002 San Joaquin River and Highway 4
S-RSW-002A San Joaquin River and Burns Cutoff
S-RSW-003 San Joaquin River at Deep Water Channel
S-RSW-004 San Joaquin River at Light 45
S-RSW-005 San Joaquin River at Light 41
S-RSW-006 San Joaquin River at Light 36
S-RSW-007 San Joaquin River at Light 24
S-RSW-008 San Joaquin River at Light 18

City of Stockton and County of San Joaquin

CR-2R Calaveras River
CR-39R Calaveras River at Brookside
CR-4R Calaveras River at Pacific Ave
DC-65R Duck Creek in vicinity of El Dorado street overcrossing
FM-3R Five-Mile Slough at Lighthouse Dr
FM-2R Five-Mile Slough at Plymouth Rd
5M-27R Five-Mile Slough at Swenson Park Golf Course
5M-25R Five-Mile Slough east of confluence with 14-Mile Slough
FM-1R Five-Mile Slough, Swenson Park at Alexandria Pl

CR-3R Lower Calaveras River
MR-2R Mormon Slough at Commerce Street
MR-4R Mormon Slough at Weber Ave Overpass
MS-6R Mosher Slough - Site 6R
MS-4R Mosher Slough at Don Ave.
MS-14R Mosher Slough in vicinity of Mariners Drive
SC-1R Smith Canal (in the vicinity of Pershing Ave)
SC-5R Smith Canal
DW-1R Stockton Deep Water Ship Channel d/s of McLeod Lake
DW-2R Stockton DWSC u/s of confluence with Mormon Slough

City of Tracy

TRCYR-001 Old River, ~1 mile upstream of Outfall 001
TRCYR-002 Old River, ~500 ft downstream of Outfall 001
TRCYR-003 Old River, ~500 ft downstream of Outfall 001
TRCYR-004 Old River, ~500 ft downstream of Outfall 002
TRCYR-005 Old River, ~ 4 mi downstream of Outfall 001
TRCYR-006 Grant Line Canal, downstream of Outfall 001

Deuel Vocational Institution

DV-RSW-001 450 ft u/s of Discharge Pt 003 in Deuel Drain
DV-RSW-002 450 ft d/s of Discharge Pt 001 in Deuel Drain

GWF Power Systems Company

GWFPSIVR-1 328 feet east of the point of discharge
GWFPSIVR-2 R-2 328 feet west of the point of discharge

Mountain House Community Services District

MHR-001 R-001 Old River, Midstream
MHR-002 R-002 Old River, Midstream
MHR-003 R-003 Old River, Midstream
MHR-004 R-004 Wicklund Cut, Midstream, Bethany Road

Oakwood Lake Water District

BSMAR-1 100 feet downstream from the point of discharge
BSMAR-250 feet upstream from the point of discharge

Sacramento RCSD

SRCS D R-3 Cliffs Marina
SRCS D R-1 Freeport upstream of SRWTP
RivrMile44 River Mile 44 downstream of SRWTP

Sacramento Stormwater Quality Program

FMSacStorm Freeport Marina

Sacramento Valley Water Quality Coalition

GIDLR Grand Island Drain near Leary Road
SSLIB Shag Slough at Liberty Island Bridge
TCHWY Tule Canal at I-80
UCBRD Ulati Creek at Brown Road
ZDDIX Z Drain - Dixon RCD

San Joaquin County & Delta Water Quality Coalition

544RIDAHT Roberts Island Drain at Holt Road
544XXSWTD South Webb Tract Drain
544XTTHWT Terminous Tract Drain at Highway 12
544WSAWAV Walthall Slough @ Woodward Avenue

South San Joaquin Irrigation District

531XXXD11 Drain 11 at Walsal Slough (Top of Bank)

DRAFT FINAL

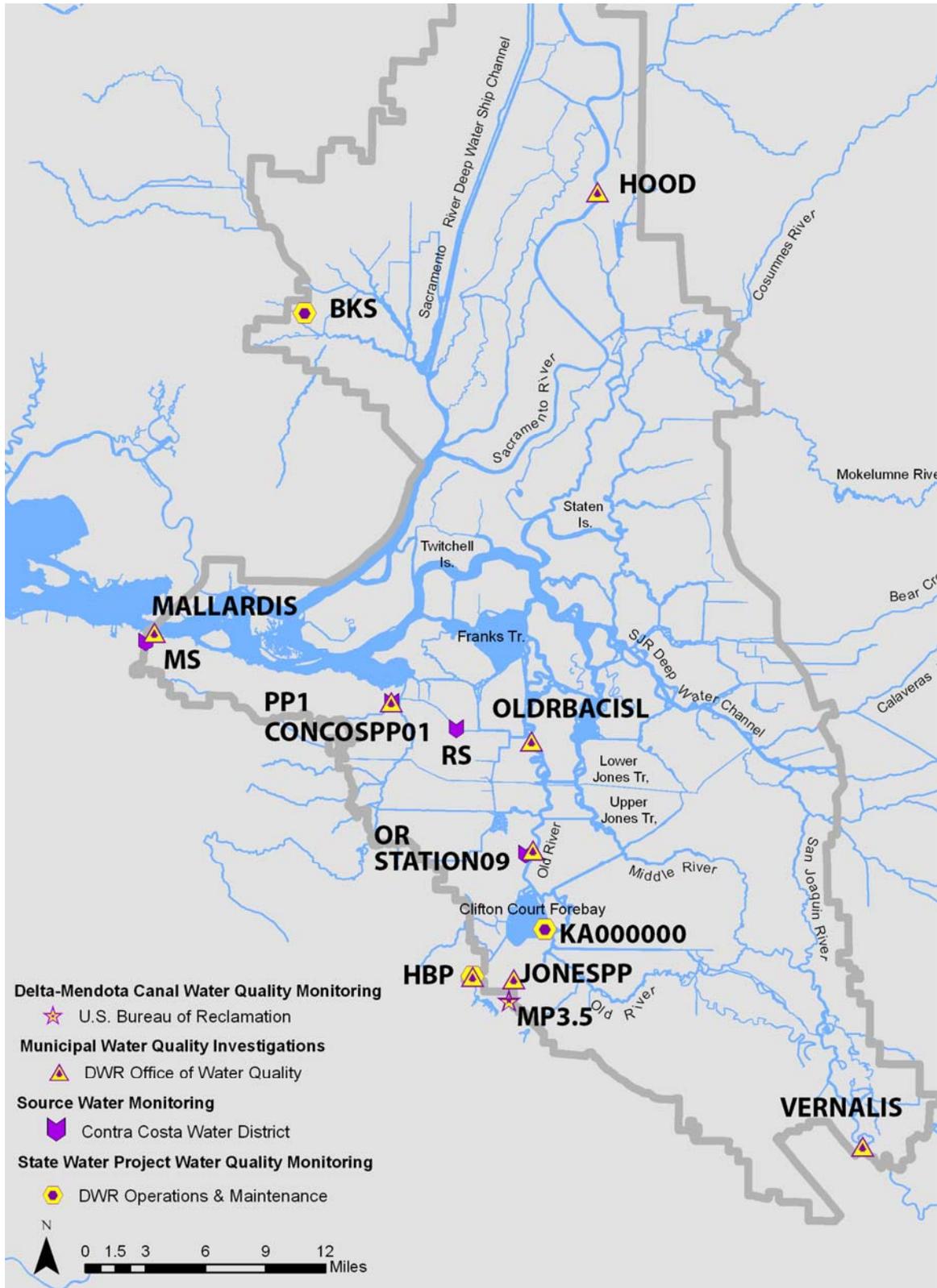
Stockton Port District

R1SJStorm	SJR south of the Santa Fe Railroad Bridge
R2SJStorm	DWSC downstream of the east Burns Cutoff confluence
R3SJStorm	DWSC turning basin
R4SJStorm	DWSC downstream of the west Burns Cutoff confluence
R5SJStorm	Burns Cutoff

Town of Discovery Bay Community Services District

DB-RSW-001	Old River, 500 ft upstream of discharge point
DB-RSW-002	Old River, 500 ft d/s of discharge point

B.3. Water Supply Monitoring



Water Supply Monitoring Sites

Delta-Mendota Canal Water Quality Monitoring

MP3.5 DMC Headworks

Municipal Water Quality Investigations

CONCOSPP01	Contra Costa PP @ Rock Slough
HBP	Harvey O. Banks PP Headworks
JONESPP	Jones PP
OLDRBACISL	Old R @ Bacon Island
STATION09	Old R nr Byron Tract
HOOD	Sacramento R @ Hood
MALLARDIS	Sacramento R @ Mallard Island
VERNALIS	JR nr Vernalis

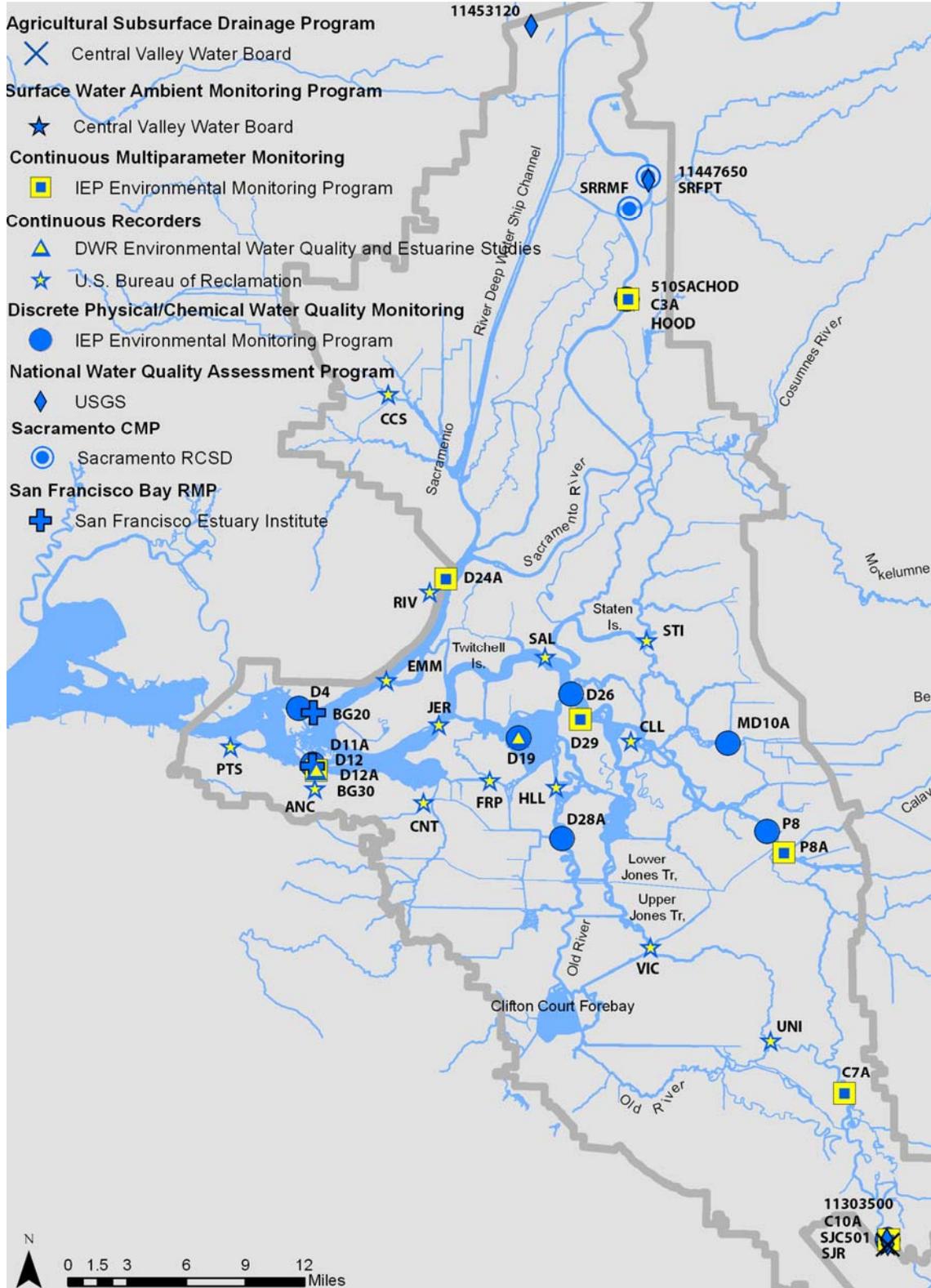
Source Water Monitoring (Contra Costa Water District)

