SWAMP
Surface Water Ambient Monitoring Program

Monitoring Plan	2011- 2012

PROJECT PLAN
FOR THE SURFACE WATER AMBIENT MONITORING PROGRAM IN THE COLORADO RIVER BASIN REGION
FY 11-12

Prepared by

Basin Planning Section

California Regional Water Quality Control Board
Colorado River Basin Region

Updated April 2011

CALIFORNIA Water Boards

www.waterboards.ca.gov/swamp

Table of Contents

1. INTRODUCTION

1.1 Background

The Surface Water Ambient Monitoring Program (SWAMP) is a water quality monitoring program implemented by the State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards (RWQCBs) for the purpose of developing a statewide and regional picture of the status and trends in the quality of California's surface waters. SWAMP is intended to meet four goals:

1. Create an ambient monitoring program that addresses all hydrologic units of the State using consistent and objective monitoring, sampling and analytical methods; consistent data quality assurance protocols; and centralized data management.
2. Document ambient water quality conditions in potentially clean and polluted Areas at site-specific to statewide scales.
3. Identify specific water quality problems preventing the SWRCB, RWQCBs, and the public from realizing the full beneficial uses of water in targeted watersheds.
4. Provide data to evaluate the overall effectiveness of water quality regulatory programs in protecting beneficial uses of waters of the State (SWRCB, 2000).

The SWRCB continues to use several performance objectives and measures for its programs. The measures generally are output-related and designed to measure program efficiency and timeliness. These measures include: (a) percent of total inspections completed versus the number of permitted sites, (b) number of Cleanup and Abatement Orders (CAOs) issued, and (c) median time required to issue new National Pollutant Discharge Elimination System (NPDES) permits and Waste Discharge Requirements (WDRs). Historically, however, the ability to relate directly the performance of their programs to water quality outcomes has been hampered by limited data management capabilities and fragmented and incomplete water quality monitoring data collection, evaluation, and management. SWAMP provides a comprehensive tool to evaluate water quality and changes to it; for establishing a closer link between budgeted water quality program activities and the impact those activities have on protecting and improving water quality.

This work plan details regional SWAMP plans and procedures for FY 11-12. SWAMP monitoring in Region 7 for FY 11-12 continues the monitoring strategy developed in previous years. Water samples will continue to be collected from strategic monitoring locations and subjected to analysis of parameters that are indicators of water quality. Water samples from these same stations have been collected and analyzed since 2002. The budget is based on the most current cost estimates from San Jose State University Foundation who provides the majority of sampling and analytical services for Region 7.

Region 7 SWAMP staff recognizes that the Comprehensive Monitoring and Assessment Strategy and Scientific Planning and Review Committee (SPARC) review mean that significant changes have to occur at all levels of SWAMP, so that the program can continue and be successful. SPARC made it clear that the alignment of regional efforts to SWAMP statewide goals is essential for program survival (SCCWRP, 2006). This work plan highlights areas where Region 7 has aligned its efforts with that of SWAMP strategy goals, as recommended by SPARC. SWAMP monitoring is essential for the support of regional programs and other functions:

- Evaluate Protection Level/ Restoration Efforts
- Protection of Beneficial Uses
- Creation of Total TMDLs
- Enforcement Actions and Permitting
- Creation/ Updates of CWA 303(d) Impaired Waters List

These include the protection of beneficial uses through supportive programs such as Total Maximum Daily Loads (TMDLs), which rely heavily on data generated by the SWAMP monitoring. Both TMDLS and the Clean Water Act (CWA) 303(d) list rely greatly on SWAMP monitoring data, another mutual goal intended to support regional programs. Finally, Swamp and Region 7 agree that SWAMP monitoring should be able to evaluate the current level of protection for the region's waters, and it should also be able to gauge the effectiveness of restoration efforts that have already been implemented.

Region 7 Monitoring Objectives
The objectives of Region 7 SWAMP monitoring translate the State's CWA Section 106 work plan objectives into regional objectives in order to answer the following questions:

- What is the overall quality of water in the Lower Colorado River, New River, Alamo River, Whitewater River, and Salton Sea, the region's main surface waters?
- Is water quality in the Lower Colorado River, New River, Alamo River, Whitewater River, and Salton Sea changing over time?
- Are there areas in the Lower Colorado River, New River, Alamo River, Whitewater River, and Salton Sea with known or potential problems that need additional protection? What level of protection is needed?
- How effective are Management Practices currently being implemented in Imperial Valley agricultural fields at reducing silt levels in the New River, Alamo River, and Imperial Valley Drains?
- How effective is the new waste water treatment plant (WWTP) in Mexicali, Mexico at reducing bacterial concentrations in the New River?

1.2 **PROBLEM STATEMENT**

The overall goal of SWAMP is to develop a statewide and regional picture of the status and trends of the quality of California's surface waters (SWRCB, 2000). Regional Board staff selected 26 strategic monitoring stations. These stations are located along the

Lower Colorado River, New River, Alamo River, Whitewater River, and Salton Sea; five surface water bodies of major interest in the Region. These water bodies are the focus of many Total Maximum Daily Load (TMDL) programs for sediments, nutrients, selenium, pesticides, and pathogens. Measures of physical, chemical, and biological parameters (water quality indicators) will be collected.

In addition, ambient monitoring will be used to support the regions proposed TMDLs, such as a proposed pesticide TMDL for the Alamo River. Monitoring will also assess the effectiveness of implemented MPs. Management Practices (MPs) to control silt runoff are currently being applied in Imperial Valley as required by three Silt TMDLs (RWQCB CRBR 2001a, 2002, and 2005). A wastewater treatment plant was recently constructed in Mexicali, B.C. Mexico to treat water before it is discharged into the New River to comply with a Bacteria Indicators TMDL (RWQCB CRBR, 2001b). Ambient monitoring will be used to measure MP effectiveness in reducing silt and evaluate the effectiveness of the newly constructed WWTP.

1.3 Target Audience and Management Decisions

The SPARC members recommended that SWAMP identify key target audiences that reflect the updated program goals. The target audience should include those with regional and statewide responsibilities for the protection of water resources, and expand from existing relationships. The key target audiences for SWAMP data include: Individuals involved in Basin Planning issues; 303(d)/305(b) Integrated Reporting; TMDL development and implementation staff; NPDES activities; other regulatory or planning programs that focus on preventing pollution in surface waters; members of the public. SWAMP provides data for establishing a closer link between budgeted water quality program activities and the impact those activities have on protecting and improving water quality.

