Surface Water Ambient Monitoring Program

Site-Specific Monitoring Workplan FY 2003-2004
Central Coast Regional Water Quality Control Board

Five Year Plan

Introduction

Fiscal Year (FY) 2003-04 will mark the third year of the coordinated implementation of the Surface Water Ambient Monitoring Program (SWAMP). The "site-specific" monitoring efforts described as one component of SWAMP is presented in Section VI of the report to the Legislature titled "Proposal for a comprehensive ambient surface water quality monitoring program." This workplan is intended to address that component of the SWAMP program. A description of the monitoring efforts that will be implemented through the Central Coast Ambient Monitoring Program (CCAMP) is described in this document.

State Board guidance intended that this portion of SWAMP be targeted at specific locations in each region but provides the RWQCBs significant flexibility in this site selection effort. The RWQCBs, at their discretion, may perform monitoring at clean sites to determine baseline conditions or in areas suspected or known to be polluted. CCAMP has already completed a five-year rotation and 23 months of coastal confluences monitoring (April 2001 – March 2003). Figure 1 shows the watershed rotation area schedule. Beginning March 2004 monitoring will resume at coastal confluence sites. This study design will follow that of previous years, where long-term "ambient" monitoring sites are again sampled at the lower end of major creeks and rivers throughout the region. Monitoring sites are located upstream of each waterbody's confluence with the ocean or coastal lagoon. Watershed rotation monitoring will resume the following January (2005) in the Pajaro watershed rotation area and continue with annual rotation monitoring in each of the five watershed rotation areas (Figure 1). Ambient site selection is not based on suppositions regarding water quality, but rather on hydrogeomorphology, site access and flow conditions. Focused monitoring sites are selected using a number of different criteria, including watershed size, land use patterns, known problem areas, etc.

Goals and Objectives

The CCAMP mission statement is to collect, assess and disseminate water quality information to aide decision makers and the public in maintaining, restoring and enhancing water quality and associated beneficial uses in the Central Coast Region. The CCAMP monitoring strategy calls for dividing the Region into five watershed rotation areas and conducting synoptic, tributary based sampling each year in one of the areas. Over a five-year period all of the Hydrologic Units in the Region are monitored and evaluated. In addition to the synoptic site selection approach, 31 of the Regions coastal creeks and rivers are monitored continuously just upstream of their confluence with the Pacific Ocean.

The CCAMP strategy of establishing and maintaining permanent long term monitoring sites provides a framework for trend analysis and detection of emergent water quality problems. CCAMP uses a variety of monitoring approaches to characterize status and trends of coastal watersheds, as well as acquisition of basic GIS data layers, where available, describing land use, geology, soils, discharge

locations, known problem sites, etc. Monitoring data collected by CCAMP for watershed assessment includes the following: Conventional water quality analysis, benthic invertebrate community assemblage, analysis of tissue, water, and sediment for organic chemicals and metals, toxicity evaluations, and habitat assessments

In order to develop a broad picture of the overall health of waters in Region 3, a similar baseline monitoring study design is applied in each watershed and coastal confluence site. This provides compatibility across the Region and allows for prioritization of problems across a relatively large spatial scale. However, it is important that each watershed analysis incorporate additional, watershed specific knowledge into the study design, so that questions which are narrower in focus can also be addressed. For example, in watersheds where Total Maximum Daily Load assessments are being undertaken, other program funds can be applied to support additional monitoring for TMDL development. Special studies are undertaken as funding and staffing permits to further focus monitoring on questions of interest specific in individual watersheds.

Watershed characterization involves three major components: acquisition and evaluation of existing data, monitoring of surface water and habitat quality, and developing a watershed assessment based on findings.

Evaluation of existing sources of data
Existing sources of data are evaluated for pollutants of concern, historic trends, data gaps, etc. These include Department of Health Services, USGS, Department of Fish and Game, Department of Pesticide Regulation, Toxic Substances Monitoring Program, STORET, NPDES discharge data, and other sources. Data from County, City, and other selected programs are also acquired. Selected data is compiled into the CCAMP data base format and used along with data collected by CCAMP to evaluate standard exceedances, pollutant levels which warrant attention, beneficial use impairment, and other pertinent information.

Monitoring approaches
Table 1 indicates the relationship between monitoring types and beneficial uses recognized in the Central Coast Basin Plan. Monitoring approaches currently employed by CCAMP are shown in bold. Though the program will become more comprehensive as additional monitoring approaches are added, the current suite of monitoring activities address all beneficial uses to some degree. Virtually all major rivers and streams and their immediate tributaries in Region 3 are designated for cold water fisheries, commercial and sport fishing, contact and non-contact recreation, groundwater recharge, municipal and domestic supply, spawning, and migration beneficial uses. Many also support threatened and endangered species and biological habitats of special significance. Because these important beneficial uses tend to be universal in the Region and require most stringent water quality objectives, the CCAMP suite of indicators targets these beneficial uses particularly, and is intended to be applied uniformly to all sites.

Table 1. Relationship between beneficial uses in Region 3 and monitoring activities; Xs identify monitoring approaches currently employed by CCAMP.

	CWQ	Sed Chemistry	H2O Chemistry	Tissue Chemistry	Rapid Bioassessment	Toxicity	Geomorphology	Habitat	Remote Sensing	Flow	Sedimentation
Municipal & Domestic	X		+	X					+	X	
Estuarine Habitat	X	X	+	X	X	X	+	+	+	X	+
Marine Habitat	X	X	+	X	X	X	+	+	+		+
Wildlife Habitat	X	X	+	X	X	X	+	+	+	X	+
Biological Habitat of Special Significance	X	X	+	X	X	X	+	+	+	X	+
Rare & Endangered Species	X	X	+	X	X	X	+	+	+	X	+
Fish Migration	X	X	+	X	X	X	+	+	+	X	+
Fish Spawning	X	X	+	X	X	X	+	+	+	X	+
Shellfishing	X			X							
ASBS	X	X	+	X	X	X	+	+	+	X	+
Agricultural Supply	X	X	+							X	
Industrial Process Supply	X		+								
Industrial Service Supply	X								+		+
Groundwater Recharge	X		+				+		+	X	
Fresh Water Replenishment	X		+				+		+	X	
Navigation	X	X				X	+		+	X	+
Hydroelectric Power Generation	X						+		+	X	
Water Contact Recreation	X										
NonContact Recreation	X										
Commercial and Sport Fishing	X	X	+	X	X	X	+	+	+	X	
Aquaculture	X	X	+	X		X					
Warm Water Habitat	X	X	+	X	X	X	+	+	+	X	+
Coldwater Habitat	X	X	+	X	X	X	+	+	+	X	+

Methods to Achieve Objectives

The CCAMP program design includes monthly monitoring for conventional water quality (CWQ) at all sites. At a subset of sites, generally selected based on hydrogeomorphological considerations or special interest, other monitoring approaches are applied. These include sediment chemistry and toxicity, tissue chemistry, benthic macroinvertebrate assessment, habitat assessment and flow measurement. Other approaches which have not yet been applied but which will be included as funding increases include water column chemistry, sedimentation assessment, habitat assessment, geomorphology and remote sensing.

The following objectives address questions posed in the SWAMP Site-Specific Monitoring Guidance related to beneficial use support. Monitoring activities which address these objectives are indicated in Table 1 and more specific data types or indicators are identified in Table 2.

Table 2. Program objectives and monitoring activities that can address them.

SWAMP Question	CWQ	SedChem	H2OChem	Tissue Chem	Rapid Bioassessment	Toxicity	Geomorphology	Habitat	Remote Sensing	Flow	Sedimentation
Safe to Swim	X										
Safe to Drink	X		+								
Safe to Eat Fish	X			X							
Aq. Pops Protected	X	X	+	X	X	X	+	X	+	X	+
Spawning	X	X	+		X	X	+	+		+	+
Flow	X				X		+	+		X	+
Ag Use	X										
Industrial Supply	X		+								
Non Contact Rec	X							+			

Is it safe to swim?
Beneficial Use: Water Contact Recreation (REC-1)
Monitoring Approach: Monthly monitoring for indicator organisms (E. coli, total and fecal coliforms) ; compilation of other data sources
Objective(s): At sites throughout water bodies that are used for swimming, or that drain to areas used for swimming, screen for indications of bacterial contamination by determining percent of samples exceeding adopted water quality objectives. CCAMP data as well as data collected by local agencies and organizations will be used to assess shoreline and creek conditions.

Is it safe to drink the water?
Beneficial Use: Municipal and Domestic Water Supply (MUN)
Monitoring Approach: Monthly sampling for nutrients and minerals
Objective(s): At sites throughout water bodies that are sources of drinking water, determine percent of samples having microbial or chemical contaminants that exceed drinking water standards or adopted water quality objectives used to protect drinking water quality.

Is it safe to eat fish and other aquatic resources?
Beneficial Uses: Commercial and Sport Fishing (COMM), Shellfish Harvesting (SHELL)
Monitoring Approach: Annual fish and mussel tissue collection and chemical analysis
Objective(s): At sites located near the lower ends of streams and rivers, and in lakes, enclosed bays and estuaries, screen for chemical pollutants by determining the concentration of chemical contaminants in fish and shellfish samples, and assessing whether samples exceed several critical threshold values of potential human impact (advisory or action levels).

Are aquatic populations, communities, habitats and anadromous fisheries protected?

Beneficial Uses: Cold Freshwater Habitat (COLD); Preservation of Biological Habitats (BIOL); Warm Freshwater Habitat (WARM); Wildlife Habitat (WILD); Rare and Endangered Species (RARE); Spawning (SPAWN)
Monitoring Approach: Synoptic sampling for sediment and water column toxicity, sediment chemistry, benthic invertebrate assemblages and conventional water quality monitoring for dissolved oxygen, pH, turbidity and water temperature. Pre-dawn sampling for dissolved oxygen sags. Toxicity Identification Evaluation and/or chemistry follow-through for toxic sites.
Objective(s): At sites along the mainstem and at the lower ends of major tributaries of streams and rivers, screen for indications of water quality and sediment degradation for aquatic life and related uses, using several critical threshold values of toxicity, benthic community analysis, habitat condition, and physical and chemical condition.

Is water safe for agricultural use?
Beneficial Use: Agricultural supply (AGR)
Monitoring Approach: Monthly sampling for nutrients, salts and total dissolved solids
Objective(s): At sites throughout waterbodies that are used for agricultural purposes, determine percent of samples with concentrations of chemical pollutants above screening values or adopted water quality objectives used to protect agricultural uses.