PP1	Contra Costa Canal at Pumping Plant 1
RS	Contra Costa Canal, near Rock Slough at the Trash Rack
MS	Mallard Slough
OR	Old River

State Water Project Water Quality Monitoring

KA000000	Clifton Court Forebay
HBP	Harvey O. Banks PP Headworks
BKS	North Bay Aqueduct @ Barker Slough PP

B.4. Regional and Watershed Monitoring



DRAFT FINAL

Regional and Watershed Monitoring Sites

Agricultural Subsurface Drainage Program

510SACHOD Sacramento River at Hood
SJC501 SJR @ Airport Way

Continuous Recorders (DWR)

D19 Franks Tract nr Russo's Landing
D11A Sherman Lake nr Antioch

Continuous Recorders (Reclamation)

ANC Antioch
CCS Cache Slough
CLL Collinsville
CNT Contra Costa Canal
EMM Emmaton
FRP Farrar Park
HLL Holland Tract
JER Jersey Island
PTS Pittsburg
RIV Rio Vista
SAL San Andreas Ldg.
STI Staten Island
UNI Union Island
VIC Victoria Island

Continuous Multiparameter Monitoring (IEP EMP)

C3A SacR @ Hood
D24A SacR @ Rio Vista
D12A SJR @ Antioch Water Works
P8 SJR @ Mossdale
D29 SJR @ Prisoners Point
P8A SJR @ Rough and Ready Island
C10A/SJR SJR nr Vernalis

Discrete Physical/Chemical Water Quality Sampling (IEP EMP)

C10A C10A – San Joaquin River near Vernalis
MD10A Disappointment Slough near Bishop Cut
D19 Franks Tract nr Russo's Landing
D28A Old R @ Rancho Del Rio
HOOD Sacramento R @ Hood
D4 Sacramento River above Point Sacramento
D12 San Joaquin River @ Antioch Ship Channel
P8 SJR @ Buckley Cove
D26 SJR @ Potato Point

National Water Quality Assessment Program

11453120 Yolo Bypass @ I-80
11303500 San Joaquin R near Vernalis
11447650 Sacramento River @ Freeport

Sacramento Coordinated Monitoring Program

SRFPT Freeport upstream of SRWTP
SRRMF River Mile 44 downstream of SRWTP

San Francisco Bay RMP

BG20 Sacramento River
BG30 San Joaquin River

Surface Water Ambient Monitoring Program

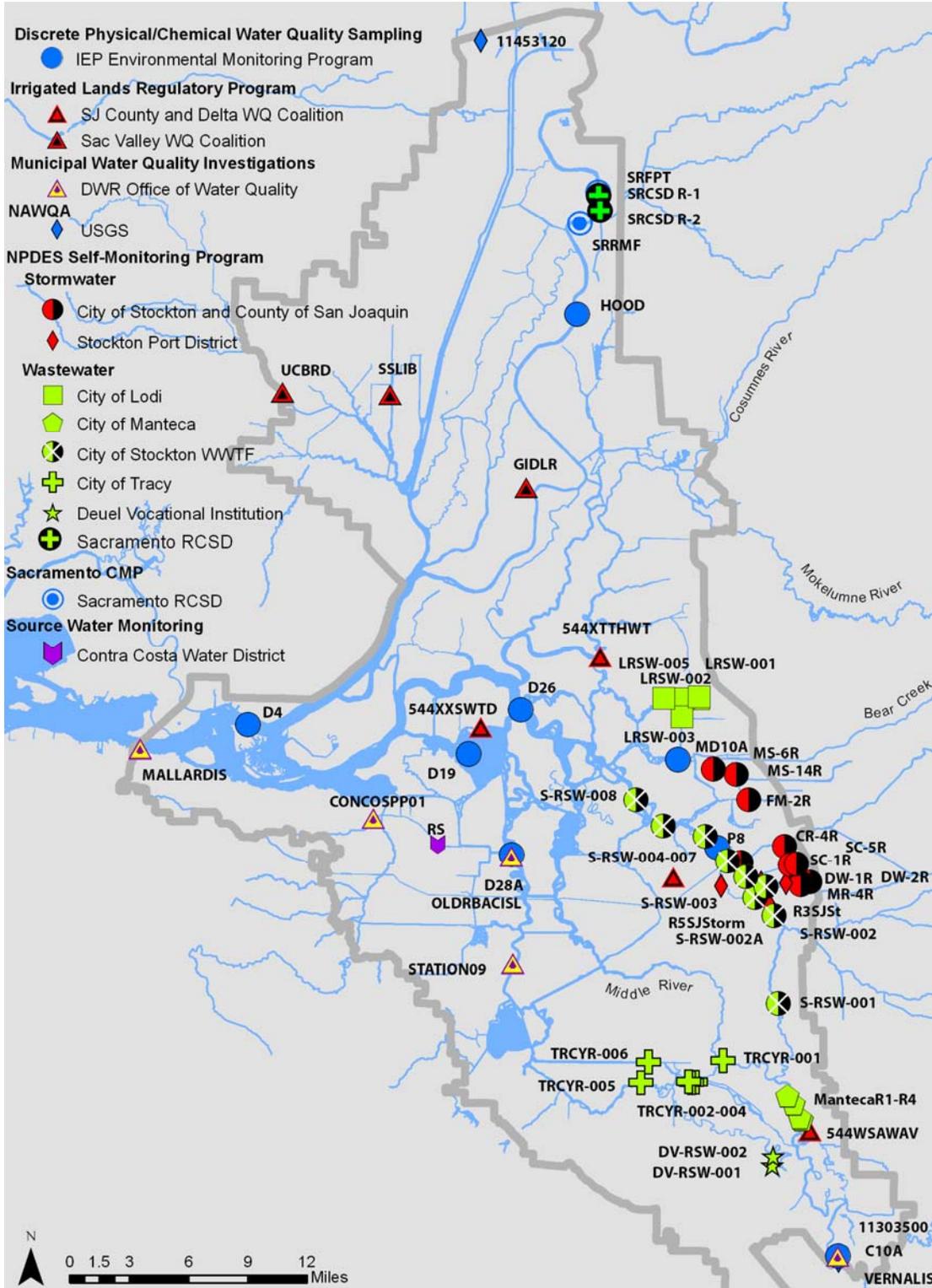
510SACHOD Sacramento River at Hood
SJC501 SJR @ Airport Way

DRAFT FINAL

C. Overview Maps of Existing Delta Water Quality Monitoring – Selected Parameters Organized by Monitoring Program Category

- C.1. Ammonia
- C.2. Disinfection Byproducts
- C.3. Dissolved Organic Carbon (DOC)
- C.4. Dissolved Oxygen (DO)
- C.5. Mercury & Methyl Mercury
- C.6. Pesticides
- C.7. Salinity
- C.8. Sediment Chemistry
- C.9. Sediment Toxicity
- C.10. Water Toxicity

C.1. Ammonia



DRAFT FINAL

Ammonia Monitoring Sites

City of Lodi

LRSW-001 Middle of the bridge crossing over Dredger
LRSW-002 Dredger Cut at White Slough
LRSW-003 Eastside of Bishop Cut at Telephone Cut
LRSW-004 Eastside of Highline Canal
LRSW-005 North Channel White Slough at Upland Canal

City of Manteca

MantecaR-1 100 feet upstream of discharge point
MantecaR-2 500 feet of discharge point
MantecaR-3 1 mile downstream of discharge point
MantecaR-4 2 miles downstream of discharge point

City of Stockton

S-RSW-001 San Joaquin River and Bowman Road
S-RSW-002 San Joaquin River and Highway 4
S-RSW-002A San Joaquin River and Burns Cutoff
S-RSW-003 San Joaquin River at Deep Water Channel
S-RSW-004 San Joaquin River at Light 45
S-RSW-005 San Joaquin River at Light 41
S-RSW-006 San Joaquin River at Light 36
S-RSW-007 San Joaquin River at Light 24
S-RSW-008 San Joaquin River at Light 18

City of Stockton & County of San Joaquin

CR-3R Lower Calaveras River
CR-4R Calaveras River at Pacific Ave
DW-1R Stockton Deep Water Ship Channel d/s of McLeod Lake
DW-2R DWSC u/s of confluence with Mormon Slough
FM-2R Five-Mile Slough at Plymouth Rd
MR-4R Mormon Slough at Weber Ave Overpass
MS-14R Mosher Slough in vicinity of Mariners Drive
MS-6R Mosher Slough
SC-1R Smith Canal (in the vicinity of Pershing)
SC-5R Smith Canal

City of Tracy

TRCYR-001 Old River, ~1 mile upstream of Outfall 001
TRCYR-002 Old River, ~500 ft downstream of Outfall 001
TRCYR-003 Old River, ~500 ft downstream of Outfall 001
TRCYR-004 Old River, ~500 ft downstream of Outfall 002
TRCYR-005 Old River, ~ 4 mi downstream of Outfall 001
TRCYR-006 Grant Line Canal, downstream of Outfall 001

Deuel Vocational Institution

DV-RSW-001 450 ft u/s of Discharge Pt 003 in Deuel Drain
DV-RSW-002 450 ft d/s of Discharge Pt 001 in Deuel Drain

Discrete Physical/Chemical Water Quality Sampling (IEP EMP)

C3A Sacramento R @ Hood
C10A San Joaquin River near Vernalis
D19 Franks Tract nr Russo's Landing
D26 SJR @ Potato Point
D28A Old R @ Rancho Del Rio
D4 Sacramento River above Point Sacramento
MD10A Disappointment Slough near Bishop Cut
P8 SJR @ Buckley Cove