2. REGIONAL DESCRIPTION

2.1 WATERSHED DESCRIPTIONS

The Colorado River Basin region encompasses approximately 13 million acres (20,000 square miles) in southeastern California, including all of Imperial County and portions of San Bernardino, Riverside, and San Diego Counties. The region is bordered to the northeast by Nevada; to the east by the Colorado River; to the south by Mexico; to the west by the Laguna, San Jacinto, and San Bernardino Mountains; and to the north by the New York, Providence, Granite, Old Dad, Bristol, Rodman, and Ord Mountain Ranges.

The Region's watersheds are categorized into three larger watershed management areas: The Lower Colorado River, Salton Sea Trans boundary, and Desert Aquifers (CRWQCB CRBR, 2004). They are predominantly desert landscape, but possess water bodies of statewide, national, and international importance (e.g., Salton Sea and Colorado River). The majority of the region's surface waters are located in the Imperial Valley and East Colorado River planning areas, with a few situated in the Coachella Valley, Lucerne, Anza-Borrego, and Hayfield planning areas (Figure 1). Since the majority of surface waters are in the Imperial Valley and East Colorado River planning areas, our ambient surface water-monitoring program is focused there. Much of these waters are agricultural drains that receive runoff from crop fields. The most common crops include alfalfa, barley, wheat, and various grasses that are irrigated by both ground water and by imported canal water via the All-American Canal. The runoff from these fields carries with it the fertilizers, pesticides, and silts into the discharge drains, which in turn discharge into the Alamo and New Rivers, and ultimately end up in the Salton Sea.

The climate of these watersheds is hot, with dry summers, occasional storms, and high winds. The Imperial Valley is considered to be one of the most arid regions in the United States, with temperatures hovering above 100°F for nearly 4-5 months per year, and an average rainfall of less than three inches per year. In this arid region, there are 3 general soil associations that dominate the Imperial Valley: Imperial; Imperial Holtville-Glenbar; and Meloland-Vint-Indio. These soils range from excessively drained to poorly drained, and consist of nearly level to moderately steep, valley fill, alluvial fans, and lacustrine deposits. The majority of soils are poorly drained due to their low permeabilities.

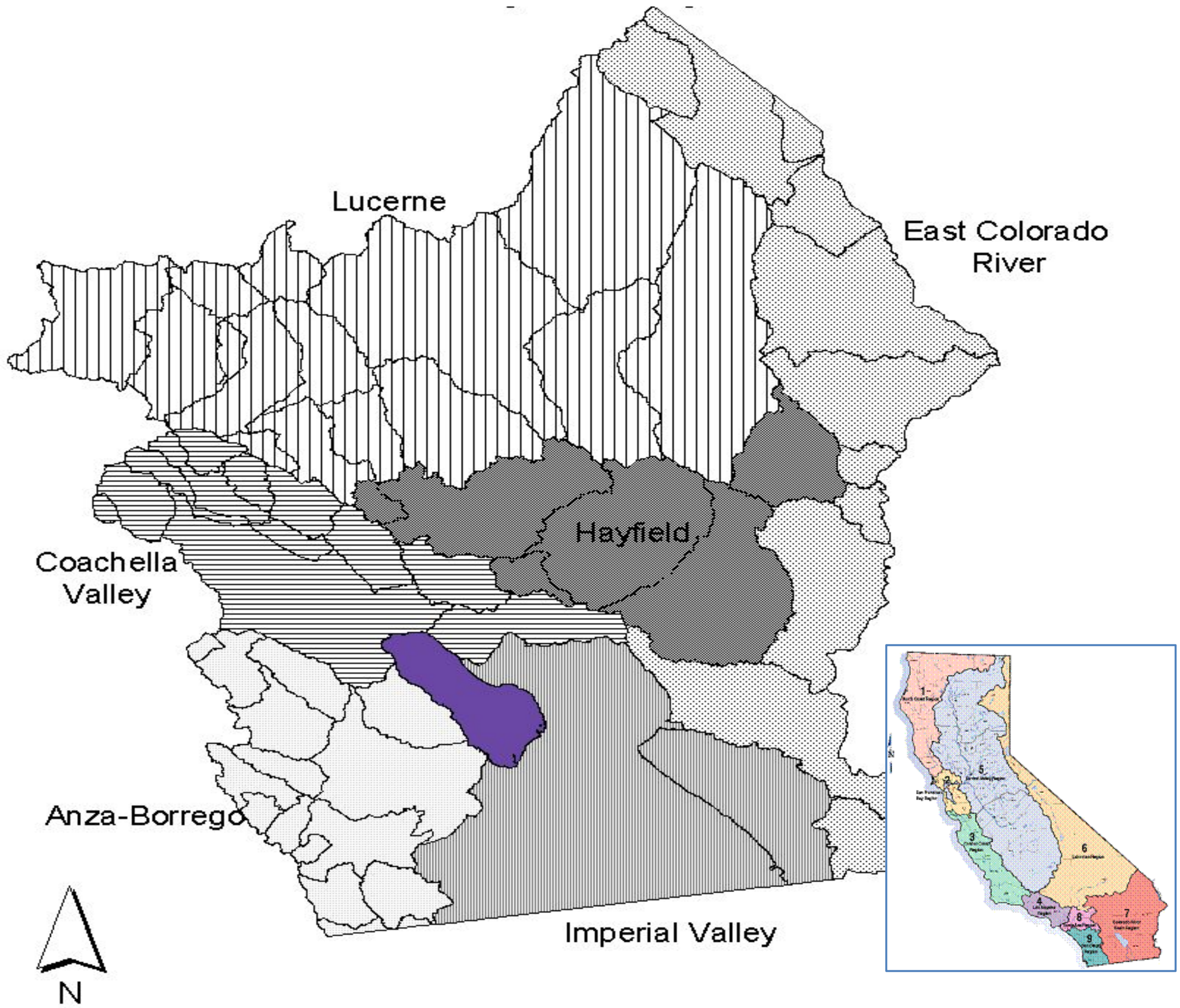

Figure 1. Colorado River Basin Region and the Basin Planning Areas

Lower Colorado River

The East Colorado River planning area makes up the Lower Colorado River watershed management area (Figure 1). The East Colorado River planning area is bound to the north by Nevada, to the east by the Colorado River (which forms the Arizona-California border), to the south by Mexico, and to the west by the drainage division of California streams and washes that are directly tributary to the Colorado River. The area is 200 miles long with a maximum east-west width of 40 miles. The Palo Verde and Bard Valleys are included in this planning area. The main source of water in the East Colorado River Valley is the Lower Colorado River. All drainage flows to the Colorado River except for a minor amount, which flows into the Colorado River Aqueduct via Gene Wash and Copper Basin Reservoirs.