Are aesthetic and other non-contact recreational uses of the water protected?
Beneficial Use: Non-Contact Water Recreation (REC-2)
Monitoring Approach: Monthly sampling for pathogen indicator organisms (E. coli, total and fecal coliforms); monthly qualitative assessment of % algal cover, presence of scum, odor, etc.
Objective(s): At sites throughout waterbodies that are used for non-contact recreation, screen for indications of bacterial contamination by determining the percent of samples exceeding adopted water quality objectives and assess aesthetic condition for protection of non-contact water recreation, based on monthly samples collected over a year period in 5-year intervals.

Deliverables
A schedule of monitoring plan deliverables is provided in Table 3. Annual workplans and annual reports will follow SWAMP specified formats.

Table 3. Monitoring schedule and deliverables.

Task Deliverable	Time line / due date	Task completed
FY 03-04 Site specific workplan	January 2004	Yes
FY 01-02 and 02-03 annual report	April 2004	In progress
FY 03-04 DFG master contract work order	March 2004	Yes
Harbors study annual report	April 2005	
FY 04-05 Site specific workplan	March 2004	
FY 04-05 DFG master contract work order	May 2004	
Coastal confluences annual report	August 2005	
FY 05-06 Site specific workplan	March 2005	
FY 05-06 DFG master contract work order	May 2005	
Pajaro and North Coast rotation area annual report	August 2006	
FY 06-07 Site specific workplan	March 2006	

FY 06-07 DFG master contract work order	May 2006	
Salinas watershed rotation area annual report	August 2007	
FY 07-08 Site specific workplan	March 2007	
FY 07-08 DFG master contract work order	May 2007	
Santa Maria watershed rotation area annual report	August 2008	
FY 08-09 Site specific workplan	March 2008	
FY 08-09 DFR master contract work order	May 2008	
South Coast watershed rotation area annual report	August 2009	
FY 09-10 Site specific workplan	March 2010	
FY 09-10 DFG master contract work order	May 2010	
Santa Lucia watershed rotation area annual report	August 2011	

Completion Matrix

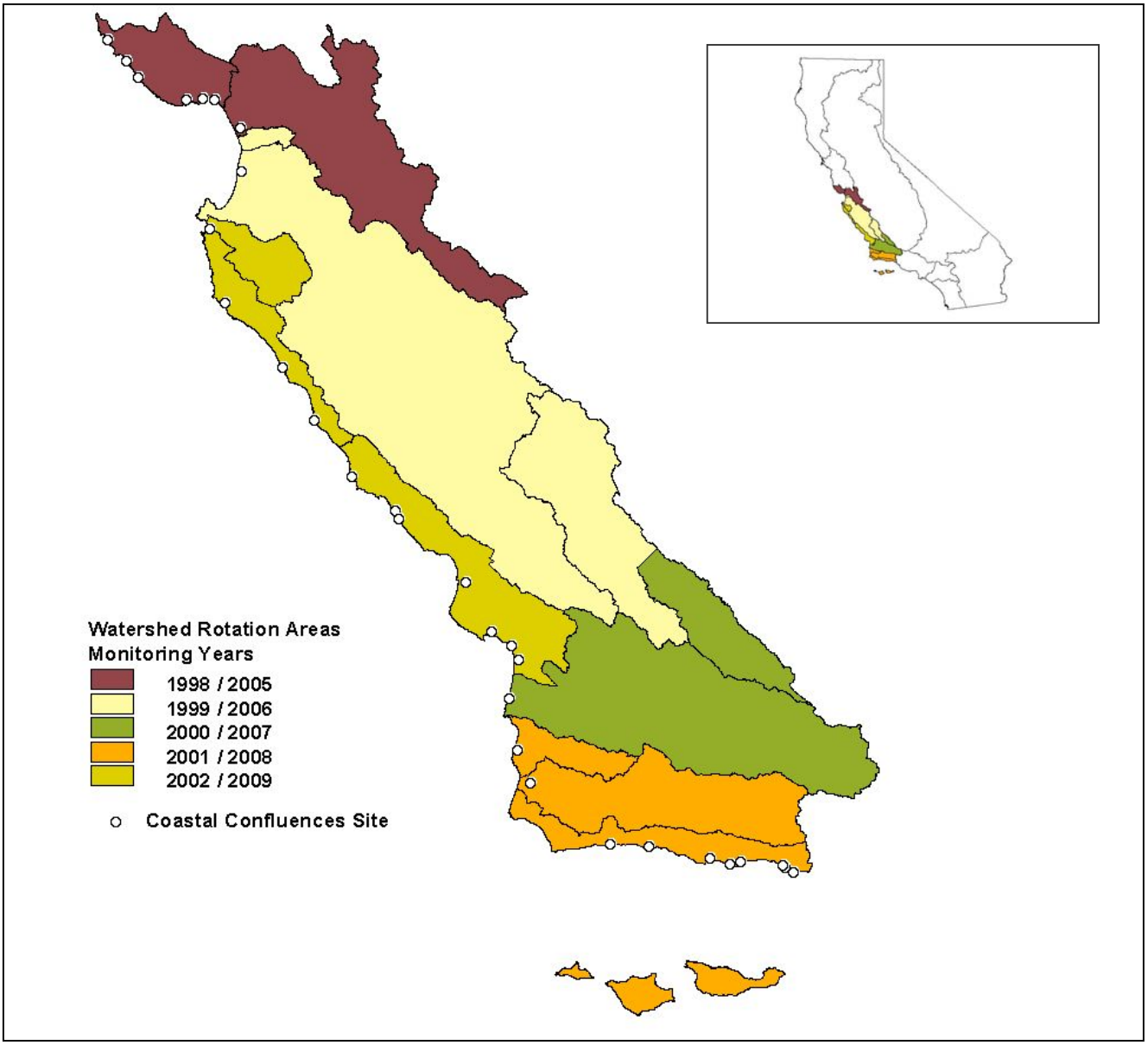
Help with format is coming from SWRCB

Annual Plan

Introduction

Coastal confluences monitoring will resume March 2004, adding to the 2-year data set that has already been established at sites on 31 coastal creeks in Region 3. Coastal confluence sites are located in the lowest reaches of the watershed above the confluence with the ocean or coastal lagoon. The coastal confluences component of the CCAMP study design provides ongoing monitoring at the lower end of major water bodies in our region and can provide information on trends in water quality, detect emerging problems upstream and provide indications of possible impacts to the nearshore environment. Maintenance of these long-term trend monitoring sites compliments annual watershed rotational monitoring. Figure 1 shows the spatial representation of coastal confluence sites in relation to the five watershed rotation areas. CCAMP uses a variety of monitoring approaches to characterize status and trends at coastal confluence sites, including: Conventional water quality analysis, benthic macroinvertebrate community assemblages, tissue chemistry, sediment chemistry, toxicity evaluations, and habitat assessments. These data provide information at a level of detail suitable for assessment reporting requirements, including Clean Water Act 305(b) and 303(d), and for supporting various statewide programs and initiatives (e.g. Nonpoint Source Program, Watershed Management Initiative).

Figure 1. Coastal confluence sites and watershed rotation areas in Region 3



Methods to achieve objectives

Site Selection – The 31 watersheds sampled through the coastal confluences program were selected based on watershed size, geomorphology and/or known water quality concerns in the watershed. Sampling sites are located at the lowest reach of the watershed but above the coastal lagoon and tidal influence when ever possible. Site selection is constrained by site accessibility. Safe, all-weather access sites are located preferably at bridges where sampling devices can be suspended during periods of high flow. Benthic invertebrates are collected upstream of conventional water quality sites, out of the immediate influence of bridges. Other sampling activities are conducted at conventional water quality sites.

Conventional Water Quality – The Central Coast Basin Plan has identified several numeric objectives for conventional pollutants. Basic conventional pollutants are monitored monthly at all coastal confluence sites. Monthly sampling provides an opportunity to evaluate seasonal variability as well as a variety of flow conditions. This program is not designed to be a storm event-monitoring program. Sampling is maintained on an even monthly interval without regard for timing of weather events. Even interval sampling permits use of certain time-series analysis techniques, such as the Mann-Kendall or seasonal Kendall tests described by the U.S. EPA National Monitoring Program (EPA 1997).

CCAMP uses a multi-analyte probe to measure several parameters in the field, and collects grab samples to be analyzed by the Regional Board's contract laboratory. A Hydrolab DS4a multianalyte probe is used to collect data for dissolved oxygen, pH, water temperature, turbidity, conductivity, salinity and chlorophyll *a*. Observations of air temperature, algal growth, scum, odor, and other indications of water and habitat conditions are also recorded. Flow is estimated using a number of means. Wherever possible, sites are located near existing county and USGS gages. Stream profiles and flow calibration curves are used elsewhere. In some locations flow measurements are not possible.

Samples to be analyzed by the Regional Board's contract laboratory are collected at each site in clean bottles provided by the contract laboratory. Water samples are bottled as appropriate and held at $4^{o}C$, before being transferred to a commercial laboratory for analysis. Chain-of-Custody documentation is maintained for all samples. Samples are analyzed for nutrients, dissolved solids, suspended solids, salts and coliforms. Quality assurance procedures at the laboratory are consistent with SWAMP approved quality assurance requirements and follow U.S. EPA approved methods (BC Laboratories, 1998). See the SWAMP QAPP target reporting limits and analytical methods for more information on specific analyses.

Benthic Macroinvertebrate Sampling - Benthic macroinvertebrate assemblages are indicators of stream health. Different species of invertebrates respond differently to water pollution and habitat degradation and provide information on biological integrity. Benthic macroinvertebrate community assemblages will be sampled at 28 of the coastal confluence sites. Benthic macroinvertebrates are not collected at 3 sites that have lagoon-like habitat characteristics in the spring.

Benthic macroinvertebrate communities are sampled using California Rapid Bioassessment Protocols and quality assurance guidance for non-point source assessments (Harrington, 2003). Benthic invertebrates are collected in spring at selected sites. Three riffle locations are selected randomly

from within stream reaches associated with water and sediment sampling. When stream morphology limits riffle habitat, a low gradient protocol is adopted which includes sampling of stream margins. The creek reach of interest is characterized according to geomorphic parameters, including bankful width, slope, drainage area, upstream river miles, particle size and other features. Geomorphic characteristics are considered during data evaluation.

Physical habitat quality is assessed at each sampling reach according to state protocols, using the habitat assessment scoring methods developed by the California Aquatic Bioassessment Laboratory (CABL). This assessment is qualitative in nature and can be subjective. Therefore, field crews intercalibrate their assessments with CABL staff prior to conducting field work.

Sediment Chemistry and Toxicity– Some organic chemicals are found adhered to fine sediments; metals can also be found at elevated concentrations in sediment. Organic chemicals and metals may also bioaccumulate in the tissues of aquatic organisms and at elevated concentrations can be directly toxic. The Central Coast Basin Plan has a narrative objective for pollutants in sediment, and therefore we utilize several peer-reviewed criteria to evaluate sediment data for probable effects, including: NOAA Effects Range Medium values (ERMs) and Florida Probable Effects Levels (PELs). Sediment samples are analyzed by Department of Fish and Game laboratories at Rancho Cordova and Moss Landing, and on occasion by our contracted private laboratory. Laboratory analysis includes polyaromatic hydrocarbons, organochlorine and organophosphate chemicals, metals, particle size distribution, and total organic carbon. See the SWAMP QAPP for more information on QAQC procedures (Puckett 2002).