Municipal Water Quality Investigations

CONCOSPP01 Contra Costa PP @ Rock Slough
MALLARDIS Sacramento R @ Mallard Island
OLDRBACISL Old R @ Bacon Island
STATION09 Old R nr Byron Tract
VERNALIS SJR nr Vernalis

NAWQA

11303500 San Joaquin R near Vernalis
11453120 Yolo Bypass @ I-80

Sacramento Coordinated Monitoring Program

SRFPT Freeport upstream of SRWTP
SRRMF River Mile 44 downstream of SRWTP

Sacramento Regional County Sanitation District

SRCSD R-1 Freeport upstream of SRWTP
SRCSD R-3 Cliffs Marina (4200 feet downstream of SRWTP)

Sacramento Valley Water Quality Coalition

GIDLR Grand Island Drain near Leary Road
SSLIB Shag Slough at Liberty Island Bridge
UCBRD Ulatis Creek at Brown Road

San Joaquin County & Delta Water Quality Coalition

544RIDAHT Roberts Island Drain at Holt Road
544WSAWAV Walthall Slough @ Woodward Avenue
544XTTHWT Terminous Tract Drain at Highway 12
544XXSWTD South Webb Tract Drain

Source Water Monitoring (Contra Costa Water District)

RS Contra Costa Canal, near Rock Slough at the Trash Rack

Stockton Port District

R1SJStorm SJR south of the Santa Fe Railroad Bridge
R2SJStorm DWSC downstream of the east Burns Cutoff confluence
R3SJStorm DWSC turning basin
R4SJStorm DWSC downstream of the west Burns Cutoff confluence
R5SJStorm Burns Cutoff

DRAFT FINAL

Disinfection Byproducts Monitoring Sites

City of Brentwood

BD-RSW-001 100 feet upstream of Discharge Point No. 001

City of Lodi

LRSW-001 Middle of the bridge crossing over Dredger
LRSW-002 Dredger Cut at White Slough
LRSW-003 Eastside of Bishop Cut at Telephone Cut
LRSW-004 Eastside of Highline Canal
LRSW-005 North Channel White Slough at Upland Canal

City of Manteca

MantecaR-1 100 feet upstream of discharge point
MantecaR-4 2 miles downstream of discharge point

City of Rio Vista Beach WWTF

RV-RSW-001 Sac R~ 1 mile u/s of Discharge Point No. 1

City of Stockton

S-RSW-001 San Joaquin River and Bowman Road
S-RSW-002 San Joaquin River and Highway 4
S-RSW-002A San Joaquin River and Burns Cutoff
S-RSW-003 San Joaquin River at Deep Water Channel
S-RSW-004 San Joaquin River at Light 45
S-RSW-005 San Joaquin River at Light 41
S-RSW-006 San Joaquin River at Light 36
S-RSW-007 San Joaquin River at Light 24
S-RSW-008 San Joaquin River at Light 18

City of Tracy

TRCYR-001 Old River, ~1 mile upstream of Outfall 001
TRCYR-002 Old River, ~500 ft downstream of Outfall 001
TRCYR-003 Old River, ~500 ft downstream of Outfall 001
TRCYR-004 Old River, ~500 ft downstream of Outfall 002
TRCYR-005 Old River, ~ 4 mi downstream of Outfall 001
TRCYR-006 Grant Line Canal, downstream of Outfall 001

Mountain House Community Services District

MHR-001 R-001 Old River, Midstream
MHR-002 R-002 Old River, Midstream
MHR-004 R-004 Wicklund Cut, Midstream, Bethany Road

Sacramento Regional County Sanitation District

SRCS D R-1 Freeport upstream of SRWTP
RivrMile44 River Mile 44 downstream of SRWTP

Sacramento Regional WWTP P4

SRCS D R-1 Freeport upstream of SRWTP
RivrMile44 River Mile 44 downstream of SRWTP

DRAFT FINAL

Dissolved Organic Carbon Monitoring Sites

Municipal Water Quality Investigations

CONCOSPP01	Contra Costa PP @ Rock Slough
HOOD	Sacramento R @ Hood
JONESPP	Jones PP
MALLARDIS	Sacramento R @ Mallard Island
OLDRBACISL	Old R @ Bacon Island
STATION09	Old R nr Byron Tract
VERNALIS	SJR nr Vernalis

NAWQA

11303500	San Joaquin R near Vernalis
11453120	Yolo Bypass @ I-80

Sacramento Coordinated Monitoring Program

SRFPT	Freeport upstream of SRWTP
SRRMF	River Mile 44 downstream of SRWTP

San Francisco Bay RMP

BG20	Sacramento River
BG30	San Joaquin River

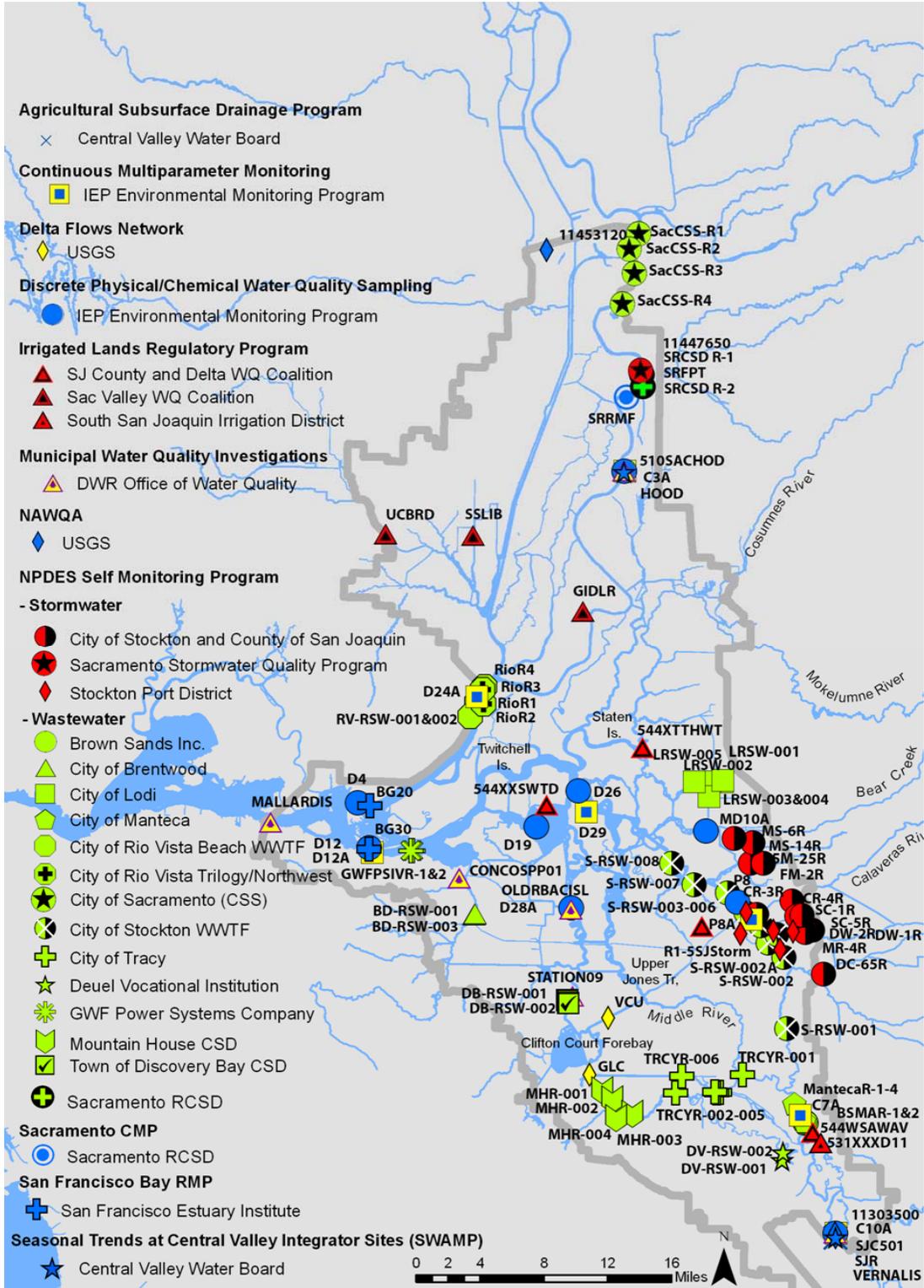
State Water Project Water Quality Monitoring Program

BKS	North Bay Aqueduct @ Barker Slough PP
HBP	Harvey O. Banks PP Headworks
KA000000	Clifton Court Forebay

Seasonal Trends at Central Valley integrator Sites (SWAMP)

510SACHOD	Sacramento River at Hood
SJC501	SJR @ Airport Way

C.4. Dissolved Oxygen (DO)



DRAFT FINAL

Dissolved Oxygen Monitoring Sites

Agricultural Subsurface Drainage Program

SJC501 SJR @ Airport Way

City of Brentwood

BD-RSW-001 100 feet upstream of Discharge Point No. 001
BD-RSW-003 300 feet downstream of Discharge Point 001

City of Lodi

LRSW-001 Middle of the bridge crossing over Dredger
LRSW-002 Dredger Cut at White Slough
LRSW-003 Eastside of Bishop Cut at Telephone Cut
LRSW-004 Eastside of Highline Canal
LRSW-005 North Channel White Slough at Upland Canal

City of Manteca

MantecaR-1 100 feet upstream of discharge point
MantecaR-2 500 feet of discharge point
MantecaR-3 1 mile downstream of discharge point
MantecaR-4 2 miles downstream of discharge point

City of Rio Vista Beach WWTF

RV-RSW-001 Sac R ~ 1 mile u/s of Discharge Point No. 1
RV-RSW-002 Sac R ~ 250 ft u/s of Discharge Point No. 1

City of Rio Vista Trilogy/Northwest

RioR1 ~ 100 feet upstream of Discharge Point 001
RioR2 ~ 100 feet downstream of Discharge Point 001
RioR3 Sac R, ~ 500 feet upstream of Discharge Point 002
RioR4 Sac R, ~ 500 feet downstream of Discharge Point 002

City of Sacramento (Combined Sewer System)

SacCSS-R1 Sac River upstream of CSO outfalls, at the Delta King
SacCSS-R2 Downstream of outfalls 006 and 007, at Miller Park
SacCSS-R3 Sac R d/s of outfalls 004 and 005, at Captains Table
SacCSS-R4 Sac R d/s of outfalls 002 and 003, at Wooden Stairs

City of Stockton

S-RSW-001 San Joaquin River and Bowman Road
S-RSW-002 San Joaquin River and Highway 4
S-RSW-002A San Joaquin River and Burns Cutoff
S-RSW-003 San Joaquin River at Deep Water Channel
S-RSW-004 San Joaquin River at Light 45
S-RSW-005 San Joaquin River at Light 41
S-RSW-006 San Joaquin River at Light 36
S-RSW-007 San Joaquin River at Light 24
S-RSW-008 San Joaquin River at Light 18