Salton Sea Trans boundary

The Imperial Valley, Coachella Valley, and Anza-Borrego planning areas make up the Salton Sea Trans boundary watershed management area (Figure 1). The Imperial Valley planning area encompasses 2,500 square miles in the southern portion of the Region, almost all of it in the Imperial Valley. Its northerly boundary is along the Salton Sea and the Coachella Valley planning area and its south boundary follows the International Boundary with Mexico. The main source of water in the Imperial Valley is the Lower Colorado River, imported via the All American Canal. The imported water is used for irrigation, industry, and domestic consumption. The Alamo and New Rivers receive agricultural irrigation drainage from numerous agriculture discharge drains as well as surface runoff and treated municipal and industrial wastewater. In addition, the New River also conveys untreated wastewater discharges from Mexicali in Baja California, Mexico. Both rivers spill into the south end of the Salton Sea.

The Coachella Valley planning area lies almost entirely in Riverside County and covers 1,920 square miles in the west-central portion of the Region (Figure 1). The main source of surface water in the Coachella Valley is the Lower Colorado River, imported via the Coachella Branch of the All American Canal. The imported water is used for irrigation, industry, and domestic purposes. The Whitewater River is the major drainage course in the planning area. There is perennial flow of the Whitewater River in the mountains, but due to diversions and percolation into the basin, the river becomes dry further downstream. The constructed downstream extension of the river channel, known as the Coachella Valley Storm Water Channel, serves as a drainage way for irrigation return flows, treated community wastewater, and storm runoff. The channel ultimately flows into the Salton Sea.

The Anza-Borrego planning area comprises 1,000 square miles in parts of San Diego and Imperial Counties, with a small segment in Riverside County (Figure 1). The main source of surface water in the Anza-Borrego area is from rainfall and snowmelt. The drainage flows to the Salton Sea except for two small areas of internal drainage in Clark and Borrego Valleys in the northwest corner of the planning area.

Desert Aquifers

The Lucerne and Hayfield planning areas make up the Desert Aquifers watershed management area (Figure 1). The Desert Aquifers Watershed has little surface water but extensive groundwater aquifers.

2.2 Ecological Attributes of Concern

The Salton Sea Trans boundary Watershed Management Area is the priority watershed for Region 7 (CRWQCB CRBR, 2004). It comprises five main surface waterbodies: the Salton Sea, the New River, the Alamo River, the Imperial Valley Agricultural Drains, and the Coachella Valley Stormwater Channel. Water diverted from the Colorado River has unintentionally created an irrigated agricultural ecosystem throughout this watershed management area. Humans, wildlife and aquatic species are dependent on and make use of the habitat created and maintained through the discharge of agricultural return flows. These waters provide critical habitat for the endangered desert pupfish and migratory birds. Nearly all of the water bodies located within the watershed, including the Alamo and New Rivers, are man-made. Pollutants have always been an issue of concern for these waters, particularly the significant loads of pesticides and fertilizers that are carried into the rivers by discharge drains. Heavy loading of sediments is also a problem for water quality, since the soils are composed of fine sediments and silt that are poorly drained.

The Salton Sea is situated along the Pacific Flyway, a critical stop for migratory birds, and it is frequented by many threatened and endangered bird species. Contaminants and salts continue to concentrate within the sea, because the sea lacks an outlet. The high rate of evaporation and the lack of an outlet have resulted in a highly eutrophic sea. The high salinity cannot be addressed strictly from a regulatory stance; rather, a coordinated approach aimed at stabilizing and/or restoring salinity to levels that maintain beneficial uses and water quality objectives must be implemented.

The designated uses for these waters associated with aquatic life beneficial uses are aquaculture (AQUA), warm freshwater habitat (WARM), cold freshwater habitat (FRSH), wildlife habitat (WILD), preservation of rare, threatened or endangered species and wildlife habitats (RARE) and Water Contact Recreation (REC1), as cited in the Region's Water Quality Control Plan.

3. MONITORING DESIGN

3.1 Monitoring Goals

The goal of this program is to inform the public of the physical, chemical and biological integrity of the waters of the state through information generated by the interpretation of water quality data. n layman’s terms, we will assess the ability of water bodies to support their designated beneficial uses by collecting water samples and analyzing them.

For the region’s 11-12 sampling work, priority will be given to the collection of water samples and the analysis of water quality indicators that support the assessments of the status and trends of aquatic life uses. To the extent possible we will collect water samples and analyze them for water quality indicators that support the assessment of bioaccumulation and the human health impacts associated with fish consumption, as we are doing for the 10-11 fish tissue monitoring. We will continue to collect and analyze for water quality indicators to assess the ability of specific water bodies to support other designated beneficial uses

For aquatic life uses, the monitoring aims to determine if aquatic populations, communities, and habitats are being protected. The following questions are of interest:

- What are the extent and locations of water bodies, which do not meet beneficial uses for aquatic life protection?
- What are the extent and locations of at-risk water bodies?
- What are the extent and locations of high-quality waters and watersheds with high physical, chemical, and biological integrity?
- What is the proportion of water bodies in the State and each region for which evidence exists that they do or do not meet beneficial uses for aquatic life protection?
- Are conditions in water bodies or hydrologic units improving over time?
- What metrics are needed to evaluate trends in biological integrity, physical habitat, and water chemistry?
- What are appropriate time frames for evaluating trends?
- How precise do trend measurements need to be?
- Have water bodies that previously supported aquatic life uses become impaired?
- Have previously impaired water bodies been restored?
- How is the proportion of water bodies meeting aquatic life uses changing over time?

For fishable uses (fish consumption), the following are of interest:

- What are the extent and locations of water bodies with fishing as a beneficial use?

- What are the extent and locations of water bodies with some indications that the fishing beneficial use may not be supported (screening-level evidence of fish contamination)?
- What are the extent and locations of water bodies supporting the fishing beneficial use?
- What is the proportion of water bodies in the State and each region where consumption advice is unnecessary; limited consumption is advised; or no consumption is advised (advisory-level evidence)?
- Are water bodies improving or deteriorating with respect to the fishing beneficial use?
- Have water bodies fully supporting the fishing beneficial use become impaired?
- Has full support of the fishing beneficial use been restored for previously impaired water bodies?
- How is the proportion of water bodies where the fishing beneficial use is unimpaired changing over time (this skirts the detailed question about "fully, partially, or not supporting" the fishing BU and includes screening info)?

Similar assessment questions can be applied to assess the status and trends of water bodies to support other designated beneficial uses. Adherence to these monitoring goals is dependent on finalized sampling costs and funding.