Sediment samples for chemistry and toxicity analysis are collected at each site by CDFG staff, and sampling targets fine grain sediments. Precleaned Teflon™ scoops are used to collect the top 2 cm of sediment from five or more locations at each site. The scooped samples are collected in a precleaned glass composite jar. The sample is subsequently homogenized thoroughly and aliquoted into precleaned sample jars (as appropriate) for chemical or toxicological analysis. Samples are then stored at 4°C and shipped with appropriate COC and handling procedures to the analytical laboratories. See bed sediment procedures in the SWAMP QAPP for more detail on sediment sampling (Puckett 2002).

Ten-day sediment toxicity testing is performed at the UC Davis – Granite Canyon Marine Pollution Control Laboratory using *Hyalella azteca* according to standard EPA protocols (EPA 2000). For each sediment sample, eight replicates each containing 10 *H. azteca* individuals are tested. Endpoints recorded after ten days are survival and growth (as dry weight). See the Granite Canyon QAQC and SOP contained in the SWAMP QAPP for more information on these analyses (Puckett 2002).

Site-specific monitoring activities

Planned sampling includes funding from several sources other than SWAMP, including the CCAMP Guadalupe Endowment and State Mussel Watch Endowment. Several special projects are anticipated, which will be funded through other sources and are not described in detail in this work plan. For example, CCAMP is supporting work by the California Department of Fish and Game to analyze sea otter tissues for bioaccumulated chemicals; data will be used to determine if there are associations between high tissue burdens of chemicals and impaired immune function and increased rates of mortality from disease. We have also provided CDFG and U.C. Davis funding to sample

mussels and other invertebrates for specific pathogens known to be of concern for sea otter health. This work will help us understand mechanisms and sources of infection in several geographic areas of concern.

Table 4. Monitoring activites at coastal confluence sites to be sampled during FY 2003-04.

Site description	CWQ	BMI	SED CHEM	SED TOX
304SCO-Scott Creek lagoon	X		X	X
304WAD-Waddell Creek lagoon	X		X	X
304LOR-San Lorenzo Estuary	X		X	X
304APT-Aptos Creek lagoon	X	X	X	X
304SOQ-Soquel Creek lagoon	X		X	X
304GAZ-Gazos Creek Lagoon	X	X	X	X
305PJP-Pajaro River @ Main Street	X	X	X	X
307CML-Carmel River @ Highway 1	X	X	X	X
308BGC-Big Creek @ Highway 1	X	X	X	X
308BSR-Big Sur River @ Andrew Molera	X	X	X	X
308WLO-Willow Creek @ Highway 1	X	X	X	X
309OLD-Old Salinas River @ Monterey Dunes Way	X		X	X
309DAV-Salinas River @ Davis Road	X	X	X	X
309TDW-Tembladero Slough @ Monterey Dunes Way	X		X	X
310ADC-Arroyo de la Cruz @ Highway 1	X	X	X	X
310SSC-San Simeon Creek @ State Park foot bridge	X	X	X	X
310SRO-Santa Rosa Creek @ Moonstone Drive	X	X	X	X
310TWB-Chorro Creek @ South Bay Boulevard	X	X	X	X
310SLB-San Luis Obispo Creek @ San Luis Bay Drive	X	X	X	X
310PIS-Pismo Creek above Highway 101	X	X	X	X
310ARG-Arroyo Grande Creek @ 22nd Street	X	X	X	X
312SMA-Santa Maria River @ Estuary	X	X	X	X
313SAC-San Antonio Creek @ Rail Road Bridge, u/s lagoon	X		X	X
314SYN-Santa Ynez River @ 13th Street	X	X	X	X
315GAV-Canada de la Gaviota @ State Park entrance	X	X	X	X
315ATA-Atascadero Creek @ Ward Drive	X	X	X	X
315ABU-Arroyo Burro Creek @ Cliff Drive	X	X	X	X
315MIS-Mission Creek @ Montecito Street	X	X	X	X
315CRP-Carpinteria Creek @ 6th Street	X	X	X	X
315FRC-Franklin Creek @ Carpenteria Avenue	X	X	X	X
315RIN-Rincon Creek @ Bates Road, u/s Highway 101	X	x	X	X

Coastal Confluence Site Characterizations

Following are brief characterizations of watersheds monitored as part of the Coastal Confluences strategy. Characterizations include location of the watershed, size in acres, major land use categories that can affect water quality, known water quality impairments and 303(d) listings.

Each characterization also contains a summary of known information about water quality in the watershed, including available data collected in the watershed by various researchers, agencies, and organizations, past CCAMP data, and data collected in coordination with the Department of Fish and Game (DFG) State Mussel Watch Program (SMW), Toxic Substances Monitoring Program (TSM) and Bay Protection and Toxic Clean Up Program (BPTCP).

Water and sediment chemistry data are discussed in terms of exceedance of specific criteria. Table 5 lists the criteria referred to in the text. Typically, there are multiple samples collected for conventional water quality at a given site. However, for sediment chemistry and toxicity samples there are usually fewer than 4 total samples at a given site. When discussing data for conventional parameters, we use the term elevated levels when more than 10% of total samples exceed a numeric criteria.. For all other types of chemistry monitoring, the term elevated levels is used if there are any exceedances of numeric or narrative criteria,. Benthic macroinvertebrate (BMI) data is analyzed using a multi-metric biological index. This index is a relative ranking of all sites for which CCAMP has collected BMI data. CCAMP has categorized Index values above the 75^{th} percentile as good, between the 25^{th} and 75^{th} percentile as fair and below the 25^{th} percentile as poor. .

Table 5.Water quality criteria used to evaluate existing data for the watersheds monitored as part of the Coastal Confluences program.

Parameter	**Numeric Criteria**	**Criteria Reference**
Water Criteria		
Nitrate	10 mg/L NO3 as N	Basin Plan objective - Municipal and domestic supply
Dissolved Oxygen	7.0 mg/L	Basin Plan objective - Cold water fish habitat
OrthoPhosphate	0.1 mg/L OPO4 as P	EPA recommended 303(d) listing criteria
Fecal Coliform	400 MPN/100 mL	Basin Plan objective - Contact recreation
Glyphosphate	0.07 mg/L	Basin Plan objective Municipal and domestic supply
Chlorpyrifos	$8.3x10^{-5}$ mg/L	EPA recommended criteria. Criteria maximum concentration (EPA CMC)
Diazinon	$0.9x10^{-8}$ mg/L	EPA CMC
Malathion	0.0001 mg/L	EPA Criterion continuous concentration (CCC) and Goldbook chronic level
Sediment Criteria		
DDT	46.1 ng/g	NOAA Effects Range-Median
Dieldrin	8.0 ng/g	NOAA Effects Range-Median
Cadmium	9.6 mg/kg	NOAA Effects Range-Median
Chromium	370 mg/kg	NOAA Effects Range-Median
Mercury	0.7 mg/kg	NOAA Effects Range-Median

Nickel	51.6 mg/kg	NOAA Effects Range-Median
Tissue Criteria		
DDT	1,000 ug/kg	National Academy of Sciences Recommended guideline for shellfish
Dieldrin	300 ug/kg	U.S. Food and Drug Administration Action level for Freshwater and shellfish
Cadmium	1.0 ug/kg	Median International Standard (MIS) For shellfish
Chromium	1.0 ug/kg	MIS For shellfish
Mercury	0.5 ug/kg	MIS For shellfish
Selenium	0.3 ug/kg	MIS For shellfish

Gazos Creek

Gazos Creek is located in southern San Benito County and is the northernmost coastal watershed in the Region, flowing to the ocean at Gazos State Beach. The watershed is approximately 7475 acres in size with the largest tributary being Old Woman's Creek. The coastal confluence site is located upstream of the Highway 1 bridge. The majority of the watershed is steep and heavily forested while the lower watershed is rolling foothills and floodplain. Timber harvesting has been the primary land use in the upland forested areas of the watershed since the 1870's. In the lower elevations and in the floodplain, agriculture, grazing and rural residential land uses are common. Erosion, both from natural and anthropogenic causes, is widespread in this watershed (Conrad 2002).

Gazos Creek and its tributaries are habitat to coho salmon and steelhead. Major issues in the watershed include sedimentation, water diversions, migration barriers and loss of riparian habitat. Coho abundance data for Gazos Creek show missing or weak year classes due to a combination of rigid life history (3 year life cycle) and loss of spawning reds due to fine sediments filling in pools and gravel habitats during storm flows in 1992, 1995, 1998 and 1999 (Smith 2003). CCAMP data collected between April 2001 and March 2003 show elevated turbidity in association with winter flows, however summer low flows have low turbidity (below 10 NTUs). Data also shows a single depressed dissolved oxygen measurement collected during pre-dawn monitoring. Benthic invertebrate community assemblage data from this site indicate that relative to all other monitoring sites in the Region this site has relatively poor biological integrity.

Waddell Creek

Waddell Creek is located in Northern Santa Cruz County and to some extent in southern San Mateo County. Waddell Creek flows from steep heavily forested areas of the Santa Cruz mountains to the ocean at Waddell Beach. There are two subwatersheds; the West Waddell Creek subwatershed including Berry Creek, and the East Waddell Creek subwatershed, which is further divided into Opal and Blooms creeks. The majority of the watershed is within Big Basin Redwoods State Park. The major land uses in the watershed are recreation, and outside the park rural residential. The Park's wastewater treatment plant, which discharges to East Waddell Creek, has had a history of chronic

violations of water quality criteria. This creek is currently on the 303(d) list because of nutrient impairment and is the focus of TMDL assessment at this time. This creek supports both coho salmon and steelhead.

The CCAMP coastal confluence site is located at the Highway 1 bridge, inside the lagoon except in extremely high flow situations. CCAMP water quality data does not show a nutrient impairment in the lagoon nor does it show eutrophication (as measured by algal cover, chlorophyll a and range of dissolved oxygen measurements). Fecal coliform was elevated in 20% of all CCAMP samples; however, this is not reflected in the beach water quality monitoring conduced by the county. The Heal the Bay report card shows no water quality exceedances at the Waddell Creek beach in 2002 or 2003 (Heal the Bay web site).

Scott Creek

Scott Creek is located in northern Santa Cruz County. The watershed drains approximately 18,400 acres, flowing 11 miles through the steep and heavily forested west side of the Santa Cruz Mountains. The major tributaries are Big Creek and Mill Creek. Timber harvesting and agriculture are the major land uses in the watershed and other land uses include rural residential, rangeland and recreation.