City of Stockton and County of San Joaquin

5M-25R Five-Mile Slough east of confluence with 14-Mile Slough
CR-3R Lower Calaveras River
CR-4R Calaveras River at Pacific Ave
DC-65R Duck Creek in vicinity of El Dorado Street overcrossing
DW-1R Stockton Deep Water Ship Channel d/s of McLeod Lake
DW-2R Stockton DWSC u/s of confluence with Mormon Slough
FM-2R Five-Mile Slough at Plymouth Rd
MR-4R Mormon Slough at Weber Ave Overpass
MS-6R Mosher Slough - Site 6R
MS-14R Mosher Slough in vicinity of Mariners Drive

SC-1R Smith Canal (in the vicinity of Pershing Ave)
SC-5R Smith Canal

City of Tracy

TRCYR-001 Old River, ~1 mile upstream of Outfall 001
TRCYR-002 Old River, ~500 ft downstream of Outfall 001
TRCYR-003 Old River, ~500 ft downstream of Outfall 001
TRCYR-004 Old River, ~500 ft downstream of Outfall 002
TRCYR-005 Old River, ~ 4 mi downstream of Outfall 001
TRCYR-006 Grant Line Canal, downstream of Outfall 001

Continuous Multiparameter Monitoring (IEP EMP)

C3A SacR @ Hood
C10 SJR nr Vernalis
D12A SJR @ Antioch Water Works
D24A SacR @ Rio Vista
D29 SJR @ Prisoners Point
P7 SJR @ Mossdale
P8A SJR @ Rough and Ready Island

Delta Flows Network

GLC Grant Line Canal at Tracy Road Bridge
VCU Victoria Canal near Byron

Discrete Physical/Chemical Water Quality Sampling (IEP EMP)

C3A SacR @ Hood
C10A San Joaquin River near Vernalis
D4 Sacramento River above Point Sacramento
D12 San Joaquin River @ Antioch Ship Channel
D19 Franks Tract nr Russo's Landing
D26 SJR @ Potato Point
D28A Old R @ Rancho Del Rio
MD10A Disappointment Slough near Bishop Cut
P8 SJR @ Buckley Cove

Deuel Vocational Institution

DV-RSW-001 450 ft u/s of Discharge Pt 003 in Deuel Drain
DV-RSW-002 450 ft d/s of Discharge Pt 001 in Deuel Drain

GWF Power Systems Company

GWFP SIVR-1 328 feet east of the point of discharge
GWFP SIVR-2 R-2 328 feet west of the point of discharge

Mountain House Community Services District

MHR-001 R-001 Old River, Midstream
MHR-002 R-002 Old River, Midstream
MHR-003 R-003 Old River, Midstream
MHR-004 R-004 Wicklund Cut, Midstream, Bethany Road

Municipal Water Quality Investigations

CONCOSPP01 Contra Costa PP @ Rock Slough
HOOD Sacramento R @ Hood
MALLARDIS Sacramento R @ Mallard Island
OLDRBACISL Old R @ Bacon Island
STATION09 Old R nr Byron Tract
VERNALIS SJR nr Vernalis

NAWQA

11303500 San Joaquin R near Vernalis
11447650 Sacramento River @ Freeport
11453120 Yolo Bypass @ I-80

Oakwood Lake Water District

BSMAR-1 100 feet downstream from the point of discharge
BSMAR-2 50 feet upstream from the point of discharge

DRAFT FINAL

Sacramento Coordinated Monitoring Program

SRFPT Freeport upstream of SRWTP
SRRMF River Mile 44 downstream of SRWTP

Sacramento Regional County Sanitation District

SRCSD R-1 Freeport upstream of SRWTP
SRCSD R-3 Cliffs Marina

Sacramento Stormwater Quality Program

FMSacStorm Freeport Marina

Sacramento Valley Water Quality Coalition

GIDLR Grand Island Drain near Leary Road
SSLIB Shag Slough at Liberty Island Bridge
UCBRD Ulatis Creek at Brown Road

San Francisco Bay RMP

BG20 Sacramento River
BG30 San Joaquin River

San Joaquin County & Delta Water Quality Coalition

544RIDAHT Roberts Island Drain at Holt Road
544XXSWTD South Webb Tract Drain
544XTTHWT Terminous Tract Drain at Highway 12
544WSAWAV Walthall Slough @ Woodward Avenue

South San Joaquin Irrigation District

531XXD11 Drain 11 at Walsal Slough (Top of Bank)

Stockton Port District

R1SJStorm SJR south of the Santa Fe Railroad Bridge
R2SJStorm DWSC d/s of the east Burns Cutoff confluence
R3SJStorm DWSC turning basin
R4SJStorm DWSC d/s of the west Burns Cutoff confluence
R5SJStorm Burns Cutoff

Surface Water Ambient Monitoring Program

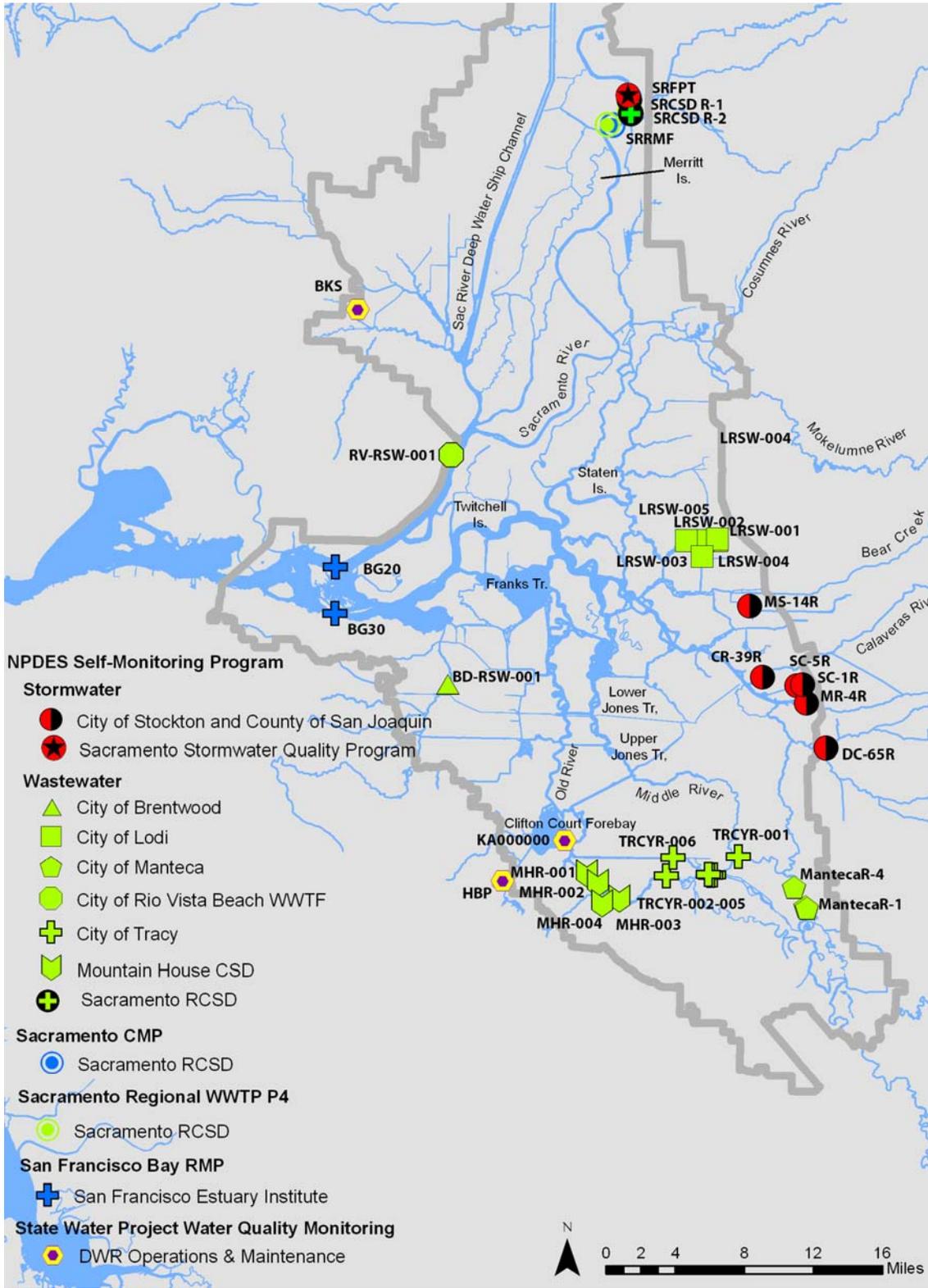
510SACHOD Sacramento River at Hood
SJC501 SJR @ Airport Way

Town of Discovery Bay Community Services District

DB-RSW-001 Old River, 500 ft upstream of discharge point
DB-RSW-002 Old River, 500 ft d/s of discharge point

DRAFT FINAL

C.5. Mercury and Methyl Mercury



DRAFT FINAL

Mercury and Methylmercury Monitoring Sites

City of Brentwood

BD-RSW-001 100 feet upstream of Discharge Point No. 001

City of Lodi

LRSW-001 Middle of the bridge crossing over Dredger
LRSW-002 Dredger Cut at White Slough
LRSW-003 Eastside of Bishop Cut at Telephone Cut
LRSW-004 Eastside of Highline Canal
LRSW-005 North Channel White Slough at Upland Canal

City of Manteca

MantecaR-1 100 feet upstream of discharge point
MantecaR-2 500 feet of discharge point
MantecaR-3 1 mile downstream of discharge point
MantecaR-4 2 miles downstream of discharge point

City of Rio Vista Beach WWTF

RV-RSW-001 Sac R~ 1 mile u/s of Discharge Point No. 1

City of Stockton and County of San Joaquin

CR-39R Calaveras River at Brookside
DC-65R Duck Creek in vicinity of El Dorado street overcrossing
MR-4R Mormon Slough at Weber Ave Overpass
MS-14R Mosher Slough in vicinity of Mariners Drive
SC-1R Smith Canal (in the vicinity of Pershing Ave)
SC-5R Smith Canal

City of Tracy

TRCYR-001 Old River, ~1 mile upstream of Outfall 001
TRCYR-002 Old River, ~500 ft downstream of Outfall 001
TRCYR-003 Old River, ~500 ft downstream of Outfall 001
TRCYR-004 Old River, ~500 ft downstream of Outfall 002
TRCYR-005 Old River, ~ 4 mi downstream of Outfall 001
TRCYR-006 Grant Line Canal, downstream of Outfall 001

Mountain House Community Services District

MHR-001 Old River, Midstream
MHR-002 Old River, Midstream
MHR-003 Old River, Midstream
MHR-004 Wicklund Cut, Midstream, Bethany Road