3.2 Monitoring Design

The monitoring design for FY 11-12 continues the same basic design from previous years of collecting water samples at the strategic monitoring stations twice per year, and it compliments other studies carried out in the region. We plan to sample in spring 2013, and fall 2013, using FY 11-12 funds. May was selected because of increased use of agricultural chemicals at this time (e.g., pesticides, fertilizers), and high rates of flow due to melting snow and irrigation runoff. October was selected because of relatively low flow rates due to decreased irrigation. Monitoring stations located at the outlets and inlets of both the Alamo and New Rivers have allowed SWAMP to collect a wealth of water quality data over the past several years. Historical monitoring at these sites has shown both positive and negative correlations between water quality impairments at opposite ends of these water bodies. Essentially, some pollutants that are found in high concentrations at the head of the river tend to be present in significantly lower concentrations at the outlet. The reverse is also true, since some pollutants at the head of these rivers are either found in low concentrations or perhaps not even detected, while those same pollutants are found to be present in very high concentrations at the outlets. By strategically selecting static monitoring stations between the outlets and inlets, not just within the river itself but also the tributaries and agricultural drains, SWAMP monitoring in this region can pinpoint with some degree of certainty where these impairments are originating from, and thus provide the scientific support necessary for the implementation of regional programs that will serve to protect these waters from further degradation.

3.3 MONITORING STATION SELECTION

Regional SWAMP staff used best professional judgment when selecting the strategic monitoring stations to address management needs. The rationale for selecting the strategic monitoring stations was that they were located on the Region's major surface waters, and many of our cleanup programs are focused there. Table 1 identifies the 26 FY 11-12 SWAMP monitoring stations, their designated beneficial uses, and known or potential water quality problems. Region 7 SWAMP staff is amenable to relocating monitoring stations to support a statewide monitoring design to include a probability-based network for making statistically valid inferences about the condition of all State water types over time.

Table 1. Strategic Monitoring Stations

	Monitoring Station	Beneficial Uses[1]	Known Problems	Potential Problems
1	Colorado River @ Nevada State Line	MUN, AGR, IND, GWR, REC1, REC2, WARM, COLD, WILD, POW, RARE	Se	Perch
2	Colorado River @ Imperial Dam	Same as Colorado River @ Nevada State Line	Se	O, P, M Perch
3	Colorado River Upstream of Imperial Dam	Same as Colorado River @ Nevada State Line	Se	Perch
4	Palo Verde Lagoon	REC1, REC2, WARM, WILD, RARE	B, P	P, N, M
5	Palo Verde Outfall Drain	Same as Palo Verde Lagoon	B, P	P, N, M
6	Alamo River Outlet	FRSH, REC1, REC2, WARM, WILD, POW, RARE	O, P, N, S	B, M
7	Alamo River Drop 6A	Same as Alamo River Outlet	O, P, N, S	B, M
8	Alamo River Drop 10	Same as Alamo River Outlet	O, P, N, S	B, M
9	Alamo River Drop 8	Same as Alamo River Outlet	O, P, N, S	B, M
10	Alamo River Drop 6	Same as Alamo River Outlet	O, P, N, S	B, M

	Monitoring Station	Beneficial Uses[1]	Known Problems	Potential Problems
11	Alamo River Drop 3	Same as Alamo River Outlet	O, P, N, S	B, M
12	New River Outlet	FRSH, IND, REC1, REC2, WARM, WILD, RARE	B, O, P, M, N, S, V	-
13	New River @ International Boundary	Same as New River Outlet	B, O, P, M, N, S, V	-
14	New River @ Rice Drain	Same as New River Outlet	B, O, P, M, N, S, V	-
15	New River @ Rice Drain #3	Same as New River Outlet	B, O, P, M, N, S, V	-
16	New River Drop 2	Same as New River Outlet	B, O, P, M, N, S, V	-
17	New River @ Evan Hewes	Same as New River Outlet	B, O, P, M, N, S, V	-
18	Salton Sea Drain SW2	RECI, RECII, FRSH, WARM, WILD,RARE	Se, M, TDS, O,P,N-	-
19	Salton Sea Drain S1	RECI, RECII, FRSH, WARM, WILD,RARE	Se, M, TDS, O,P,N	-
20	Salton Sea Drain S2	RECI, RECII, FRSH, WARM, WILD,RARE	Se, M, TDS, O,P,N	-
21	Salt Creek Slough	RECI, RECII, FRSH, WARM, WILD,RARE	Se, M, TDS, O,P,N	-
22	Whitewater River Upstream of Preserve	MUN, AGR, GWR, REC1, REC2, COLD, WILD, POW	na	B, ammonia
23	Whitewater River Downstream of Preserve	MUN, AGR, GWR, REC1, REC2, COLD, WILD, POW	na	B, ammonia
24	Whitewater River at Interstate 10	MUN, AGR, GWR, REC1, REC2, COLD, WILD, POW	na	B, ammonia
25	Coachella Valley Storm Water Channel @ Ave 52	FRSH, REC1, REC2, WARM, WILD, RARE	B, P	N
26	Coachella Valley Storm Water Channel Outlet	FRSH, REC1, REC2, WARM, WILD, RARE	B, P	N

B = Bacteria, P = Pesticides, O = Organics, M = Metals, N = Nutrients, S = Silt; Se = Selenium, Perch = Perchlorate; T = Trash, V = Volatile Organic Compounds.[1]Beneficial Use definitions can be found in CRWQCB CRBR, 2003.

3.4 MONITORING STATION BACKGROUND

Monitoring stations established for agricultural drains are located at the point where the drain discharges into the river, in order to obtain samples that are representative of the entire length of the drain, and therefore these locations do not typically change. Stations located along the rivers themselves typically do not change either, but for different reasons. Due to the nature of the terrain in these locations, there are many safety hazards present and access is very limited. Some of these hazards include steep and unstable terrain, venomous snakes and insects, bee swarms, wild dogs, and to a lesser degree, vagrants. Overgrown vegetation along the steep river banks makes it virtually impossible to establish new sites along both the Alamo and New Rivers. The monitoring sites that have been selected are free from most of these hazards and are usually located at or near established drop structures that are maintained by other government agencies.

Lower Colorado River Watershed
Three stations were selected in the Lower Colorado River watershed management area. The Colorado River at the Nevada State Line was selected because it is important to know the quality of water in the Colorado River as it enters the State and before its waters are distributed throughout Southern California. The Colorado River at the Imperial Dam station is located near the International Boundary with Mexico. The Imperial Dam serves as a diversion structure for water deliveries throughout southeastern California, Arizona and Mexico. This site is important in that it diverts water to Imperial, Coachella, and Mexicali valleys for agricultural and municipal use.