Scott Creek and its tributaries are habitat to coho salmon and steelhead. The Coho population in Scott Creek has been supplemented in recent years by stocking of juveniles from the hatchery on Big Creek. Water diversion and deposition of fine sediments are implied as the primary impairment to coho and steelhead populations in this watershed (DFG 2003, Smith 2002 and Snider et al. 1995). CCAMP collected monthly water quality monitoring data at the Highway 1 site. This site is located in the lagoon and therefore the habitat is not characteristic of the riparian corridor. Temperature, dissolved oxygen and other pollutants may be of concern for anadromous fish in lagoon habitats. CCAMP monitoring at the lagoon site did not detect elevated water temperature or depressed oxygen conditions, nor did the lagoon show elevated turbidity or nutrient levels. However, the data does show elevated fecal coliform in 50% of all samples. Interestingly, the Heal the Bay report card shows no water quality exceedances at Scott Creek beach in 2002 or 2003 (Heal the Bay web site). CCAMP coordinated with DFG and UCSB staff to collect and analyze sand crabs from Scott Creek beach. Sand crab tissues were tested for metals, petroleum products and synthetic organic chemicals. Sand crab tissue bioaccumulation data shows elevated levels of copper, selenium and zinc. Several synthethic organic chemicals and PAHs, were also present in tissue samples but below levels of concern.

San Lorenzo River

The San Lorenzo River is a 25-mile long river that drains to the Pacific Ocean at the northern end of Monterey Bay. It drains approximately 86,122 acres. The river flows through a steep, heavily forested landscape on the west slope of the central Santa Cruz Mountains to the ocean at Santa Cruz Harbor. Major tributaries in the watershed include Zayante Creek, Boulder Creek, Bean Creek, Newell Creek, Carbonera Creek and Branciforte Creek. Branciforte Creek is channelized in its lowest mile before it joins the San Lorenzo River. The lower 2.2 miles of the San Lorenzo River is also channelized where it flows through the city of Santa Cruz. This reach of stream does not have a well-shaded canopy, though vegetation restoration projects have begun to improve bank vegetation along the levees. Loch Lomond is an impoundment on Newell Creek, formed in 1961. This large watershed is influenced by several land uses which can affect water quality. Large urban areas

include the city of Santa Cruz, and Scotts Valley. Smaller urban areas include Felton, Mt. Hermon, Ben Loman and Boulder Creek. Others land uses include rural residential, timber harvest, rangeland and recreation. The coastal confluence site is located at Laurel Street in Santa Cruz. This site is can be tidally influenced during high tides and storm events. Just below this site the San Lorenzo River lagoon provides critical summer habitat for juvenile steelhead. Breaching of the lagoon to prevent flooding is an ongoing management concern for protection of steelhead habitat.

The San Lorenzo River is listed on the 303(d) list as impaired by nutrients, pathogens and sedimentation. The San Lorenzo River estuary is also listed for pathogens and sedimentation. The Regional Water Quality Control Board revised the Basin Plan so that the Nitrate numeric objective in the adopted TMDL will replace the current site-specific objective. Carbonera and Lompico Creeks are also listed for pathogens, nutrients and sedimentation. Shingle Mill Creek is listed for nutrients and siltation. Several tributaries are also listed for sediment, including Branciforte Creek, Newell Creek, Bear Creek, Bean Creek and Boulder Creek. To implement nutrient reduction in the San Lorenzo River watershed the County of Santa Cruz and the Regional Board have developed the San Lorenzo Nitrate Management Plan (County of Santa Cruz 1995).

Santa Cruz County has been collecting water quality data at several sites throughout the watershed since the late 1960's; their data identifies excessive nutrients, particularly nitrate, from a variety of sources including septic systems. CCAMP water quality data collected at the coastal confluence site partially supports the San Lorenzo River listing for nutrient and pathogen indicator impairment. In 40% of samples collected between April 2001 and March 2003 orthophosphate exceeded the EPA proposed listing criteria; however, neither nitrate or unionized ammonia values exceeded criteria. County of Santa Cruz data collected at this same location between 1996 and 2000 did not show elevated nitrate levels; orthophosphate was not sampled. Indicators of eutrophication include wide ranges of dissolved oxygen measurements, appearance of algae and elevated concentrations of chlorophyll a. CCAMP monitoring data shows wide dissolved oxygen swings with values ranging from 5.9 – 12.8 mg/L as well as documented algal cover. Data collected by the County of Santa Cruz between 1996 and 2000 also shows elevated water temperature and supersaturated dissolved oxygen conditions (Ricker et al. 2001).

CCAMP data supports the 303(d) listing for impairment to the river for pathogens. The listing criterion was exceeded in 88% of fecal coliform samples collected monthly between April 2001 and March 2003 . The lagoon, just downstream of the coastal confluence site, has been posted as unsafe to swim since 1980 and continues to have elevated fecal coliform counts (Ricker et al. 2001). The County of Santa Cruz beach water quality monitoring at the river outlet shows several exceedances of beach water quality criteria, particularly during winter storm runoff. However, the majority of data colleted at this beach is within the acceptable limit.

Aptos Creek

Aptos Creek is located in southern Santa Cruz County and flows 20.5 miles to Monterey Bay south of the City of Santa Cruz. The coastal confluence site is located at Winfield Street and can be tidally influenced. There are two main subwatersheds of similar size, Aptos Creek and Valencia Creek, and their confluence is approximately a half-mile upstream of the coastal lagoon in the town of Aptos. The major tributaries in the Aptos Creek subwatershed are Bridge and Mangels Gulch and in the

Valencia Creek subwatershed Trout Creek is the largest tributary. Historically, the majority of the Aptos Creek watershed was heavily forested. Most of the Aptos subwatershed is protected in Nisene Marks State Park. Recreation is the major land use in the upper watershed. The lower reaches of Aptos are influenced by rural residential and urban land uses. The Valencia Creek subwatershed is primarily in private ownership. Orchard and timber harvest are the primary land uses in the upper watershed and the lower reaches of the watershed are dominated by rural residential and urban land uses (land use information is adapted from Beck and Mathis 2003).

Both Aptos and Valencia Creeks are listed on the 303(d) impaired waterbodies list for siltation and pathogens, and are the subject of Total Maximum Daily Load analysis. CCAMP data collected monthly (between April 2001 through March 2003) support the 303(d) listing for pathogens, showing elevated levels in more than 80% of the samples collected. CCAMP data also shows elevated phosphorus levels. Fish tissue bioaccumulation data from this location (by the Toxic Substances Monitoring Program) does not show exceedances of available criteria for metals or organic chemicals. The County of Santa Cruz beach water quality monitoring at the creek mouth (Seacliff State Beach) shows some exceedances of beach water quality criteria, particularly during winter storm runoff. However, the majority of data colleted at this beach is within the acceptable limit.

Soquel Creek

Soquel Creek drains approximately 27,000 acres in Santa Cruz County. It flows from the southern end of the Santa Cruz Mountains to Monterey Bay in the city of Capitola. Major subwatersheds include the West Branch Soquel Creek with its tributary Hester Creek, and East Branch Soquel Creek with its tributary Hinkley Creek. Lower in the watershed, tributaries to the main stem include Love Creek and Bates Creek. Land uses within the watershed include urban, rural residential, agriculture, parks and recreation, mining and timber harvesting. The lower reaches of Soquel Creek flow through the unincorporated town of Soquel and the city of Capitola. In the middle and upper watershed urban gives way to rural residential and a portion of the watershed is within Nisene Marks State Park. The upper watershed is primarily rural residential, timber harvest and state open space holdings (Santa Cruz County Resource Conservation District 2003).

Soquel Creek is important habitat for steelhead trout and is historic habitat for coho salmon. Major limiting factors to anadromous fish populations in Soquel Creek are low summer flow and siltation, which results in loss of pool and spawning habitat. The Soquel Creek Lagoon is listed on the 303(d) impaired waterbodies list for pathogens, nutrients, and siltation. USGS conducted water quality sampling at its gaging station between 1953 and 1966. This data shows relatively high levels of hardness and dissolved solids in the Creek, but are comparable to ground water supply in the area. County of Santa Cruz data show that Soquel Creek has among the highest alkalinity levels of all creeks sampled by their program, averaging 210 mg/L (County of Santa Cruz data, unpublished). CCAMP coastal confluence monitoring at the Capitola site between April 2001 and March 2003 indicated elevated levels of pathogen indicators and orthophosphate. Eighty-eight percent of fecal coliform samples exceeded 200 MPN/100mL. The geomean of all samples was 717 MPN/100 ml. Nitrate levels were very low, averaging 0.02 mg/L. Orthophosphate (as P) averaged 0.116 mg/L, exceeding EPA recommended listing criteria. Dissolved oxygen levels were not depressed; however, the maximum value was 13.88, which may indicate supersaturation and potential wide swings in daily dissolved oxygen levels. County of Santa Cruz data generally supports these findings. County

of Santa Cruz beach water quality monitoring at the Capitola beach east of the jetty (at the creek mouth) shows some exceedances of beach water quality criteria, particularly during winter storm runoff. However, the majority of data collected at this beach is within acceptable limits.

Pajaro River

The Pajaro River watershed encompasses over 1,300 square miles in the Pajaro River Hydrologic Unit (305) and parts of four counties: San Benito County (about 65% of the watershed area), Santa Clara County (about 20% of the watershed), Santa Cruz County (about 10% of the watershed) and Monterey County (less than 5% of the watershed). The major direct tributaries to the Pajaro River include San Benito River, Santa Ana Creek/Tequisquita Slough, Pacheco Creek, Llagas Creek, Uvas Creek, and Corralitos/Salsipuedes Creek. The Pajaro River flows to Monterey Bay. The Pajaro River coastal confluence site is located at Porter Road just upstream of Highway One. This site location was moved upstream from Thurwachter bridge due to its occasional tidal influence and lagoon nature at certain times of the year. The Porter Road site is higher in the watershed than a typical coastal confluence site; however, it is the most downstream location where there is bridge access, year round flow and habitat that is more representative of the fresh water river system.

There are five incorporated cities within the watershed: Watsonville, Gilroy, Morgan Hill, Hollister, and San Juan Bautista. The Pajaro River watershed contains a wide variety of land uses in addition to urban, including row crop agriculture, livestock grazing, forestry, industrial, and rural/urban residential. The watershed also contains significant amounts of natural vegetative cover, which provides habitat to numerous native bird and wildlife species including steelhead trout.

Water quality degradation in the Pajaro River and its tributaries has resulted in several listings on the 303(d) list. The Pajaro River is listed for pathogens, nutrients and siltation. Llagas Creek is also listed for nutrients and fecal coliform as well as chloride. Tequisquita Slough, a tributary to Llagas Creek, is listed for fecal coliform. In the San Benito subwatershed, the San Benito River itself is listed for fecal coliform and sedimentation. Clear Creek and the Hernandez Reservoir are listed for mercury which has been attributed to historic mining practices in the watershed.