Sacramento Coordinated Monitoring Program

SRFPT Freeport upstream of SRWTP
SRRMF River Mile 44 downstream of SRWTP

Sacramento Regional County Sanitation District

SRCSD R-1 Freeport upstream of SRWTP
SRCSD R-3 Cliffs Marina

Sacramento Regional WWTP P4

RivrMile44 River Mile 44 downstream of SRWTP
SRCSD R-1 Freeport upstream of SRWTP
SRCSD R-3 Cliffs Marina

Sacramento Stormwater Quality Program

FMSacStorm Freeport Marina

San Francisco Bay RMP

BG20 Sacramento River
BG30 San Joaquin River

State Water Project Water Quality Monitoring Program

BKS North Bay Aqueduct @ Barker Slough PP
HBP Harvey O. Banks PP Headworks
KA000000 Clifton Court Forebay

DRAFT FINAL

Pesticides Monitoring Sites

City of Brentwood

BD-RSW-001 100 feet upstream of Discharge Point No. 001

City of Manteca

MantecaR-1 100 feet upstream of discharge point
MantecaR-4 2 miles downstream of discharge point

City of Rio Vista Beach WWTF

RV-RSW-001 Sac R~ 1 mile u/s of Discharge Point No. 1

City of Stockton and County of San Joaquin

CR-2R Calaveras River
DC-65R Duck Creek in vicinity of El Dorado Street
overcrossing
FM-3R Five-Mile Slough at Lighthouse Dr
MS-14R Mosher Slough in vicinity of Mariners Drive
SC-1R Smith Canal (in the vicinity of Pershing)
SC-5R Smith Canal

City of Tracy

TRCYR-001 Old River, ~1 mile upstream of Outfall 001

Delta & San Joaquin County Water Quality Coalition

544RIDAHT Roberts Island Drain at Holt Road
544WSAWAV Walthall Slough @ Woodward Avenue
544XXSWTD South Webb Tract Drain

Mountain House Community Services District

MHR-001 Old River, Midstream

NAWQA

11303500 San Joaquin R near Vernalis
11447650 Sacramento River @ Freeport
11453120 Yolo Bypass @ I-80

Sacramento Coordinated Monitoring Program

SRFPT Freeport upstream of SRWTP
SRRMF River Mile 44 downstream of SRWTP

Sacramento Regional County Sanitation District

RivMile44 River Mile 44 downstream of SRWTP
SRCSD R-1 Freeport upstream of SRWTP

Sacramento Stormwater Quality Program

FMSacStorm Freeport Marina

Sacramento Valley Water Quality Coalition

GIDLR Grand Island Drain near Leary Road
SSLIB Shag Slough at Liberty Island Bridge
UCBRD Ulatis Creek at Brown Road

San Francisco Bay RMP

BG20 Sacramento River
BG30 San Joaquin River

South San Joaquin Irrigation District

531XXD11 Drain 11 at Walsal Slough (Top of Bank)

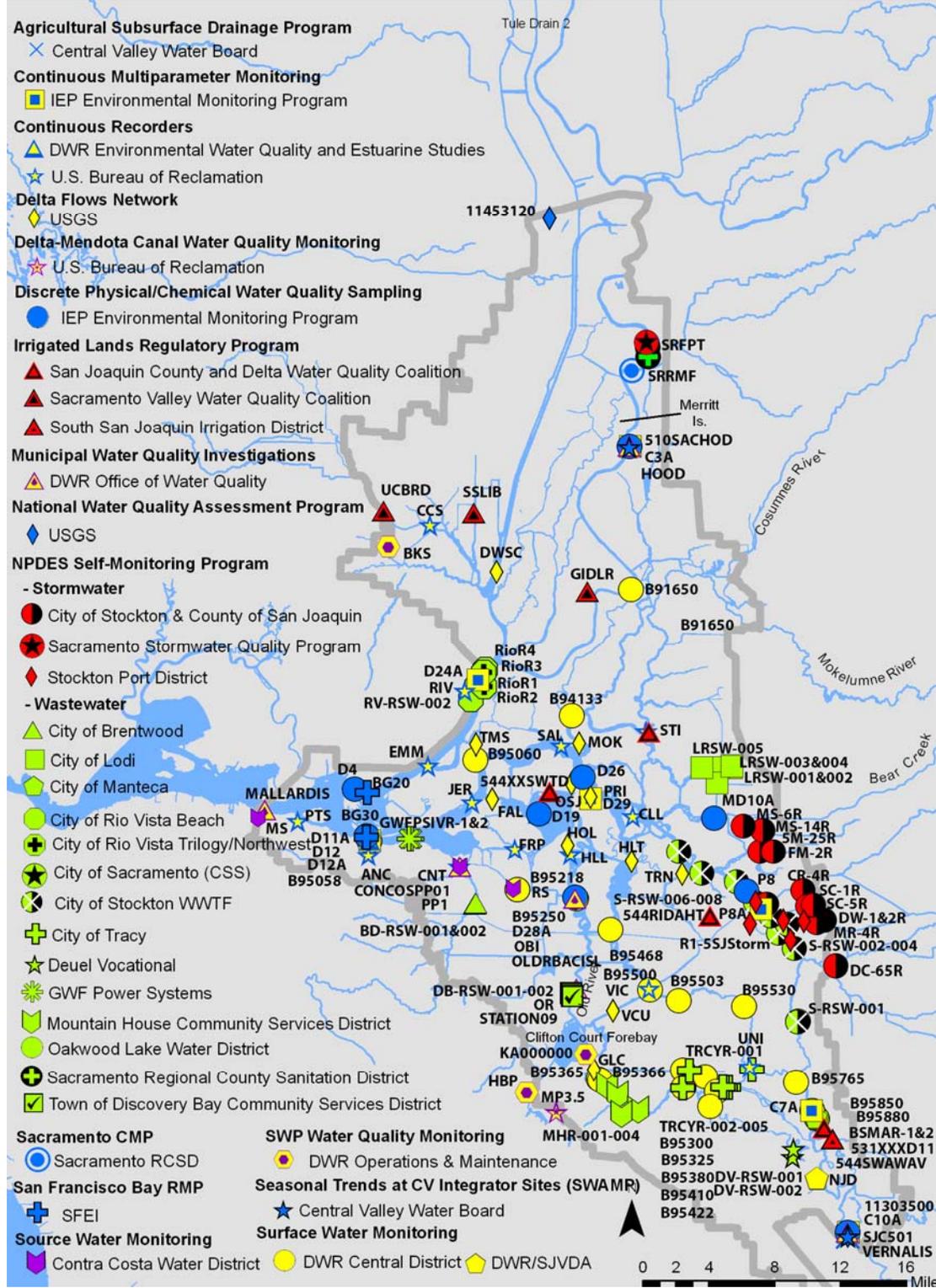
State Water Project Water Quality Monitoring Program

BKS North Bay Aqueduct @ Barker Slough PP
HBP Harvey O. Banks PP Headworks
KA000000 Clifton Court Forebay

Stockton Port District

R1SJStorm SJR south of the Santa Fe Railroad Bridge
R2SJStorm DWSC d/s of the east Burns Cutoff confluence
R3SJStorm DWSC turning basin
R4SJStorm DWSC d/s of the west Burns Cutoff confluence
R5SJStorm Burns Cutoff

C.7. Salinity



DRAFT FINAL

Salinity Monitoring Sites

Agricultural Subsurface Drainage Program

SJC501 SJR @ Airport Way

City of Brentwood

BD-RSW-001 100 feet upstream of Discharge Point No. 001
BD-RSW-003 300 feet downstream of Discharge Point 001

City of Lodi

LRSW-001 Middle of the bridge crossing over Dredger
LRSW-002 Dredger Cut at White Slough
LRSW-003 Eastside of Bishop Cut at Telephone Cut
LRSW-004 Eastside of Highline Canal
LRSW-005 North Channel White Slough at Upland Canal

City of Manteca

MantecaR-1 100 feet upstream of discharge point
MantecaR-2 500 feet of discharge point

City of Rio Vista Beach WWTF

RV-RSW-001 Sac R ~ 1 mile u/s of Discharge Point No. 1
RV-RSW-002 Sac R ~ 250 ft u/s of Discharge Point No. 1

City of Rio Vista Trilogy/Northwest

RioR1 ~ 100 feet upstream of Discharge Point 001
RioR2 ~ 100 feet downstream of Discharge Point 001
RioR3 Sac R, ~ 500 feet upstream of Discharge Point 002
RioR4 Sac R, ~ 500 feet downstream of Discharge Point 002

City of Stockton

S-RSW-001 San Joaquin River and Bowman Road
S-RSW-002 San Joaquin River and Highway 4
S-RSW-002A San Joaquin River and Burns Cutoff
S-RSW-003 San Joaquin River at Deep Water Channel
S-RSW-004 San Joaquin River at Light 45
S-RSW-005 San Joaquin River at Light 41
S-RSW-006 San Joaquin River at Light 36
S-RSW-007 San Joaquin River at Light 24
S-RSW-008 San Joaquin River at Light 18

City of Stockton & County of San Joaquin

5M-25R Five-Mile Slough east of confluence with 14-mile slough
CR-3R Lower Calaveras River
CR-4R Calaveras River at Pacific Ave
DC-65R Duck Creek in vicinity of El Dorado Street overcrossing
DW-1R Stockton Deep Water Ship Channel d/s of McLeod Lake
DW-2R Stockton DWSC u/s of confluence with Mormon Slough
FM-2R Five-Mile Slough at Plymouth Rd
MR-4R Mormon Slough at Weber Ave Overpass
MS-14R Mosher Slough in vicinity of Mariners Drive
MS-6R Mosher Slough
SC-1R Smith Canal (in the vicinity of Pershing)
SC-5R Smith Canal

City of Tracy

TRCYR-001 Old River, ~1 mile upstream of Outfall 001
TRCYR-002 Old River, ~500 ft downstream of Outfall 001
TRCYR-003 Old River, ~500 ft downstream of Outfall 001
TRCYR-004 Old River, ~500 ft downstream of Outfall 002
TRCYR-005 Old River, ~ 4 mi downstream of Outfall 001
TRCYR-006 Grant Line Canal, downstream of Outfall 001

Continuous Multiparameter Monitoring (IEP EMP)

C3A SacR @ Hood
C7A SJR @ Mossdale
C10A SJR nr Vernalis
D12A SJR @ Antioch Water Works
D24A SacR @ Rio Vista
D29 SJR @ Prisoners Point
P8A SJR @ Rough and Ready Island

Continuous Recorders (DWR)

D11A Sherman Lake nr Antioch
D19 Franks Tract nr Russo's Landing

Continuous Recorders (Reclamation)

ANC Antioch
CCS Cache Slough
CLL Collinsville
CNT Contra Costa Canal
EMM Emmaton
FRP Farrar Park
HLL Holland Tract
JER Jersey Island
PTS Pittsburg
RIV Rio Vista
SAL San Andreas Ldg.
STI Staten Island
UNI Union Island
VIC Victoria Island