Two stations were selected near the city of Palo Verde (Palo Verde Lagoon and Palo Verde Outfall Drain). Palo Verde is a community located about one hundred miles south of the Nevada State line station, six miles west of the Colorado River. Water is diverted from the Colorado River into the Palo Verde area to irrigate agricultural crops. The runoff is then discharged into canals that ultimately discharge back into the Colorado River. Palo Verde is about forty miles upstream from Imperial Dam.

Four stations were selected in the Salton Sea Trans boundary watershed management area. The most significant water quality problems in the Salton Sea Trans boundary watershed management area occur in the Salton Sea and its tributaries. Because this area is a closed basin, the only way that water in the Salton Sea is lost is through evaporation. When the water evaporates, salts and other contaminants remain, leading to increased concentrations. The Salton Sea is approximately 30% more saline than the Pacific Ocean, with salinity predicted to increase. The Sea is also classified as a hyper-eutrophic lake because of high concentrations of nutrients from agricultural runoff. Nonetheless, it supports a National Wildlife Refuge and is a critical stop on the Pacific Flyway for migratory birds, including some listed endangered and threatened species.

Two stations were selected for the Coachella Valley Storm Water Channel, which extends approximately 17 miles from Indio to the Salton Sea. The engineered Channel is a constructed extension of the Whitewater River and serves as a depository and drainage way for irrigation return water, treated wastewater and storm water runoff that is conveyed to the Salton Sea. The Channel is one of the major tributary waters to the Salton Sea.

Six sites were selected along the New River, which originates in Mexico and flows north for several miles until it enters the Salton Sea. The New River is one of the major tributary waters to the Salton Sea. As the New River flows, it receives urban and agricultural runoff, untreated and partially treated municipal and industrial waste from Mexicali Valley, Mexico. In the United States, the river receives urban runoff, agricultural runoff, treated industrial waste and treated, disinfected domestic waste from Imperial Valley. Its flow at the International Boundary fluctuates between166 and 359 cubic feet per second (cfs), and at the outfall to the Salton Sea between 459 and 940 cfs as reported by the United States Geological Survey's National Water Information System.

Six stations were selected along the Alamo River. The Alamo River is the main tributary of the Salton Sea with respect to flow volume. As the River flows from the International Boundary to its outlet at the Salton Sea, it receives treated wastewater and agricultural return flows. The Alamo's flow volume is dominated by agricultural return flows from Imperial Valley

Three stations were selected along the northern portion of the Whitewater River, located in northern Palm Springs. The river is fed by snow melt and springs, originating in the San Gorgonio wilderness area and terminating in North Palm Springs where the river is channeled to a series of recharge basins for the purpose of recharging the aquifer. The first monitoring station is located upstream from a natural preserve that is owned and operated by the Nature Conservancy. Three artificial pools containing high concentrations of Rainbow Trout are located on the premises. The pools are situated in a tiered pattern, allowing water from the river to flow through all three consecutively, and empty back into the river downstream. Dogs are permitted on trails, and there is evidence of animal fecal matter on trails and near the water's edge. Therefore, ammonia and bacteria will be among the requested analyses. The second station is located just downstream of the preserve in order to determine if activities in or around the fish ponds are impacting water quality. The third station is located much further downstream, just past the Interstate 10 freeway where water imported by the Metropolitan Water District discharges into the river.

3.5 Indicators and Measurement Parameters

Water quality indicators are measured to assess the ability of specific water bodies to support their designated beneficial uses, and they can be of a physical, chemical, or biological nature. Under section 303(d) of the Clean Water Act (CWA), states are required to develop a list of impaired waters located within its borders. Several of the monitoring stations described in this report are on that list, as outlined in Table 2a. Table 2b presents indicators that USEPA suggests using in ambient monitoring efforts.

Use of a particular indicator depends upon funding, sampling cost, and characteristics of the water body.

Table 2a. List of Region 7 Water Bodies found on the CWA 303(d) list.

Waterbody Name	Pollutants	Potential Sources Of Impairment
Alamo River	Chlorpyrifos	Source Unknown
	Chlordane	Source Unknown
	DDT	Source Unknown
	Diazinon	Source Unknown
	Dieldrin	Source Unknown
	E. coli	Source Unknown
	Endosulfan	Source Unknown
	Enterococcus	Source Unknown
	Mercury	Source Unknown
	PCB's	Source Unknown
	Sediments/ Silt	Agricultural Return Flows
	Selenium	Agricultural Return Flows
	Toxaphene	Source Unknown
Coachella Valley Storm Water Channel	Pathogens	Source Unknown
	DDT	Source Unknown
	Dieldrin	Source Unknown
	PCBs	Source Unknown
	Toxaphene	Volatile Organic Compounds (VOC) Metal chemistry, Organic and inorganic sediment chemistry, Total organic carbon, Shellfish or fish tissue chemistry, Nutrients, Turbidity Inorganic and organic water chemistry
Colorado River (Imperial Reservoir to California-Mexico Border)	Selenium	Source Unknown
Imperial Valley Drains	Chlordane	Source Unknown
	DDT	Source Unknown
	Dieldrin	Source Unknown
	Endosulfan	Source Unknown
	PCBs	Source Unknown
	Selenium	Agricultural Return Flows
	Toxaphene	Source Unknown
	Sediment/ Silt	Agricultural Return Flows
New River (Imperial County)	Chlordane	Source Unknown
	Chlorpyrifos	Source Unknown
	Copper	Source Unknown
	DDT	Source Unknown
	Diazinon	Source Unknown
	Dieldrin	Source Unknown
	Hexachlorobenzene	Source Unknown
	Mercury	Source Unknown
	Nutrients	Agricultural Return Flows
	Organic Enrichment/ Low Dissolved Oxygen	Source Unknown
	PCBs	Source Unknown

Waterbody Name	Pollutants	Potential Sources Of Impairment
	Pathogens Sediment/ Silt Selenium Toxaphene Toxicity Trash Zinc	Confined Animal Feeding Operations Source Unknown Source Unknown Source Unknown Source Unknown Out-of-State Source Source Unknown
Palo Verde Outfall Drain And Lagoon	DDT Pathogens Toxaphene	Source Unknown Source Unknown Source Unknown
Salton Sea	Arsenic Chlorpyrifos DDT Enterococcus Nutrients Salinity Selenium	Source Unknown Source Unknown Source Unknown Source Unknown Agricultural Return Flows Agricultural Return Flows Source Unknown
West Lake (Lake and Reservoir)	DDT	Source Unknown

Revised: 2010

Table 2b. List of Water Quality Indicators for Assessing Beneficial Uses.