CCAMP monitoring focused on the Pajaro River Hydrologic unit in the 1998 watershed area rotation monitoring and additional monitoring was conducted at the coastal confluence site between April 2001 and March 2003. CCAMP data shows mean nitrate levels at sites in lower Llagas Creek exceeding the Basin Plan criteria (CCAMP 2003). This finding is consistent with the findings of other researchers (Williamson et al. 1994, Montgomery Consulting Engineers 1993, and Jones et al. 1983). CCAMP data collected on the Pajaro River also shows elevated orthophosphate levels, greatly exceeding the EPA suggested listing criteria. Nutrient-enriched streams may lead to eutrophication, as evidenced by nuisance algal growth and large fluctuations in daily dissolved oxygen levels. Dissolved oxygen data collected by CCAMP staff shows numerous dissolved oxygen measurements below the Basin Plan objective throughout the Pajaro watershed. All sites on the Pajaro main stem had depressed oxygen levels during summer months. These findings were consistent with historic data collected by Williamson (1994), James Montgomery Consulting Engineers (1993) and Jones et al. (1983). Metals data collected by CCAMP in water, sediment and tissues support the listing of Clear Creek and Hernandez Reservoir for mercury. CCAMP data also identified elevated levels of chromium and copper in the San Benito River, and in the Pajaro River, elevated levels of lead, chromium, nickel and zinc were observed in some areas. See Pajaro River Watershed Summary of

Findings (CCAMP 2003) for a detailed literature review of water quality data in this watershed. The Monterey County beach water quality monitoring at the river mouth (Pajaro dunes beach) shows the majority of coliform data colleted at this beach are within acceptable limits.

Salinas River

The Salinas River watershed flows north from San Luis Obispo County through Monterey County to the Salinas River Refuge and the Pacific Ocean in Monterey Bay. The Salinas River and its tributaries cover nearly 3 million acres and two hydrologic units, the Salinas River Hydrologic Unit (309) and the Estrella River Hydrologic Unit (317). The watershed's main tributaries are the Arroyo Seco, Nacimiento, San Antonio, and Estrella Rivers.

Grazing and pasture lands and dry land farming have historically been the dominant land uses in the upper Salinas watershed, however large areas in southern Monterey County and northern San Luis Obispo County are being converted to vineyards. Irrigated cropland is predominant in the lower Salinas watershed, with row crops such as lettuce, celery, broccoli and cauliflower on the valley floor, and grazing and vineyards in more upland areas. The lower Salinas watershed is one of the most productive agricultural areas in the world, with a gross annual value of nearly $2 billion. The rapidly expanding wine-producing region in the upper Salinas watershed around Paso Robles is also becoming a highly productive agricultural area. Urban development occurs primarily in a corridor along the Salinas River. Major cities in the lower Salinas watershed include King City, Greenfield, Soledad, Gonzalez, Salinas and Castroville. The largest city, Salinas, has more than 140,000 people and is growing rapidly. Urban development and rapid growth in the upper Salinas watershed is occurring in the small cities of Santa Margarita, Atascadero, Templeton and Paso Robles. In addition to agriculture and urban development, other land uses in the Salinas River watershed area include two military facilities (Fort Hunter Liggett and Camp Roberts), exploitation of mineral and oil reserves in the San Ardo area and a few other locations throughout the watershed, and some public land and open space. The watershed has three major reservoirs, one on the upper Salinas River south of Santa Margarita, one on the Nacimiento River and one on the San Antonio River. The above information is adapted from the Salinas River Watershed Management Action Plan (RWQCB 1999).

A great deal of water quality data has been collected in the Salinas watershed. The Salinas River watershed was the focus of the CCAMP 1999 watershed rotation monitoring. Additional monitoring has been conducted at the coastal confluence site, at Davis Road, between April 2001 and March 2003. This site is located nearly 8 miles upstream from the lagoon and the actual confluence with the ocean. This site was chosen because it is the most downstream location with surface flows and year round access. Additional monitoring conducted in coordination with CCAMP include fish and fresh water clam tissue bioaccumulation (Toxic substances Monitoring Program collected in 1999 and State Mussel Watch Program collected in 1999), water and sediment toxicity with some associated chemistry (Granite Canyon Marine Pollution Studies Laboratory, U.C Davis in 1999 and 2000), and water quality and sediment chemistry data for organic chemicals (RWQCB staff in 1980, Bay Protection and Toxic Clean up Program in 1998, and Central Coast Watershed Institute in 2002).

These data have led to and support the listing of twenty-two waterbodies within the Salinas River watershed on the 2002 Clean Water Act 303(d) list of impaired water bodies for specific pollutants. Main stem listings and relevant data are summarized here. The Salinas River is subdivided into three

geographic reaches for listing purposes. The upper Salinas River (Santa Margarita Reservoir to the confluence with Nacimiento River) is listed for chloride and sodium impairment to beneficial uses. CCAMP data collected in 1999 at sites within this reach support this listing, as site-specific objectives were exceeded in 100% of sample collected. Limited data are available regarding minerals and salts in surface waters of the upper Salinas watershed prior to the CCAMP sampling program. Available data from Bradley, indicates that prior to 1981, chloride levels were within Basin Plan objectives, but sulfate levels were elevated. Region 3 staff suggested that the site specific objectives should be raised for these parameters in a 1981 report (Jagger et al. 1981). The middle reach of the Salinas River (Nacimiento River confluence to Gonzalez) is listed on the 303(d) list for impairment to beneficial uses from pesticides, salinity/TDS/chlorides and sedimentation. CCAMP data collected at sites in the middle reaches of the Salinas River show that on several occasions the Basin Plan sites specific objective for chloride and TDS was exceeded. CCAMP staff also collected a single sediment sample at sites in this reach; these samples did not show elevated levels of legacy pesticides in sediment. The lower reaches of the Salinas River (Gonzales to the estuary) are listed for fecal coliform, nutrients, pesticides, salinity/TDS/chlorides and sedimentation. CCAMP has monitored three sites in this reach and the data has confirmed impairment by nutrients, coliforms, chloride and pesticides. Similar findings have been documented by recent data collected by Central Coast Watershed Institute (CCoWS) and the Granite Canyon Marine Pollution Studies Laboratory in the lower Salinas watershed (CCoWS 2003 and Anderson et al. 2003). Agriculturally dominated tributaries including Chualar Creek, Quail Creek, Gabilan Creek and Blanco Drain have extremely high levels of nutrients (NO_3, NH_3 and Ortho PO_4) that significantly influence concentrations on the main stem Salinas River (CCoWS 2003). Elevated nutrient levels and associated problems with algal blooms and dissolved oxygen extremes in the lower Salinas watershed have been well documented from as early as 1965 (SWRCB, 1965). CCAMP monitoring at sites in the lower Salinas River and in Quail Creek have also shown exceedances of site specific objectives for chloride and TDS, supporting existing listings.

Monitoring efforts have revealed elevated levels of a wide variety of pesticides since the early 1970's. Available pesticide data include sediment data collected in 1980 (Jagger et al. 1981), 1998 (Downing et al. 1998), and 1999 (CCAMP), resident fish tissue (Toxic Substances Monitoring Program 1999), and transplanted bivalve tissue (State Mussel Watch Program 1999), from sites throughout the lower Salinas watershed. Toxicity testing on numerous occasions between 1997 and 2003 has shown that the waters and sediments of numerous sites in the lower Salinas watershed are toxic to standard test organisms (CCoWS 2003 and Anderson et al. 2003). Agriculturally dominated tributaries to the Salinas have shown the highest toxicity, with some sites exhibiting 85-100% mortality to *Ceriodaphnia* from exposure to water on fifteen separate occasions across a time span of over a year. The observed toxicity was attributed to the organophosphate pesticides chlorpyrifos and diazinon in the majority of the samples where an evaluation of toxicity sources was conducted (Downing et al. 1998, Hunt et al. 2003 and Anderson et al. 2003).

Old Salinas River and Tembladero Slough

The Old Salinas River and the Tembladero Slough are located within Monterey County and the Salinas River Hydrologic Unit (309). Their confluence is less than 2 miles upstream from the confluence with Moss Landing Harbor and Monterey Bay and is the location for two coastal confluence monitoring sites. The Old Salinas River is the historic channel that carried backflows

from the Salinas River when the lagoon was closed and prevented the Salinas River from flowing directly to the ocean. The Old Salinas River is currently channelized for flood control and is used primarily for return flows from agriculture. The confluence with Tembladero Slough is located at Monterey Dunes Way, west of Castroville. The Tembladero Slough watershed is comprised of two main subwatersheds and a series of creeks that have been modified and channelized as they flow through the cities of Salinas and Castroville. The Gabilan Creek subwatershed drains from Gabilan Range and includes several small tributaries and Natividad Creek, that are primarily influenced by rangeland and rural residential land uses. In the alluvial floodplain and lower foothills of Gabilan Creek and its tributary Natividad Creek, the channels have been modified to control flooding as they flow through intensive row crop agriculture before entering the city of Salinas. In the middle of the City is the confluence with Alisal Creek, which was channelized in 1917 for flood control through the city of Salinas. At this confluence the channelized creek is called the Salinas Reclamation Canal, and it carries agricultural return waters and storm water from Salinas to Castroville. At Highway 183 the Salinas Reclamation Canal becomes Tembladero Slough, and flows through Castroville and more intensive irrigated agriculture to the Old Salinas River.

Several waters in this watershed have been identified as having impaired beneficial uses due to pesticides, nutrients and fecal coliform. These include Tembladero Slough, Salinas Reclamation Canal and Old Salinas River Estuary. The Salinas Reclamation Canal and the Old Salinas River are also listed for low dissolved oxygen. Waters in the upper portions of the watershed are also on the 303(d) list, including Gabilan Creek for fecal coliform and Alisal Creek for fecal coliform and nitrate.

Several data sources have shown historic nutrient and pesticide levels exceeding Basin Plan criteria in this watershed. The Elkhorn Slough Foundation's long-term water quality monitoring program in the tributaries to Moss Landing Harbor indicates that nitrate (as NO_3) in the Old Salinas River and Tembladero Slough averaged 30 mg/l for the period 1988-1995 and also showed that the highest concentrations were observed during the low flow dry season, presumably due to lack of dilution of agricultural return flows (Caffrey et al. 1997). The Central Coast Watershed Institute (CCoWS), CCAMP, and USGS, summarized by Anderson et al. (2003), show that the agricultural return drains in the lower Salinas watershed, including Tembladero Slough, the Salinas Reclamation Canal, Gabilan Creek and Alisal Creek have extremely high levels of ammonia, nitrate, and ortho-phosphate. Many sites monitored had average nitrate values greater than 20 mg/L NO_3 as N.