Delta Flows Network

DWSC Sacramento River Deep Water Ship Channel nr Rio Vista
FAL False River
GLC Grant Line Canal at Tracy Road Bridge
HLT Middle River near Holt
HOL Holland Cut near Bethel Island
MOK Mokelumne River at San Andreas Island near Terminous
OBI Old River at Bacon Island
OSJ Old River at Frank's Tract near Terminous
PRI San Joaquin River at Prisoner's Point near Terminous
TMS Three-mile Slough near Rio Vista
TRN Turner Cut near Holt
VCU Victoria Canal near Byron

Delta-Mendota-Canal Water Quality Monitoring Program

MP3.5 DMC Headworks

Deuel Vocational Institution

DV-RSW-001 450 ft u/s of Discharge Pt 003 in Deuel Drain
DV-RSW-002 450 ft d/s of Discharge Pt 001 in Deuel Drain

Discrete Physical/Chemical Water Quality Monitoring (IEP EMP)

C3A SacR @ Hood
C10A San Joaquin River near Vernalis
D4 Sacramento River above Point Sacramento
D12 San Joaquin River @ Antioch Ship Channel
D19 Franks Tract nr Russo's Landing
D26 SJR @ Potato Point
D28A Old R @ Rancho Del Rio
MD10A Disappointment Slough near Bishop Cut
P8 SJR @ Buckley Cove

DRAFT FINAL

GWF Power Systems Company

GWFPSIVR-1 328 feet east of the point of discharge
GWFPSIVR-2 328 feet west of the point of discharge

Oakwood Lake Water District

BSMAR-1 100 feet downstream from the point of discharge
BSMAR-2 50 feet upstream from the point of discharge

Mountain House Community Services District

MHR-001 R-001 Old River, Midstream
MHR-002 R-002 Old River, Midstream
MHR-003 R-003 Old River, Midstream
MHR-004 R-004 Wicklund Cut, Midstream, Bethany Road

Municipal Water Quality Investigations

CONCOSPP01 Contra Costa PP @ Rock Slough
HOOD Sacramento R @ Hood
MALLARDIS Sacramento R @ Mallard Island
OLDRBACISL Old R @ Bacon Island
STATION09 Old R nr Byron Tract
VERNALIS SJR nr Vernalis

NAWQA

11303500 San Joaquin R near Vernalis
11447650 Sacramento River @ Freeport

Sacramento Coordinated Monitoring Program

SRFPT Freeport upstream of SRWTP
SRRMF River Mile 44 downstream of SRWTP

Sacramento Regional County Sanitation District

SRCS D R-1 Freeport upstream of SRWTP
SRCS D R-3 Cliffs Marina

Sacramento Stormwater Quality Program

FMSacStorm Freeport Marina

Sacramento Valley Water Quality Coalition

GIDLR Grand Island Drain near Leary Road
SSLIB Shag Slough at Liberty Island Bridge
UCBRD Ulatis Creek at Brown Road

San Francisco Bay RMP

BG20 Sacramento River
BG30 San Joaquin River

San Joaquin County & Delta Water Quality Coalition

544RIDAHT Roberts Island Drain at Holt Road
544XXSWTD South Webb Tract Drain
544XTTHWT Terminous Tract Drain at Highway 12
544WSAWAV Walthall Slough @ Woodward Avenue

Seasonal Trends at Central Valley Integrator Sites

(SWAMP)

510SACHOD Sacramento River at Hood
SJC501 SJR @ Airport Way

Source Water Monitoring (Contra Costa Water District)

MS Mallard Slough
OR Old River
PP1 Contra Costa Canal at Pumping Plant 1
RS Contra Costa Canal, near Rock Slough at the Trash Rack

South San Joaquin Irrigation District

531XXXD11 Drain 11 at Walsal Slough (Top of Bank)

State Water Project Water Quality Monitoring Program

BKS North Bay Aqueduct @ Barker Slough PP
HBP Harvey O. Banks PP Headworks
KA000000 Clifton Court Forebay

Stockton Port District

R1SJS Storm SJR south of the Santa Fe Railroad Bridge
R2SJS Storm DWSC d/s of the east Burns Cutoff confluence
R3SJS Storm DWSC turning basin
R4SJS Storm DWSC d/s of the west Burns Cutoff confluence
R5SJS Storm Burns Cutoff

Surface Water Monitoring (DWR Central District)

B91650 Sacramento River at Walnut Grove
B94133 Mokelumne River, N.F., below Snodgrass
B95058 Piper Slough at Bethal Tract
B95060 Three Mile Slough at San Joaquin River
B95218 Rock Slough at Contra Costa Canal
B95242 East Contra Costa I.D.
B95250 Old River at Bacon Island
B95300 Grantline Canal at Tracy Road
B95325 Doughty Cut near Grantline Canal
B95365 Old River near DMC (below dam)
B95366 Old River near DMC (above dam)
B95380 Old River at Tracy Road Bridge
B95410 Paradise Cut above Old River
B95422 Sugar Cut
B95468 Middle River at Middle River
B95500 Middle River at Borden Highway (Hwy 4)
B95503 Middle River at Tracy Road Bridge
B95530 Middle River at Howard Road Bridge
B95740 San Joaquin River at Brandt Bridge
B95765 San Joaquin River below O.R., near Lathrop
B95850 San Joaquin River below Paradise Dam
B95880 San Joaquin River at D.V.I. Pump

Source Water Monitoring (DWR/SJVDA)

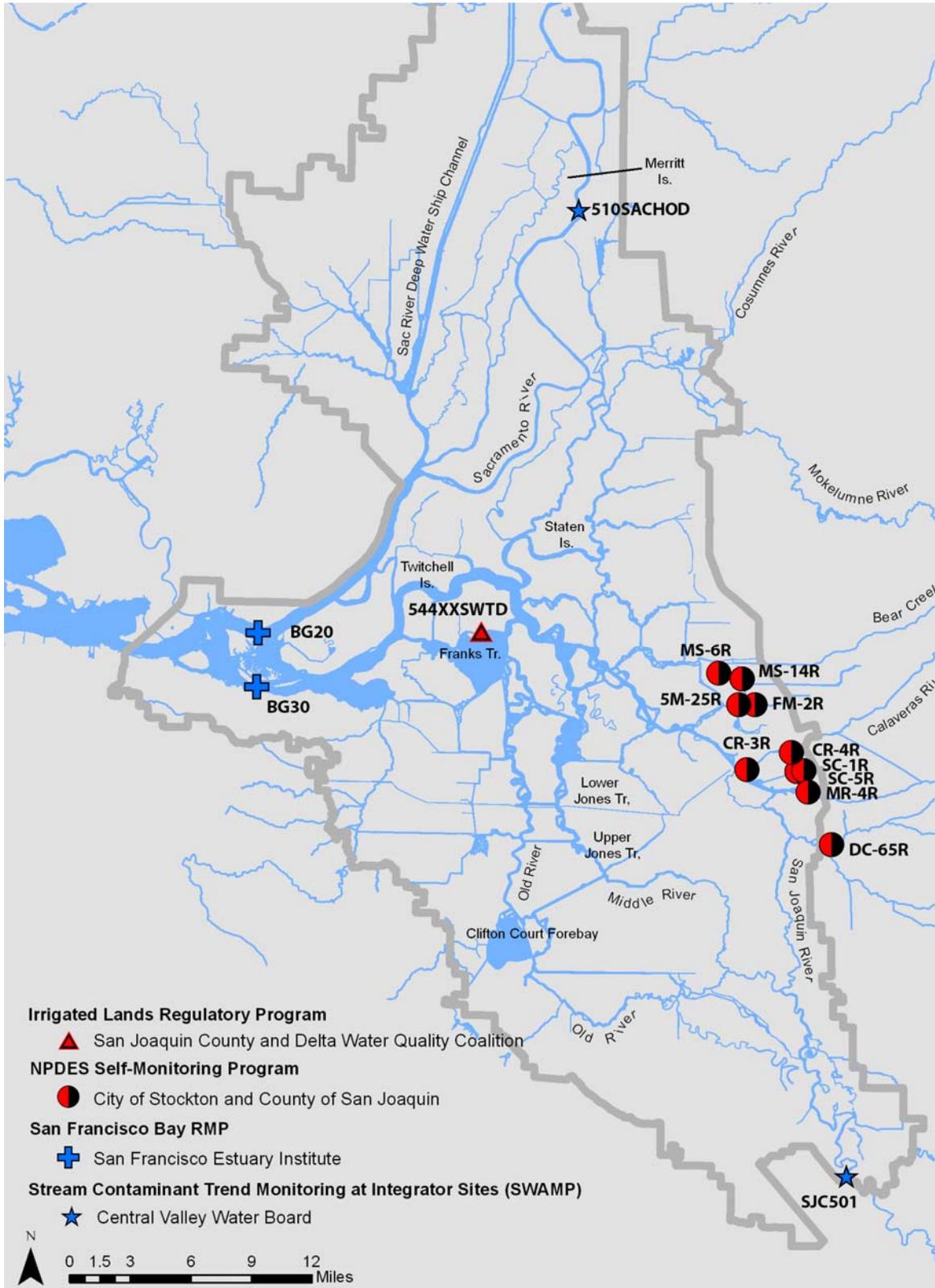
NJD New Jerusalem Drain

Town of Discovery Bay Community Services District

DB-RSW-001 Old River, 500 ft upstream of discharge point
DB-RSW-002 Old River, 500 ft d/s of discharge point

DRAFT FINAL

C.8. Sediment Chemistry



Sediment Chemistry Monitoring Sites

City of Stockton & County of San Joaquin

5M-25R Five-Mile Slough east of confluence with 14-mile Slough
CR-3R Lower Calaveras River
CR-4R Calaveras River at Pacific Ave
DC-65R Duck Creek in vicinity of El Dorado Street overcrossing
FM-2R Five-Mile Slough at Plymouth Rd
MR-4R Mormon Slough at Weber Ave Overpass
MS-14R Mosher Slough in vicinity of Mariners Drive
MS-6R Mosher Slough
SC-1R Smith Canal (in the vicinity of Pershing)
SC-5R Smith Canal