Beneficial Uses	Category	WQ Indicators To be Utilized
COLD, RARE, WARM, WILD	Biological response	No bioassessments are planned for this round of monitoring
COLD, RARE, WARM, WILD	Pollutant exposure	Volatile Organic Compounds (VOC) Metal chemistry, Organic and inorganic sediment chemistry, Total organic carbon, Shellfish or fish tissue chemistry, Nutrients, Turbidity Inorganic and organic water chemistry
COLD, RARE, WARM, WILD	Habitat	Dissolved oxygen, Sediment grain size and gradations, Sediment organic carbon, Water flow, Water temperature Electrical conductivity, Salinity Hydrogen sulfide, Ammonia
RARE, WILD	Habitat	Water flow, Suspended solids, Water temperature
RARE, WILD	Biological response	Fish assemblage and populations,
REC I	Contaminant exposure	E. coli bacteria only
REC II	Pollutant exposure	Taste and odor, Debris and trash
MUN	Contaminant exposure	Inorganic water Chemistry, Nutrients Organic water Chemistry, E. coli bacteria

Beneficial Uses	Category	WQ Indicators To be Utilized
AGR	Pollutant exposure	Organic and inorganic chemistry

Adapted from: Bernstein, 1993; SPARC, 1997; SCCWRP, 1998; Stephenson et al., 1994; CalEPA, 1998; CABW, 1998; CDFG, 1998; Noble et al., 1999; AB 982 Scientific Advisory Group, personal communication, August, 2000

3.6 Spatial and Temporal Scale

The monitoring program is designed to collect water and sediment quality data to satisfy near term regional needs and long term statewide needs. Data will serve to identify impaired waters, evaluate changes in the water quality over time, and to assess the effectiveness of implemented management practices that can be applied regionally and statewide.

4. FY 11-12 SWAMP ACTIVITIES

4.1 Sample Collection

California Department of Fish and Game (CDFG) field crews will collect sediment and water samples at the previously identified stations. CDFG field crews adhere to recommended SWAMP sample collection protocols, or approved and documented alternative protocols in order to ensure the collection of representative samples that are free of contamination. Field collection methods are outlined in the SWAMP CDFG sample collection QAPP which can be viewed on the internet at the following link: http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp_sop_field_measures_water_sediment_collection_v1_0.pdf Deviations from the standard protocols are documented by the SWAMP Quality Assurance (QA) team in the SWAMP database. Regional Board staff supplied reconnaissance forms of the strategic monitoring station to CDFG staff previously. Questions concerning station location will be resolved by consultation with the Regional Board staff member present in the field or via phone contact. Table 3 shows the list of requested analysis.

Table 3. Requested water quality sample for each monitoring station

	Monitoring Station	Indicator Category	Requested Water Quality Analysis
1	Colorado River @ Nevada State Line	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, OC/OP pest, VOCs, trace metals, nutrients, perch, bacteria, toxicity
2	Colorado River @ Imperial Dam	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, OC/OP pest, VOCs, trace metals, nutrients, perch, bacteria, toxicity
3	Colorado River Upstream of Imperial Dam	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, OC/OP pest, VOCs, trace metals, nutrients, perch, bacteria, toxicity
4	Palo Verde Lagoon	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, OC/OP pest, VOCs, trace metals, nutrients, perch, bacteria, toxicity
5	Palo Verde Outfall Drain	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, OC/OP pest, VOCs, trace metals, nutrients, perch, bacteria, toxicity
6	Alamo River Outlet	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, toxaphene, mercury, trace metals, selenium, nutrients, ceriodaphnia toxicity, TOC, Grain Size, selenate, selenite

	Monitoring Station	Indicator Category	Requested Water Quality Analysis
7	Alamo River Drop 6A	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, trace metals, nutrients
8	Alamo River Drop 10	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, toxaphene, trace metals, TSS, selenate, selenite
9	Alamo River Drop 8	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, trace metals, nutrients
10	Alamo River Drop 6	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, trace metals, nutrients
11	Alamo River Drop 3	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, trace metals, nutrients,
12	New River Outlet	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, toxaphene, mercury, trace metals, selenium, nutrients, ceriodaphnia toxicity, TOC, Grain Size, selenate, selenite
13	New River @ International Boundary	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, toxaphene, mercury, trace metals, selenium, nutrients, ceriodaphnia toxicity, TOC, Grain Size, selenate, selenite
14	New River @ Rice Drain	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, trace metals, pharmaceuticals, selenium, VOCs, nutrients, bacteria, toxicity
15	New River @ Rice Drain #3	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, trace metals, pharmaceuticals, selenium, VOCs, nutrients, bacteria,
16	New River Drop 2	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, trace metals, pharmaceuticals, selenium, VOCs, nutrients, bacteria,
17	New River @ Evan Hewes	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	OC/OP pest, pyrethroids, trace metals, pharmaceuticals, selenium, VOCs, nutrients, bacteria,
18	Salton Sea Drain SW2	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Trace metals, nutrients, pyrethroids
19	Salton Sea Drain S1	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Trace metals, nutrients, pyrethroids
20	Salton Sea Drain S2	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Trace metals, nutrients, pyrethroids
21	Salt Creek Slough	Contaminant Exposure, Biological Response, Pollutant	Trace metals, nutrients, pyrethroids

	Monitoring Station	Indicator Category	Requested Water Quality Analysis
		Exposure, Habitat	
22	Whitewater River Upstream of Preserve	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Bacteria, Nutrients, trace metals
23	Whitewater River Downstream of Preserve	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Bacteria, Nutrients, trace metals
24	Whitewater River at Interstate 10	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Bacteria, Nutrients, trace metals
25	Coachella Valley Storm Water Channel @ Ave 52	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, surfactants, pharmaceuticals, OC/OP pest, VOCs, trace metals, nutrients, perch, bacteria, toxicity
26	Coachella Valley Storm Water Channel Outlet	Contaminant Exposure, Biological Response, Pollutant Exposure, Habitat	Pyrethroids, surfactants, pharmaceuticals, OC/OP pest, VOCs, trace metals, nutrients, perch, bacteria, toxicity

Each sampling protocol specifies the types of containers suitable for the type of sample and specific analytes being collected. Sample collection, processing, and testing will be performed according to the most recent SWAMP Quality Assurance Management Plan (QAMP):
http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/qaprp082209.pdf

Scarce data dictates that spatial characteristics within sub-watersheds be addressed during each sampling event. For example, sampling locations for a small stream may vary for each sampling event due to flow conditions. Variation in flow conditions will be addressed by measuring or obtaining the flow and concentration within the water body (where possible), and calculating a mass loading. Real-time flow data is available for the outlets of the New and Alamo Rivers, and points along the Lower Colorado River from the United State Geologic Survey (USGS).