Available data on pesticides in the Salinas watershed begins in the early 1970s and includes tissue data from the State Mussel Watch Program (SMW) and Toxic Substances Monitoring Program (TSM), water samples from the Department of Water Resources (DWR), sediment chemistry and toxicity testing by the Bay Protection and Toxic Cleanup Program (BPTCP), and sampling by the Regional Water Quality Control Board in 1980 (Jagger 1981) and CCAMP in 1999. Tembladero Slough has shown very high toxicity. The observed toxicity was attributed to the organophosphate pesticides chlorpyrifos and diazinon in the majority of the samples where an evaluation of toxicity sources was conducted (Downing et al. 1998 and Hunt et al. 2003). Moss Landing Harbor and its tributaries are listed as a Toxic Hot Spot for pesticides, PCBs, nickel, chromium, and tributyl tin (SWRCB 1999).

Sand crabs were collected from Moss Landing Beach and analyzed for bioaccumulation of metals, PAHs and synthetic organic chemicals by DFG and UCSB staff in 2000. Sand crab tissue

bioaccumulation data from this site show elevated levels of several metals including cadmium, chromium and selenium. Data also shows that PAHs and synthetic organic chemicals such as DDT, Dieldrin and PCBs were present in sand crab tissues; however, concentrations were below available criteria.

Carmel River

The Carmel River watershed is located in Monterey County just south of Monterey Bay. The River valley is between the Santa Lucia Mountains on the South and the Sierra del Salinas to the North and East. The watershed drains approximately 199,570 acres flowing northwest through the Carmel Valley to the Carmel River lagoon and the Pacific Ocean near Carmel. The largest tributary to the Carmel River is Tularcitos Creek. There are two major impoundments along the watercourse, Los Padres Dam and San Clemente Dam. The Carmel Valley has a mixture of urban areas, including Carmel Village and the City of Carmel by the Sea, rural residential, agriculture, rangeland and recreational areas. The Carmel River between San Clemente Dam and Los Padres Dam flows through woodland and grassland primarily used for rangeland and rural residential. The upper reaches of the Carmel River, above the Las Padres Dam, flow through the Los Padres National Forest.

The Carmel River watershed was included in the CCAMP 2002 watershed rotation monitoring; four main stem sites and one tributary site were monitored. Additional monitoring was conducted at the coastal confluence site at Highway 1. In general, CCAMP data indicated good water quality in this watershed. However CCAMP data does show the site specific objective for total dissolved solids was exceeded multiple times at all sites. In addition, depressed oxygen levels were recorded at both the Esqueline Road site and the Nasson Road site in summer time pre-dawn monitoring. This finding is of concern for steelhead trout and other aquatic organisms in this watershed. Benthic invertebrate community assemblages collected and identified from three sites on the main stem indicate relatively healthy stream conditions. The coastal confluence site data shows that relative to other sites in Region 3 the biological integrity of this site is fair, however sites upstream are scored as having good biological integrity. Sediment and water toxicity tests were also conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, or water fleas, *Ceriodaphnia dubia*. However, in sediment toxicity tests conducted using amphipods, *Hyallea azteca*, growth was significantly different from the control group.

Sand crabs from the Carmel River area beaches were collected and analyzed for metals, petroleum products and synthetic organic chemicals by DFG and UCSB staff. Bioaccumulation data shows the presence of PAHs and synthetic organic chemicals; however, concentrations are below established criteria. Monterey County beach water quality monitoring at the river mouth (Carmel City beach) shows very few exceedances of the water quality criteria for pathogen indicators at this location.

Big Sur River

The Big Sur River is located in Monterey County and flows to the Pacific Ocean at Andrew Molera State Park on the Big Sur Coast. The watershed has a drainage area of approximately 37,392 acres, the majority of which is within Los Padres National Forest on the steep northwestern slopes of the

Santa Lucia mountains. Recreation is the primary land use. In the lower reaches of the River, rural residential, rangeland and the urban areas of Big Sur also may affect water quality. Significant tributaries to the Big Sur River include Ventana Creek, Lion Creek and the North and South Fork Big Sur Rivers.

Water quality data was collected by CCAMP staff at the coastal confluence site, located at Andrew Molera State Park, between April 2001 and March 2003. Monitoring data was also colleted upstream, at Pfieffer State Park Campground, as part of the 2002 watershed rotation monitoring. CCAMP data indicates relatively good water quality in the watershed. Site-specific Basin Plan objectives for total dissolved solids and sulfate were exceeded on several occasions, however it is not known if this is a result of anthropogenic or natural causes. Benthic invertebrate community samples collected from sites in this watershed indicate a relatively healthy ecosystem, as indicated by the high CCAMP Index of Biotic Integrity (CCAMP IBI) score.

Big Creek

The Big Creek watershed is located in Monterey County along the Big Sur Coast. The watershed drains the steep western slope of the Santa Lucia Mountains and has a drainage area of 14,275 acres, including the 7,478 acre Devils Canyon watershed. The majority of the watershed is within the Los Padres National Forest and the lower reaches of the creek are within the Landels-Hill Big Creek Ecological Reserve, used for ecological research.

CCAMP staff collected monitoring data at the coastal confluence site, located upstream of Highway 1, between April 2001 and March 2002. In general, CCAMP data indicates good water quality in this watershed. The pH is consistently elevated, relative to other sites in the region; however, this is likely a result of the geology of the watershed. The staff at Big Creek Reserve has also collected water quality data since 1999, which shows similar findings (Big Creek Web site). Benthic invertebrate community samples collected from this site indicate a healthy stream ecosystem, ranking this site as one of the highest on the CCAMP Index of Biotic Integrity (CCAMP IBI) relative to all other sites for which CCAMP has collected data.

Water quality and benthic macroinvertebrate data is also collected by the volunteers at the Landels-Hill Big Creek Ecological Reserve and is available in summary formats on their web site.

Willow Creek

Willow Creek is located in Monterey County and flows to the Pacific Ocean just north of the town of Gorda at Willow Creek picnic area on the Big Sur Coast. The Willow Creek watershed drains approximately 10,415 acres of the steep northwestern slopes of Las Padres National Forest. Significant tributaries to Willow Creek include North and South Fork Willow Creek.

The CCAMP coastal confluence site is located under the Highway 1 bridge, adjacent to the Willow Creek picnic area, a U.S. Forest Service day use area. In general, water quality data collected from this site indicates that the watershed has relatively good water quality. Benthic invertebrate data collected at this site do not indicate good biological integrity; however, the steep canyon does not lend itself to the typical riffle, run, pool habitat that is targeted by the California Streams

Bioassessment Protocol, and therefore this data is not considered to be indicative of a water quality problem.

Arroyo de la Cruz

Arroyo de la Cruz watershed is located in San Luis Obispo County and flows to the Pacific Ocean north of San Simeon. The watershed drains approximately 27,775 acres, including the watersheds of Burnett Creek and Marmolejo Creek on the upper slopes of the Santa Lucia Range. Arroyo de la Cruz is important habitat for steelhead trout. The upper watershed is primarily steep slopes covered in mixed shrubs and pine forest. The foothills are a mixture of oak woodland and annual grassland with grazing being the primary land use. The flood plain is primarily grassland with limited row crop agriculture adjacent to the lagoon.

Water quality data from this watershed was sparse prior to CCAMP monitoring. Data was collected by CCAMP staff at the coastal confluence site, upstream of Highway 1, between April 2001 and March 2003. Water quality and benthic macroinvertebrate assemblage data indicate relatively good water quality in the watershed. Dissolved oxygen levels were below Basin Plan objectives during summer pre-dawn monitoring, but these data were collected shortly before the creek went dry at this location and low flow is most likely the cause.

San Simeon Creek

San Simeon Creek watershed is within San Luis Obispo County. The watershed drains approximately 51,491 acres and originates on the western slopes of the Santa Lucia Mountains, flowing to the Pacific Ocean at San Simeon State Beach. This watershed is important habitat to steelhead trout. The upper watershed is split into two subwatersheds: Steiner Creek, and north and south forks of San Simeon Creek. The major tributary in the lower reaches of San Simeon Creek is Van Gordon Creek. The steeper slopes are covered in pine forest, which is replaced by Oak woodland and annual grassland the foothills. Land uses in the watershed that can impact water quality include grazing, rural residential, mining, a gravel quarry in the floodplain and San Simeon State Park campground near the creek mouth. The coastal confluence site is located in the State Park. The Cambria Community Services District waste water treatment plant discharges to four percolation ponds along San Simeon Creek upstream of the State Park campground.

CCAMP has collected water quality and benthic macroinvertebrate community assemblage data at two sites in this watershed. Data indicates that the lower reaches of the creek have elevated levels of chloride, conductivity and orthophosphate. CCAMP data also show depressed dissolved oxygen levels during summer time pre-dawn monitoring, which may be indicative of eutrophication. These conditions were not observed in data collected at the upstream site. Benthic macroinvertebrate data scores show that both sites in this watershed have good biological community assemblages relative to all other sites in Region 3. Water toxicity tests were also conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, or water fleas, *Ceriodaphnia dubia*.

Santa Rosa Creek

The Santa Rosa Creek watershed is located in San Luis Obispo County and drains approximately 30,400 acres as it flows from the western slopes of Black Mountain to the Pacific Ocean at the northern edge of Cambria. The creek channel has been modified in several locations along Santa Rosa Creek Road. This watershed is important steelhead trout habitat. The coastal confluence site is located at Moonstone Drive in Cambria and a second watershed site is located upstream at Ferrasi Road. Land uses in the upper watershed are primarily rural residential and rangeland. There are also abandoned mining operations in this watershed, which are known to have mercury impacts to the creek. In the foothills of the lower watershed, and upstream of the urban areas of Cambria, row crop agriculture is also a major land use.

Water quality data was collected by CCAMP staff at the coastal confluence site between April 2001 and March 2003. Monitoring data was also collected at one upstream site as part of the 2002 watershed rotation monitoring. CCAMP data indicates relatively good water quality in the watershed, although site-specific objectives were exceeded for total dissolved solids and sulfate in more than 50% of samples collected. Sediment data collected at the coastal confluence site does not indicate mercury at levels of concern for aquatic life, but elevated levels of nickel were detected. Benthic invertebrate samples collected at sites in this watershed indicate relatively good biological integrity, scoring in the upper 75^{th} percentile relative to all other sites in the Region. Sediment and water toxicity tests were conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, water fleas, *Ceriodaphnia dubia*, or amphipods, *Hyallea azteca*. Santa Rosa Creek is not currently listed on the 303(d) list of impaired waterbodies.