Delta & San Joaquin County Water Quality Coalition

544XXSWTD South Webb Tract Drain

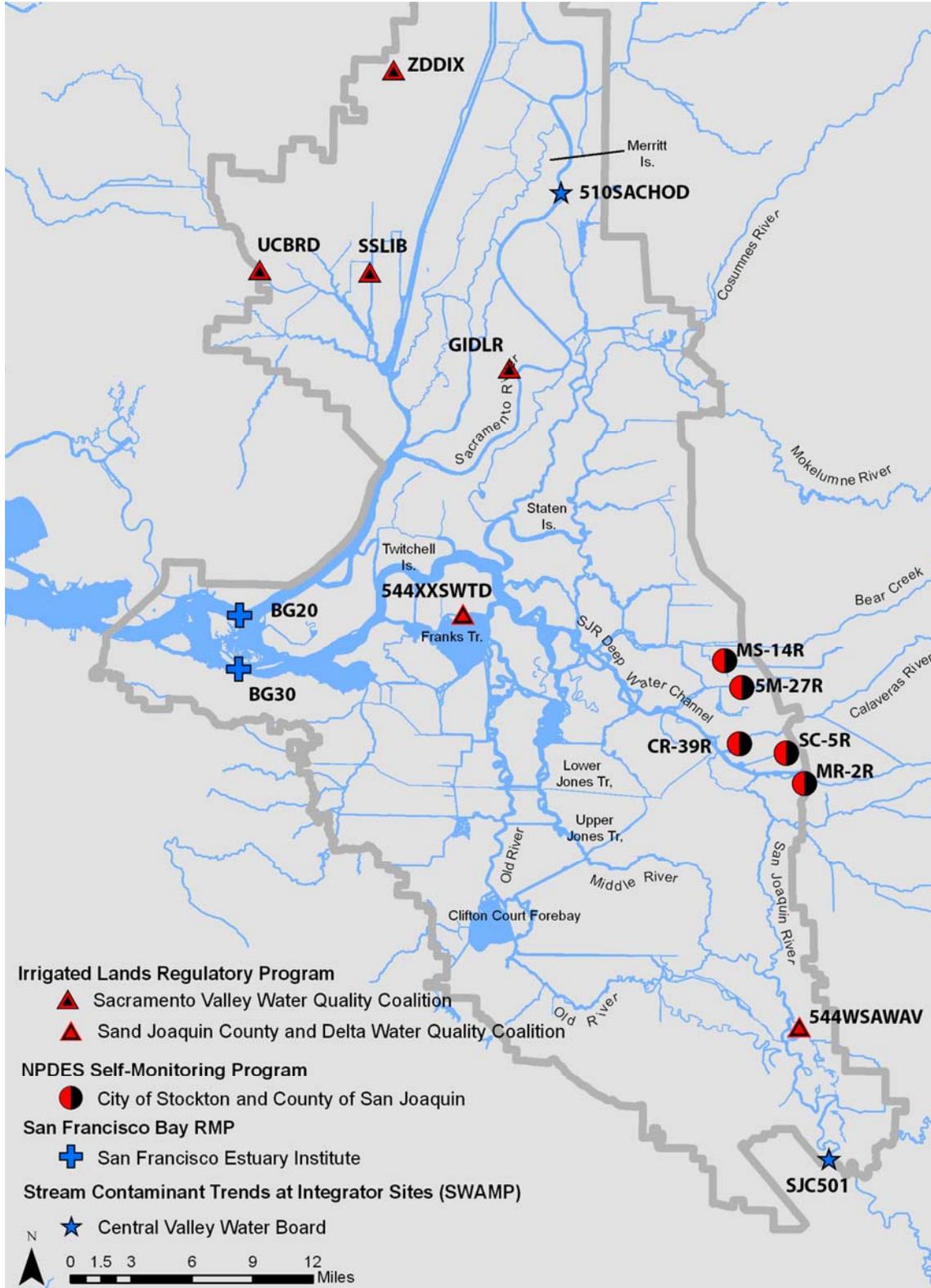
San Francisco Bay RMP

BG20 Sacramento River
BG30 San Joaquin River

Stream Contaminant Trends at Integrator Sites (SWAMP)

510SACHOD Sacramento River at Hood
SJC501 SJR @ Airport Way

C.9. Sediment Toxicity



Sediment Toxicity Monitoring Sites

City of Stockton & County of San Joaquin

5M-27R Five-Mile Slough at Swenson Park Golf Course
CR-39R Calaveras River at Brookside
MR-2R Mormon Slough at Commerce Street
MS-14R MS-14R, Mosher Slough in vicinity of Mariners Drive
SC-5R Smith Canal - Site 5R

Delta & San Joaquin County Water Quality Coalition

544WSAWAV Walthall Slough @ Woodward Avenue
544XXSWTD South Webb Tract Drain

Sacramento Valley Water Quality Coalition

GIDLR Grand Island Drain near Leary Road
SSLIB Shag Slough at Liberty Island Bridge
UCBRD Ulatis Creek at Brown Road
ZDDIX Z Drain - Dixon RCD

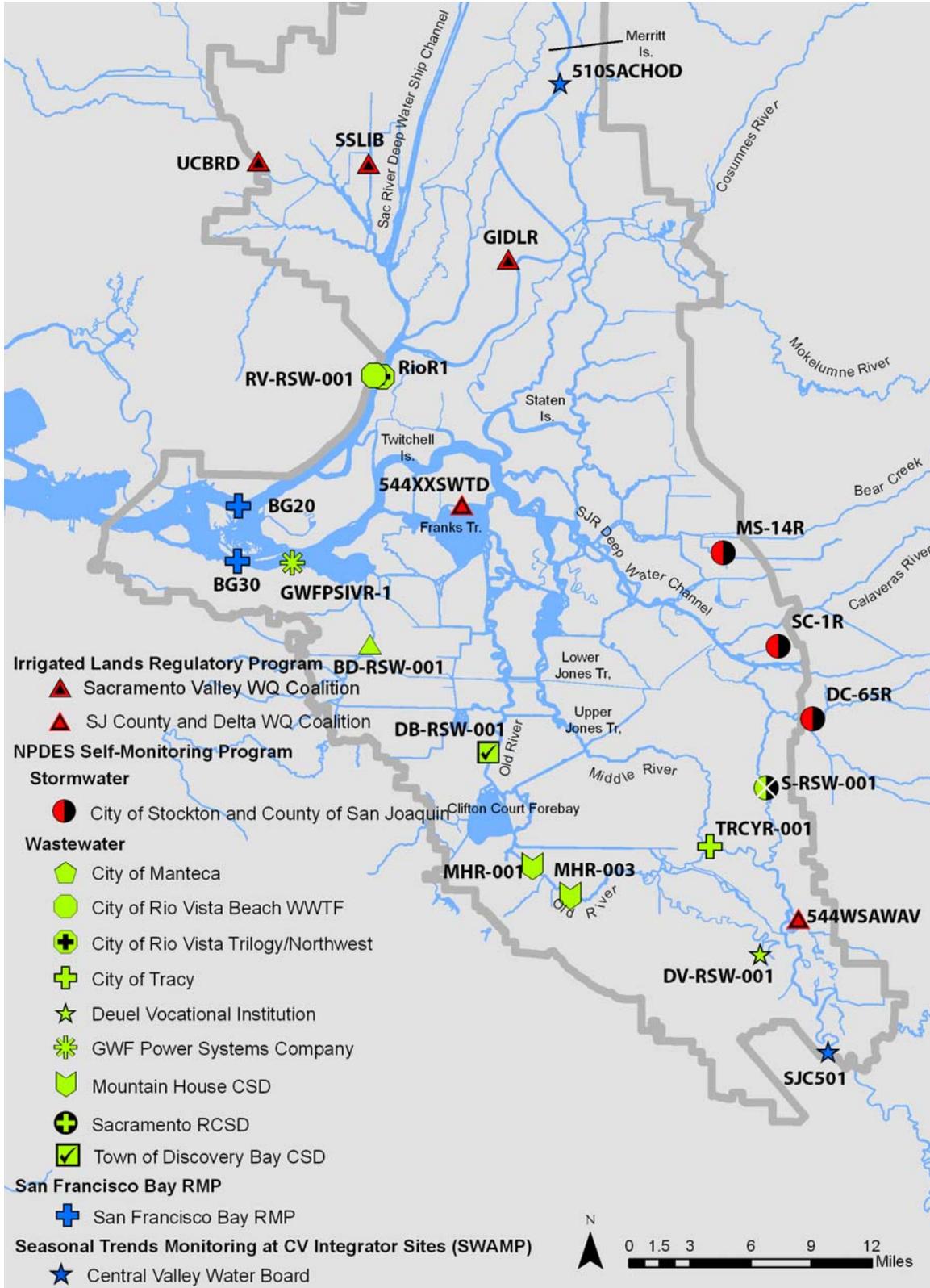
San Francisco Bay RMP

BG20 Sacramento River
BG30 San Joaquin River

Stream Contaminant Trends at Integrator Sites (SWAMP)

510SACHOD Sacramento River at Hood
SJC501 SJR @ Airport Way

C.10. Water Toxicity



DRAFT FINAL

Water Toxicity Monitoring Sites

City of Brentwood

BD-RSW-001 100 feet upstream of Discharge Point No. 001

City of Rio Vista Beach WWTF

RV-RSW-001 Sac R~ 1 mile u/s of Discharge Point No. 1

City of Rio Vista Trilogy/Northwest

RioR1 ~ 100 feet upstream of Discharge Point 001

City of Stockton

S-RSW-001 San Joaquin River and Bowman Road

City of Stockton & County of San Joaquin

DC-65R Duck Creek in vicinity of El Dorado street overcrossing

MS-14R Mosher Slough in vicinity of Mariners Drive

SC-1R Smith Canal (in the vicinity of Pershing)

City of Tracy

TRCYR-001 Old River, ~1 mile upstream of Outfall 001

Delta & San Joaquin County Water Quality Coalition

544WSAWAV Walthall Slough @ Woodward Avenue

544XXSWTD South Webb Tract Drain

544XXSWTD South Webb Tract Drain

Deuel Vocational Institution

DV-RSW-001 450 ft upstream from point of discharge of Discharge Pt No. 003 in Deuel Drain

GWF Power Systems Company

GWFPSIVR-1 328 feet east of the point of discharge

Mountain House Community Services District

MHR-001 Old River, Midstream

MHR-003 Old River, Midstream

Sacramento Valley Water Quality Coalition

GIDLR Grand Island Drain near Leary Road

SSLIB Shag Slough at Liberty Island Bridge

UCBRD Ulatis Creek at Brown Road

San Francisco Bay RMP

BG20 Sacramento River

BG30 San Joaquin River

Seasonal Trend Monitoring at Central Valley Integrator Sites (SWAMP)

510SACHOD Sacramento River at Hood

SJC501 SJR @ Airport Way

Town of Discovery Bay Community Services District

DB-RSW-001 RSW-001, 500 feet upstream from the point of discharge to Old River

D. Ongoing Multi-Year Studies

Stockton Deep Water Ship Channel Dissolved Oxygen TMDL

The next study that will be undertaken for the DO TMDL is called "Characterizing the Impact of Upstream San Joaquin River Algae Loads on Dissolved Oxygen Conditions in the Stockton Deep Water Ship Channel". This study is referred to as the Downstream Studies. Currently the contract is on hold due to the State budget crisis. The contract is expected to be finalized when the budget for the fiscal year 2009/2010 is passed. The study is expected to run through December 2010, with the final report being issued in June 2011.

The chief principal investigator for the Downstream Studies will be Dr. William T. Stringfellow of the University of Pacific and Lawrence Berkeley National Laboratory. The funding source is from Proposition 13, Article 3 Bay-Delta Multi-purpose Water Management Programs (Water Code Sections 79196.5[b] and [e] for the purpose of implementing the CALFED Ecosystem Restoration Program). The estimated total cost is ~ \$3M.