4.2 Laboratory Analysis

Chemical, physical, and biological parameters will be measured in the field and from lab analysis of water and sediment samples. Various inorganic (e.g., nitrates, selenium) and organic chemicals (e.g., VOCs, pesticides) will be evaluated. A YSI probe will be used to measure physical parameters in the field (e.g., DO, turbidity, electrical conductivity and pH).

A contract laboratory (Babcock & Sons Inc.) will perform bacterial analyses due to the short holding times for bacteria analysis (six hours). All other laboratory work will be performed through CDFG. Analytical detection limits, Quality Assurance/Quality Control criteria, and related information are included in the QAMP.

4.3 Quality Assurance

Quality Assurance (QA) defines activities that ensure that the quality of data collected is sufficient to satisfy monitoring objectives. Quality Control (QC) activities include sample collection and protocol standardization. Quality Assurance activities are a top priority of the SWAMP Program. Considerable progress has been made since the formation of the SWAMP QA Team. The SWAMP QA Officer solicits input from the Water Boards and USEPA Region 9.

QA/QC evaluation reports and verification that data met QA criteria set forth in the QAMP will be provided to the Regional Board in hardcopy and electronic format. QA/QC should be included in each data report and the final report, with information describing how the data complied with QA/QC parameters. QA/QC procedures are provided in, and will be consistent with the State Board QAMP developed by CDFG.

Chemical data includes the analytical result, method detection limit, reporting limit, and quality assurance information on surrogate recovery, duplicate relative percent difference (RPD), matrix spike percent recovery and RPD, and blank spike percent recovery and RPD. Deviations from QA goals established in the QAMP will be noted.

4.4 Data Management

Because the region's sampling and the majority of analysis are handled through a master contract with CDFG, laboratory data, field data, and associated QA/QC will be submitted in standardized formats by CDFG and entered into the SWAMP. After it is verified, the data will be available for public access and other programs or groups in need of monitoring information, through the California Environmental Data Exchange Network (CEDEN) located online: www.ceden.org

4.5 Data Analysis and Assessment

An assessment will be made as to whether chemical concentrations in the water samples meet or exceed regional, state, and federal limits set to protect designated beneficial uses. Chemical concentrations in water are to be compared with objectives established in the Basin Plan (CRWQCB CRBR 2003), with USEPA criteria, and if applicable, California CDFG 1-hour averages and instantaneous maxima for toxicity to aquatic life criteria. If none of these types of thresholds have been established, data will be compared with other criteria such as California primary and secondary maximum contaminant levels (MCLs), Department of Health Services (DHS) action levels, and California Toxics Rule (CTR)/National Toxics Rule (NTR) criteria. Data will also be compared with USEPA criteria recommendations (USEPA 1986, 2000).

Chemical concentrations in sediment will be compared with consensus-based sediment quality guidelines (SQG) presented in MacDonald et al. (2000). Adverse effects on sediment-dwelling organisms are not expected to occur below a threshold effects concentration (TEC), and adverse effects are expected to occur frequently above a probable effects concentration (PEC) (MacDonald et al. 2000). At concentrations between a TEC and PEC, it is difficult to predict whether or not the sediments will be toxic to organisms.

Analytical data will be tabulated and described using various descriptive statistical methods and provided that the data is amendable to more than descriptive statistical test or other statistical methods (e.g. inferential statistics) may be applied. Sample size and distribution will be examined prior to application of any inferential Statistical test. Piper and stiff diagrams will be developed to graphically show the similarities and differences of the constituents at each monitoring site. Measures of central tendency (means, medians and modes) for each constituent will be determined to identify the central position within the data. Standard deviation and skewness will be calculated to describe the deviation of the distribution from the central tendency (symmetry) and help identify whether the data are normally distributed. Kurtosis will be calculated to identify whether the data are peaked or flat, relative to a normal distribution. Time series plots, and box and whisker diagrams, will be used to view the data and in comparisons between minimally disturbed sites and sites further downstream or from previous sampling events.

5. COORDINATION

5.1 COORDINATION AND REVIEW STRATEGY

The Regional Board coordinates with the State Board and the Department of Fish and Game to develop SWAMP task orders and work plans. The following table describes the tasks associated with implementing SWAMP in the Region, and each organization's responsibilities (Table 4). The Regional Board requires any contracted agency to provide a QAPP to ensure that samples are collected and analyzed according to SWAMP standards.

Table 4. SWAMP tasks and responsible organizations (SWRCB, 2000).

Task	**Responsible Organization**		
	SWRCB	**RWQCB**	**CDFG**
Develop contract(s) for monitoring services	•	•	•
Identify water bodies or sites of concern and clean sites to be monitored; Identify site-specific locations with potential beneficial use impacts or non-impacted conditions that will be monitored; Select monitoring objective(s) based on potential beneficial use impact(s) or need to identify baseline conditions; Identify already-completed monitoring and research efforts focused on potential problems, monitoring objective, or clean conditions; Make decision on adequacy of available information		•	
Prepare site-specific study design based on monitoring objectives, the assessment of available information, sampling design, and indicators	• (Work Plan Review Role)	•	•

Task	Responsible Organization		
	SWRCB	RWQCB	CDFG
Implement study design (Collect and analyze samples)		• (Bacteria Analysis)	•
Track study progress, review quality assurance information, make assessments on data quality, adapt study as needed	• (Review Role)	•	•
Report data through SWRCB web site	•	• (Coordination Role)	•
Prepare written reports of data	•	•	•

6. REPORTS

6.1 Reporting Products

The following is a list of deliverable products:

- Data reports for each sampling event to the Data Management Team (DMT) for loading onto the SWAMP Database.
- Field or cruise reports by the contractor to RWQCB
- Annual data assessment reports

6.2 Project Schedule

Scheduled milestones are listed in Table 5.