Chorro Creek

The Chorro Creek watershed has a drainage area of approximately 30,000 acres in San Luis Obispo County. Chorro Creek flows through the Chorro Valley and into the Morro Bay Estuary at Morro Bay State Park. The coastal confluence site is located at South Bay Boulevard, just upstream of the estuary. A watershed rotation area site is also located upstream at Canet Road. Morro Bay supports a variety of marine habitats, recreational activities, commercial and sport fisheries and is one of the last viable shellfish fisheries in central and southern California. Morro Bay is recognized as both a State and National Estuary. Chorro Creek and several of its tributaries are habitat for threatened red-legged frogs and steelhead trout as well as several other aquatic and terrestrial organisms.

Significant tributaries in the watershed include Dairy Creek, Pennington Creek, San Lusito Creek and San Bernardo Creek. This watershed also includes the smaller Chumash and Walters Creeks. The headwaters of Chorro Creek drain to Chorro Reservoir, a source of municipal water supply, located above the California Men's Colony facilities on Camp San Luis property. Year-round releases from the reservoir are maintained.

The California Men's Colony and Camp San Luis are both in the watershed. Primary land uses affecting water quality include the Men's Colony waste water treatment plant (WWTP), storm water runoff from Cuesta College, grazing, row crop agriculture, viticulture and recreation, including parks and a golf course on Dairy Creek.

Extensive monitoring of this watershed was conducted as part of the U.S. EPA National Monitoring Program (NMP) from 1992 through 2000 (see CCRWQCB 2003) and the Morro Bay Volunteer Monitoring Program (VMP) since 2000. CCAMP has continued monitoring at two of the NMP sites on Chorro Creek. NMP and VMP data shows that Chorro Creek is impaired by nutrients, wide swings in diurnal dissolved oxygen levels, fecal coliform and sedimentation. Chorro Creek is currently listed on the 303(d) list for nutrients, pathogens and sedimentation, and the nutrient TMDL completed in 2002 identified the WWTP as the primary source of nutrient enrichment in the watershed. CCAMP data from the coastal confluence site shows that 10% of fecal coliform samples exceed the Basin Plan objective of 400 MPN. The site-specific objectives for chloride, sodium, sulfate and total dissolved solids are consistently being exceeded. CCAMP data also shows that nitrate concentration have not been observed to exceed the Basin Plan drinking water objective; however, phosphorus levels are greatly elevated below the WWTP discharge. CCAMP data collected using 24-hour continuous monitoring probes show dissolved oxygen concentration ranging from 5.9 to 8.7 mg/L. Thick algal mats have also been observed at this site. Tissue bioaccumulation data collected at 5 locations in Chorro Creek have shown elevated concentrations of the legacy pesticide DDT; 90% of the total DDT detected is in the form of DDE, one of the breakdown forms, indicating historic sources. Sediment data does not indicate elevated levels of DDT at the coastal confluence site. Elevated levels of nickel were detected, but are attributed to the geology of the watershed. Benthic macroinvertebrate data has been collected at the coastal confluence site since 1994; the range of biotic integrity scores indicate poor to fair condition. Water toxicity tests were also conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, or water fleas, *Ceriodaphnia dubia.*

San Luis Obispo Creek

San Luis Obispo Creek (SLO Creek) watershed drains approximately 54,142 acres in San Luis Obispo County. The headwaters flow from an elevation of 518 meters, through the City of San Luis Obispo to Avila Bay and the Pacific Ocean. The stream has been modified and channelized as it flows through the City. The main tributaries include Brizziolari Creek, Stenner Creek, Davenport Creek, East Fork, Prefumo Creek, See Canyon Creek and Sycamore Creek. A small dam on Prefumo Creek has created Laguna Lake, which provides recreation for local residents as well as habitat for wildlife. The San Luis Obispo WWTP currently discharges to SLO Creek approximately 7 miles upstream of the creek mouth at Avila Bay. During some months of drier years the lowest reaches of the creek are dominated by effluent flows. In addition to recreation, urban runoff and the WWTP discharge, other land uses that may have impacts on water quality in the lower watershed include agriculture, and in the upper watershed, rural residential and grazing. The CCAMP coastal confluence site is located at San Luis Bay Drive.

Several sources of data exist for SLO Creek, including volunteer data collected by the Land Conservancy of San Luis Obispo, data collected by Regional Board (including both CCAMP and TMDL staff) and data from the City of San Luis Obispo. A nutrient TMDL was developed for the watershed in 2003 and San Luis Obispo Creek is also on the 303(d) list for pathogens and priority organics. The nutrient TMDL has identified WWTP discharges and cropland in Stenner and Perfumo Creeks as sources of elevated nitrate in the main stem. The TMDL also identified the WWTP as the only significant source of ortho-phosphate in SLO Creek. CCAMP data collected at sites above and below the WWTP support this finding. CCAMP data also shows that Basin Plan site-specific objectives for total dissolved solids, chloride, sodium and sulfate were exceeded in more than 50% of

samples collected at sites downstream of the WWTP. Fecal coliform bacteria levels consistently exceed the Basin Plan objective in 90% of samples. This finding is consistent with data collected by volunteer monitors near the Mission in downtown San Luis Obispo. The coastal confluence site had 33% of samples exceeding the fecal coliform objective. However, CCAMP data did not show a single exceedance at the site downstream of the WWTP. Resident fish bioaccumulation data collected by DFG staff shows DDT levels in excess of the National Academy of Sciences guideline but mostly in the form of DDE, a breakdown product of DDT and an indication of historical source. Sediment data collected at the creek mouth does detect DDT but not at elevated levels. Benthic macroinvertebrate data collected at the coastal confluence site indicate poor biotic integrity, with scores ranking in the lower 25th percentile relative to all Region 3 sites. Upstream at Cuesta Park the benthic macroinvertebrate scores range from fair to good, ranking above the 50th percentile.

The San Luis Obispo County beach water quality monitoring program data collected at San Juan Street in Avila Beach (adjacent to the creek mouth) shows some exceedances of the water quality criteria for coliform. However, the majority of the data at this site is within acceptable limits.

Arroyo Grande Creek

The Arroyo Grande Creek watershed drains approximately 57,600 acres in San Luis Obispo County. The dam at Lopez Lake divides the watershed. The headwaters of Arroyo Grande Creek originate on the southeastern slopes of Big Baldy Mountain. Tributaries to Arroyo Grande Creek upstream of Lopez Lake include Saucelito, Potrero and Phoenix creeks. There are several other creeks that flow to Lopez Lake including Wittenberg Creek and its tributary, Huff's Hole Creek, Lopez Canyon Creek and its tributaries, and Vasquez Creek. The majority of the watershed above Lopez Lake is within the boundaries of National Forest or is in public ownership. Land uses on private lands include rural residential, grazing, and viticulture. Lopez Lake maintains continuous releases to the historic Arroyo Grande Creek channel. Major tributaries below the dam include Tar Springs and Los Berros Creeks. The creek channel has been highly modified as it flows through the City of Arroyo Grande, particularly at road crossings. From the Highway 101 crossing to the creek mouth at Oceano State Beach the stream is completely channelized and the instream vegetation is frequently removed for flood control. The primary land uses below Lopez dam include agriculture and the urban areas of Arroyo Grande and Oceano. Steelhead trout are still found in the creek below the dam and several agencies and organization are currently coordinating on habitat restiration projects to enhance remaining spawning and resting habitat.

The CCAMP coastal confluence site is located at the 22nd Street bridge and there are three additional main stem sites and one tributary site in the watershed rotation area. Volunteers for the Central Coast Salmon Enhancement Program also collect data in this watershed. CCAMP water quality data from the coastal confluence site shows elevated levels of fecal coliform, sulfate, total dissolved solids and chloride, as well as depressed pre-dawn dissolved oxygen levels (measured below 5.0) at the coastal confluence site. Elevated nutrient levels were not observed; however, dense in-stream vegetation and benthic algae was consistently observed, possibly indicating nutrient enrichment. These conditions were not consistent with data and observations from other upstream sites, particularly the two sites upstream of the city of Arroyo Grande. Sediment data does not show elevated levels of organic chemicals or metals with the exception of nickel. The benthic macroinvertebrate samples collected at the coastal confluence site indicate fair to poor biological integrity, with scores ranging from 2.0 to

5.4. Sediment and water toxicity tests were conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, or water fleas, *Ceriodaphnia dubia*.

San Luis Obispo County beach water quality monitoring data collected at Sandpiper Avenue, north of the creek mouth, shows some exceedances of the water quality criteria for coliforms; however, the majority of the data at this site is within acceptable limits.

Pismo Creek

The Pismo Creek watershed drains approximately 30,080 acres in San Luis Obispo County and flows to the Pacific Ocean at Pismo State Beach. Major tributaries to Pismo Creek include the East and West branches of Corral de Piedra Creeks. Land uses in the watershed include viticulture, agriculture, grazing, rural residential and oil refinery operations in Price Canyon. Below the Highway 101 crossing the creek is completely channelized and can be tidally influenced as it flows thought the city of Pismo Beach to the ocean.

CCAMP collected monthly water quality data at the coastal confluence site, located upstream of the Highway 101 bridge, from April of 2001 through March of 2003. CCAMP water quality data from this site shows elevated fecal coliform and severely depressed pre-dawn dissolved oxygen. Sediment chemistry monitoring did not identify elevated levels of organic chemicals or metals with the exception of nickel, which is likely due to the geology of the watershed. The benthic macroinvertebrate data shows fair to poor biological integrity at this site. Water toxicity tests were also conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, or water fleas, *Ceriodaphnia dubia*.

San Luis Obispo County beach water quality monitoring data collected at Ocean View Street, north of the creek mouth, shows some exceedances of the water quality criteria for coliforms; however, the majority of the data at this site is within acceptable limits.

Santa Maria River

At 1.2 million acres (1,880 mi^2) the Santa Maria River watershed is one of the larger coastal drainage basins of California. The Santa Maria River is formed by the confluence of the two large subwatersheds, Cuyama River and Sisquoc River, approximately 7 miles southwest of the city of Santa Maria. The Santa Maria River flows to the ocean north of Point Sal at Guadalupe Nipomo Dunes Preserve. The Santa Barbara / San Luis Obispo County line follows the Santa Maria and Cuyama Rivers. However, the upper reaches of the Cuyama River watershed are in Ventura County. Major tributaries to Santa Maria River include Nipomo Creek and Orcutt Creek. Major tributaries to the Cuyama subwatershed above Twitchell Dam include Alamo Creek, Huasna Creek, Santa Barbara Canyon Creek and New River. Major tributaries to the Sisquoc subwatershed include La Brea, Foxen Canyon and Cat Creeks.