The multi-task study will have sampling points from Disappointment Slough in the Stockton DWSC all the way up to Bear Creek and Lander Avenue in the San Joaquin River (SJR) watershed. Tasks with planned sampling activities in the Delta include:

Collection of water quality, flow, and other data from the San Joaquin Delta study area. Nineteen locations in the San Joaquin Delta between Mossdale and Disappointment Slough will be sampled and measured. Samples will be taken using depth integrated grab samples and measurements will be taken by handheld YSI 6600 data sondes. Samples will be collected at a minimum frequency of at least once per month for calendar years 2009 and 2010. Additional samples will be collected during summer months based on the adaptive DO TMDL management program. Also, YSI 6600 data sondes will be deployed at some locations for extended periods to investigate variances in water quality grab sampling events.

Survey water quality in the Old and Middle Rivers. Conduct surveys of the 303(d) listed areas of the Old and Middle Rivers to develop more information about the extent of the low DO conditions in these waterbodies. Surveys will be conducted during periods of high temperature and low flow. A minimum of two surveys will be completed but may be increased based on the adaptive management program.

Microcystis and blue green algae in the San Joaquin Delta. Lateral and vertical distribution of algae and zooplankton will be determined at three locations in the DWSC. Samples will be collected during slack, ebb, and flood tide conditions. Approximately 6 samples will be collected at each location (3 vertical stations in the middle of the channel and 3 lateral stations at mid-depth). Samples will be analyzed for the presence or absence of *Microcystis* and the concentration of microcystin and phycocyanin. This data will be combined with data collected during the water quality monitoring study in the estuary and used to provide an analysis of the temporal and spatial distribution of blue green algae and their toxins in the estuarine study area. Occurrence and distribution data will be included into a Link-Node model for the San Joaquin Delta.

DRAFT FINAL

Modeling. The DO TMDL study employs two models - The Watershed Analysis Risk Management Framework model, which is calibrated for the upstream riverine portion of the SJR (Mossdale to Lander Avenue), and the Link-Node, model which is calibrated for the estuarine portion of the SJR (Disappointment Slough to Mossdale). Planned work with the Link-Node model include the testing and calibration of various water quality parameters in Delta sloughs¹⁰, including temperature, EC, ammonia, nitrate, phosphate, suspended sediment, phytoplankton and dissolved oxygen.

Parameters to be measured in the lab include 10-day BOD, 10-day carbonaceous and nitrogenous biochemical oxygen demand, chlorophyll a, phaeophytin a, phycocyanin, TOC, DOC, volatile suspended solids, total suspended solids, total nitrogen, nitrate and nitrite nitrogen, ammonia nitrogen, soluble orthophosphate, total phosphate, microcystin, *Microcystis aeruginosa*.

Parameters to be measured in the field include chlorophyll a fluorescence, phycocyanin (blue-green algae) fluorescence, turbidity, temperature, electrical conductivity, DO, pH, algal productivity and respiration, labile oxygen demand, and as needed, ammonia oxidation rates.

POD Toxicity Monitoring with *Hyaletta azteca* and Delta Smelt

A water toxicity monitoring project was initiated in 2005 to assist in identifying the sources and quantifying the effects of contaminants on aquatic species of concern. The monitoring project is conducted by the UC Davis Aquatic Toxicology Laboratory and funded by the IEP. The total cost for monitoring in 2009 is estimated at approximately \$550,000. A total of 17 sampling sites were selected among the DFG fish survey stations and in accordance with the prevalent distribution patterns of fish species of concern. The study investigates toxicity of Delta water samples to invertebrates (*Hyaletta azteca*) and early life stages of Delta Smelt. If toxicity is detected, toxicity identification evaluations and chemical analysis will be used to identify toxicants. Toxicity data obtained to date suggest that water quality is at times compromised in the lower Sacramento River/DWSC and that insecticides (e.g., pyrethroids) were likely contributing to the observed toxicity to *H. azteca*.

Sampling will continue biweekly throughout 2009 at sites shown in the map D1.

U.S. Geological Survey Projects

Carbon capture wetland farming to reverse subsidence and reduce flood risk. A full farm-scale project is being constructed by the State and monitored by USGS. Several experimental wetlands are being constructed in which processes and effects will be assessed in detail. The linked biogeochemical processes of plant growth, DOC production, mercury methylation, and greenhouse gas production are being assessed at several scales and the rates and drivers found in the field assessments will be implemented in a coupled biogeochemical model to be used for scenario testing. The contacts for this project include Roger Fujii (rfujii@usgs.gov) and Brian Bergamaschi (bbergama@usgs.gov).

Evaluation of rice cultivation in the Sacramento-San Joaquin Delta. The USGS is conducting

¹⁰ French Camp Slough, Mormon Slough, Burns Cutoff, Calaveras River, Disappointment Slough, Fourteen Mile Slough and Turner Cut

DRAFT FINAL

research on a farm-scale demonstration rice field on Twitchell Island in the western Delta. A key outcome will be a description of ways for mitigating deleterious exports of DOC, nitrogen and disinfection byproduct precursors (DBP) that will be transferable to other Delta rice growing areas. The contact for this project is Jacob Fleck (jafleck@usgs.gov).

A non-point source of contaminants to the estuarine food web: mobilized particles from the intertidal zone. Physical processes may fractionate sediment and increase metal concentrations above the background levels for two full tidal cycles. This study seeks to provide information on where, when, and why these processes occur. The contact for this project is Jacob Fleck (jafleck@usgs.gov).

The use of in situ coagulation in conjunction with constructed wetlands to decrease island drainage water DOC export and mitigate land surface subsidence. This project combines laboratory and field studies to assess (1) how effective coagulants are at removing DOC and DBP precursors from island drainage waters, (2) the long-term stability of the DOC-metal precipitate under varying environmental conditions, (3) rates of land surface accretion in wetlands receiving flocculate compared to wetlands alone; (4) potential aquatic environmental and toxicity effects, and (5) if the technology is promising, the logistics, feasibility and costs of implementing this approach at a larger scale. The contact for this project is Tamara Kraus (tekraus@usgs.gov).

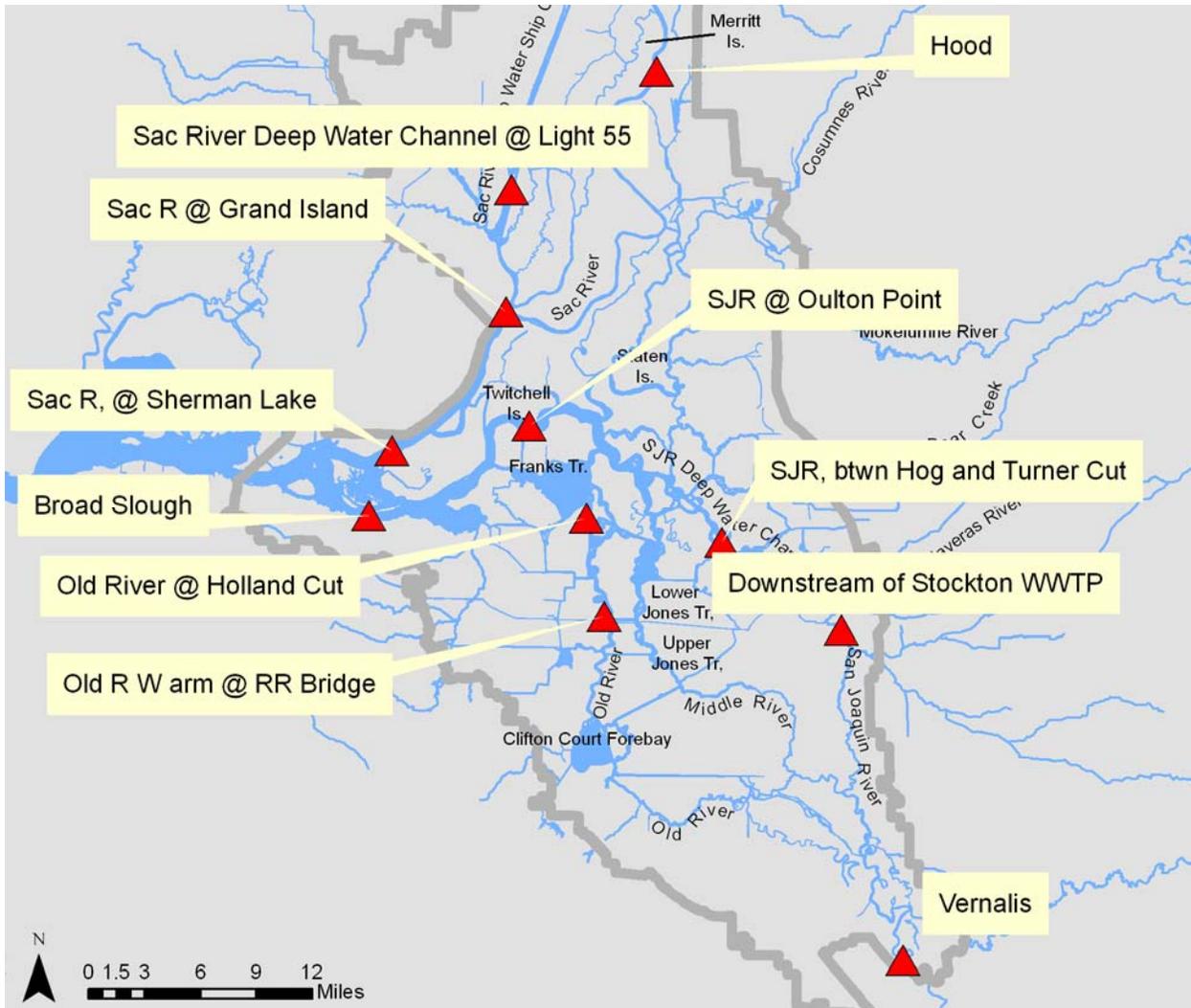
Microcystis Toxicity in the Delta

Sites – the investigators are planning to target "hot spots" (more abundant toxic *Microcystis*) as shown in the initial results, including additional sites in the Delta. Sampling is planned in the central Delta region, in an area that includes sites along the Sacramento River, from Antioch and Brannan Island, and towards the lower San Joaquin River and Mildred Island.

Sampling design - will be coordinated with DWR and DFG monitoring schedule to sample algal tissues and water samples during the seasonal development of the bloom in the Delta (ca. July - Oct).

Parameters - key environmental factors (water temperature, salinity, conductivity) in the Delta will be looked at and how they might relate to bloom development. Under controlled conditions in the laboratory, expression of the mcyD gene (associated with production of the toxin, microcystin) will be assessed as a result of exposure to various environmental parameters in the field.

Assessment - the investigators will use a molecular method, quantitative polymerase chain reaction, to estimate the abundance of toxic and non-toxic *Microcystis* at designated sites. Impacts of *Microcystis* will be assessed in juvenile Delta smelt and threadfin shad (*Dorosoma petenense*) that will also be collected at the sampling sites.



Map D1. Monitoring sites for POD Toxicity Monitoring with *Hyalella azteca* and Delta Smelt.