Table 5. Scheduled Milestones

Milestone	Scheduled Completion Date
May Sampling 2013	
Colorado River Sampling Event	June 30, 2013
Alamo River Sampling Event	June 30, 2013
New River Sampling Event	June 30, 2013
Salton Sea Sampling Event	June 30, 2013
Whitewater River Sampling Event	June 30, 2013
Data Reports	
Colorado River Data Report	December 30, 2013
Alamo River Data Report	December 30, 2013
New River Data Report	December 30, 2013
Salton Sea Data Report	December 30, 2013
Whitewater River Data Report	December 30, 2013
October Sampling 2013	
Colorado River Sampling Event	November 30, 2013
Alamo River Sampling Event	November 30, 2013
New River Sampling Event	November 30, 2013
Salton Sea Sampling Event	November 30, 2013
Whitewater River Sampling Event	November 30, 2013
Data Reports	
Colorado River Data Report	December 30, 2013
Alamo River Data Report	December 30, 2013
New River Data Report	December 30, 2013
Salton Sea Data Report	December 30, 2013

Whitewater River Data Report	December 30, 2013
FY 11-12 Data Assessment Report	
Draft Data Assessment Report	March 30, 2014
Final Data Assessment Report	March 30, 2014

6.3 ANNUAL ASSESSMENT REPORTS

Region 7 SWAMP staff has selected a suitable independent contractor, Mark Roberson, who will evaluate the collected data and produce a summary technical report, known more commonly as the Annual Assessment Report. The report is intended to interpret the monitoring data and make recommendations for future monitoring. Mr. Roberson is very familiar with the geography, history, and SWAMP operations within the region. Staff plans to have the assessment report completed by March 30, 2014. Past Reports can be found on the internet and are accessible to the public: http://www.waterboards.ca.gov/water_issues/programs/swamp/regionalreports.shtml#rb7

The State has committed to producing timely and complete water quality reports and lists called for under Sections 305(b) and 303(d) (Integrated Report) of the Clean Water Act and Section 406 of the Beaches Act. Data collected through SWAMP and annual assessment reports prepared with SWAMP data will assist with the preparation of the States Integrated Report.

7. CITATIONS

Bernstein, B. B. , B. E. Thompson and R. W. Smith. 1993. A combined science and management framework for developing regional monitoring objectives. Coastal Management 21:185-195.

Brodberg, R. K., and G. A. Pollock. 1999. Prevalence of selected target chemical contaminants in sport fishing from two California lakes: public health designed screening study. California Environmental Protection Agency. Sacramento, CA.

California Aquatic Bio assessment Workgroup. 1998. Biological Monitoring in California: Priorities of 1999-2000.

California Department of Fish and Game. 1998. Status of bio assessment in California and the development of a State-wide bio assessment program. Prepared by the Aquatic Biological Assessment Laboratory.

Cal/EPA. 1998. Coastal Water Quality Monitoring: A Strategy for Comprehensive Coastal Monitoring in California. 12 pp.

California Regional Water Quality Control Board, Colorado River Basin Region. 2001a. Sedimentation/Siltation Total Maximum Daily Load for the Alamo River. California Regional Water Quality Control Board, Colorado River Basin Region, Palm Desert, CA

California Regional Water Quality Control Board, Colorado River Basin Region. 2001b. Pathogen Total Maximum Daily Load For the New River and Implementation Plan. California Regional Water Quality Control Board, Colorado River Basin Region, Palm Desert, CA.

California Regional Water Quality Control Board, Colorado River Basin Region. 2002. Sedimentation/Siltation Total Maximum Daily Load for the New River and Implementation Plan. California Regional Water Quality Control Board, Colorado River Basin Region, Palm Desert, CA.

California Regional Water Quality Control Board, Colorado River Basin Region. 2003. Water Quality Control Plan for the Colorado River Basin-Region 7. California Regional Water Quality Control Board, Colorado River Basin Region, Palm Desert, CA.

California Regional Water Quality Control Board, Colorado River Basin Region. 2004. Watershed Management Initiative Strategic Planning Chapter. Updated October 2004.

California Regional Water Quality Control Board, Colorado River Basin Region. 2005. Sedimentation/Siltation TMDL for the Imperial Valley Drains: Niland 2, P, and Pumice Drains and Implementation Plan California Regional Water Quality Control Board, Colorado River Basin Region, Palm Desert, CA.

LeBlanc, L.A., Orlando, J.L., and Kuivila, K.M., 2004, Pesticide concentrations in water and in suspended and bottom sediments in the New and Alamo Rivers, Salton Sea watershed, California, April 2003: U.S. Geological Survey Data Series 104, 15 p.

MacDonald, D. D., C. G. Ingersoll, and T. A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Archives of Environmental Contamination and Toxicology 39: 20-31.

Noble, R.T., J.H. Dorsey, M.K. Leecaster, M. Mazur, C.D. McGee, D. Moore, V. Orozco-Borbon, D. Reid, K. Schiff, P.M. Vainik, and S.B. Weisberg. 1999. Appendix C. Comparison of Bacterial Indicator Measurements Among Southern California Marine Monitoring Laboratories. In: Southern California Bight 1998 Regional Monitoring Program: I. Summer Shoreline Microbiology. Southern California Coastal Water Research Project. Westminster, CA.

Scientific Planning and Review Committee. 1997. Recommendations on the Bay Protection and Toxic Cleanup Program monitoring activities. 23 pp. + 2 appendices.

Sibbald, Glenn F. 2003. Initial Bio assessments of Benthic Macro invertebrate Communities At Newly Established Monitoring Sites on Five Tributaries to the Salton Sea: Alamo River, New River, Salt Creek, San Felipe Creek, and Whitewater River. Aquatic Bio assessment Laboratory, Water Pollution Control Laboratory, California Department of Fish and Game. Final Report prepared for The State Water Resources Control Board. 22 pp + 6 Appendices.

Southern California Coastal Water Research Project. 2006. Review of California’s Surface Water Ambient Monitoring Program (SWAMP). Report prepared for the Scientific Planning and Review Committee. 22 pp. + 2 appendices.

Southern California Coastal Water Research Project. 1998a. Southern California Bight 1998 Regional Monitoring Survey (Bight’98) Coastal Ecology Work plan. Prepared by the Bight’98 Steering Committee. 67 pp.

SWRCB. 1993. Staff Report: The Status of the Bay Protection and Toxic Cleanup Program. Sacramento, CA. 231 pp + 5 Appendices.

State Water Resources Control Board, 2000. Report to the Legislature, Proposal for a comprehensive ambient surface water quality monitoring program. State Water Board, Sacramento, CA.

State Water Resources Control Board, 2005. Comprehensive Monitoring and Assessment Strategy to Protect and Restore California’s Water Quality. State Water Board, Sacramento, CA. 62 pp + 6 Appendices.

Stephenson, M., M. Puckett, N. Morgan, and M. Reid. 1994. Bay Protection and Toxic Cleanup Program: Quality Assurance Project Plan. Bay Protection and Toxic Cleanup Program, State Water Resources Control Board, Sacramento, CA.

U.S. Environmental Protection Agency (USEPA). 1986. Quality Criteria for Water. EPA 440/5-96-001. Office of Water, Regulations and Standards. Washington, D.C.

USEPA. 2000. Ambient water quality criteria recommendations. Information supporting the development of state and tribal nutrient criteria for rivers and streams in nutrient Eco region III. EPA-822-B-00-016. Office of Water, Office of Science and Technology. Washington, D.C.