Both the Cuyama and Sisquoc Rivers originate in wilderness areas of the Los Padres National Forest. The Cuyama River flows through the Cuyama Valley and the channel has been modified in several

places where it nears or crosses Highway 166. Major land uses in the Cuyama Valley include grazing on the foothills and upland slopes and agriculture, rural residential and agriculture in the valley. Twitchell Reservoir serves important flood control and water recharge functions in the lower end of the watershed. Releases from Twitchell Reservoir flow approximately 1 mile to the confluence with the Sisquoc River. The Sisquoc River is still an important steelhead trout creek, and provides habitat to several other aquatic species. Major land uses in the Sisquoc watershed include grazing, viticulture, rural residential, gravel mining in the river bed and row crop agriculture. The Santa Maria River has been channelized along its entire length for flood control purposes. Major activities in the Santa Maria watershed include irrigated and dryland agriculture, oil production, and urban development in Santa Maria and Guadalupe. In the nearby Guadalupe Dunes, oil processing activities have resulted in a large site contaminated with petroleum production byproduct (diluent) in ground and surface water.

The Santa Maria River is currently listed on the 303(d) list of impaired waterbodies for fecal coliform and nitrate. The CCAMP coastal confluence site is located just above the tidal influence of the estuary and downstream of the confluence with Orcutt Creek. There are also several watershed rotation area sites on the mainstem Santa Maria, Cuyama and Sisquoc Rivers. Data has been collected in the lower Santa Maria River by DFG staff working with the State Mussel Watch Program, Toxic Substances Monitoring Program, and UC Santa Barbara in coordination with CCAMP. Tissue data from mussels and fish collected in the estuary and sand crabs collected on the beach adjacent to the river mouth all show bioaccumulation of organic chemicals, particularly DDT, dieldrin, endrin and toxaphane. Of concern is the extremely high DDT levels measured recently in fish tissue, which was 200 times the National Academy of Sciences guideline. Sediment chemistry data from the estuary also slows DDT levels up to three times the NOAA ERM. Dieldrin and nickel were also elevated in sediments. Water quality monitoring has shown elevated nitrates, ammonia, fecal coliform and depressed dissolved oxygen levels at the coastal confluence site. The Santa Maria ground water basin is also plagued by elevated nitrates and total dissolved solids. Water toxicity tests were also conducted at the coastal confluence site. In 50% of the water toxicity tests conducted on water fleas, *Ceriodaphnia dubia,* toxic responses in the form of mortalities were recorded. In the other 50% of the *C. dubia* samples responses in the form of reproductive failure significantly different from the control was observed. Toxicity in the watershed has been attributed to both organophosphate and pyrethroid pesticides.

San Antonio Creek

San Antonio Creek drains approximately 17,000 acres in Santa Barbara County. The creek flows to the ocean on Vandenberg Airforce Base (AFB) property, north of the Santa Ynez River. There are several small tributaries in the watershed including Canada de las Flores and Harris Canyon Creek. Primary land uses include the residential and urban areas of the towns of Los Alamos and Vandenberg village, as well as agriculture and grazing upstream of Vandenberg AFB. San Antonio Creek is on the 303(d) list of impaired waterbodies due to sedimentation.

The coastal confluence site is located on Vandenberg AFB property at the railroad crossing. There are also two additional watershed rotation area sites on San Antonio creek. The Vandenberg AFB water quality program is also monitoring several sites on this creek. CCAMP monitoring results show elevated levels of boron throughout the watershed and depressed dissolved oxygen levels at the

coastal confluence site. The flow conditions at the coastal confluence site may be the primary factor contributing to excessive algal growth and low oxygen at this site. Coastal confluence data also shows potential concern due to periodic elevated levels of total dissolved solids and fecal coliform bacteria. Data collected at sites that are upstream in the watershed show elevated levels of ammonia, nitrite and fecal coliform. Sediment and water toxicity tests were also conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, water fleas, *Ceriodaphnia dubia*, or amphipods, *Hyallea azteca*.

Data collected by Vandenberg AFB staff at Highway 1 show consistently low oxygen levels. VAFB staff did not analyze San Antonio Creek water for nutrients. The CCAMP watershed rotation site located near the VAFB site (1 mile down stream) shows similar dissolved oxygen results as well as elevated nutrients and fecal coliform levels.

Sand crabs were collected at San Antonio Beach and analyzed for bioaccumulation of metals, PAHs and synthetic organic chemicals. Sand crab tissue data shows elevated levels of several metals, including chromium, cadmium, selenium and copper. PAHs and several synthetic organic chemicals were detected in these samples; however, all at concentrations below published criteria.

Santa Ynez River

The Santa Ynez River watershed drains approximately 574,885 acres originating in the Santa Ynez Mountains within the Los Padres National Forest. Three reservoirs have been created along the river course. The Jamison and Gibraltar Reservoirs are both located within the Los Padres National Forest. Major tributaries to the river above these reservoirs include North Fork Juncal Creek, Agua Caliente Canyon Creek, Mono Creek and Indian Creek. The Cachuma Reservoir is located along Highway 154, and major tributaries to the River between Gilbrater and Cachuma dam include Santa Cruz Creek and Cachuma Creek. The lower reaches of the River flow through Vandenberg AFB property to the ocean at Surf Beach. Major tributaries below Cachuma Dam include Santa Aguenda Creek, Alamo Pintado Creek, Zaca Creek, Santa Rosa Creek and Salsipuedes Creek. Steelhead trout are historically resident throughout the watershed, although fish passage at Cachuma Dam is notoriously poor. Land uses that may impact water quality in the watershed include recreation, including the numerous campground and day use areas along the river in the National Forest and at Lake Cachuma, grazing, dry land agriculture, viticulture and the urban and residential areas of Solvang, Buelton and Lompoc. The City of Lompoc's WWTP discharges to the river below the City.

Water quality data has been collected by CCAMP, the Lompoc WWTP and by the Vandenberg AFB water quality program. The CCAMP coastal confluence site is located on AFB property at 13th Street and there are 5 additional watershed rotation areas sites in the watershed. CCAMP data from the coastal confluence site shows elevated chlorophyll a, orthophosphate and nitrate concentrations, and potential concern for elevated ammonia, fecal coliform bacteria and depressed dissolved oxygen levels as these constituants were measured above levels of concern on at least one occacion. Site-specific objectives for dissolved solids, sodium, chloride and sulfate are also consistently exceeded at all CCAMP sites below the City of Lompoc. Depressed dissolved oxygen levels were measured by WWTP staff in 50% of the quarterly samples collected downstream of the effluent discharge point. All TDS samples collected by WWTP staff exceeded the site-specific objective, both above the

discharge and below, however the TDS levels below the discharge were consistently higher. Nitrate and orthophosphate data was not collected in Santa Ynez River by WWTP staff. Vandenberg AFB staff collect water quality data at the river mouth, near Surf Beach. Their data confirms elevated TDS levels and periodic depressed dissolved oxygen. The VAFB program does not monitor for orthophosphate in the Santa Ynez River.

Sediment chemistry data collected at the coastal confluence site by CCAMP staff indicates the presence of several organic chemicals at low levels. Sediment and water toxicity tests were also conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, water fleas, *Ceriodaphnia dubia*, or amphipods, *Hyallea azteca*. In quarterly toxicity tests conducted by the WWTP in the Santa Ynez River, no toxic responses were observed to *C. dubia* or *P. Promelas*.

Sand crabs were collected at Surf Beach and analyzed for bioaccumulation of metals, PAHs and synthetic organic chemicals. Sand crab tissue data shows elevated levels of several metals, including chromium, cadmium, selenium and copper. PAHs and several synthetic organic chemicals were detected in these samples, but all were at concentrations below published criteria. The Santa Barbara County beach water quality monitoring data collected at Surf Beach, both north and south of the river mouth indicate some exceedances of the water quality criteria for coliform; however, the majority of the data at these sites are within acceptable limits.

Canada de la Gaviota

The Gaviota watershed drains 12,900 acres. The creek flows to the ocean at Gaviota State Park. Major tributaries to this creek include Canada de las Cruces and Las Canovas Creek. Major land uses in this watershed include grazing and rural residential. The creek channel has been modified as it flows along Highway 101 and through the State Park, where camping and day use recreation occur.

Canada de la Gaviota is not currently on the 303(d) list of impaired waterbodies. The coastal confluence site is located at the campground entrance and there is an additional watershed rotation area site upstream. State Parks staff and volunteers also monitor this site. CCAMP water quality data collected at the coastal confluence site shows elevated levels of fecal coliform and boron. The benthic macroinvertebrate data collected at this site shows that the relative rank for this site ranges from good to poor. Sand crab data indicates bioaccumulation of elevated levels of PAHs and some metals including cadmium, chromium and selenium. Low levels of synthetic organic chemicals including DDT were also detected in sand crab tissue samples at the creek mouth. Sediment and water toxicity tests were also conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in water tests conducted on fathead minnows, *Pimephales promelas*, water fleas, *Ceriodaphnia dubia.* However, mortality of amphipods, *Hyallea azteca,* was significantly greater than that of the control group. State Parks data since 1997 is not currently available for inclusion in this watershed description.

The Santa Barbara County beach water quality monitoring program data collected at Gaviota State Beach (adjacent to the creek mouth) shows several exceedances of the water quality criteria for coliforms; however, there are also several data points that are within acceptable limits. The Heal the Bay report card scores for this beach are B for dry weather and F during wet weather months.

Arroyo Burro Creek

The Arroyo Burro Creek watershed drains 6,217 acres and flows to the ocean at Arroyo Burro Beach County Park (Hendrey's Beach). The headwaters are in the steep western slopes of the Santa Ynez Mountains, within the Los Padres National Forest. The major tributaries to Arroyo Burro Creek are San Roque and Barger Creeks. The confluence of the two creeks is in downtown Santa Barbara where Arroyo Burro Creek is completely channelized.
The primary land uses in this watershed are urban and residential within the city limits of Santa Barbara, and rural residential and National Forest in the upper reaches.

Arroyo Burro Creek and Arroyo Burro Beach are both on the 303 (d) list of impaired waterbodies for pathogens. CCAMP and the Long Term Ecological Research (LTER) program have collected ambient water quality data, and the county of Santa Barbara's volunteers for Project Clean Water have collected storm water data. At Arroyo Burro Beach DFG-UCSB staff collected sand crab tissue bioaccumulation and the County of Santa Barbara has collectedly bacteria samples as required by AB 411. The CCAMP, LTER and County storm water monitoring site is located at Cliff Drive, just upstream of Arroyo Burro Beach. CCAMP data collected at this site has shown elevated levels of boron and fecal coliform, and depressed dissolved oxygen measurements in pre-dawn monitoring during the summer of 2002. Sediment chemistry data did not show elevated levels of organic chemicals or metals with the exception of nickel. The benthic macroinvertebrate scores for this site indicate fair to poor biological integrity. Sediment and water toxicity tests were also conducted at the coastal confluence site. Toxicity responses (survival, growth or reproduction) were observed in both sediment and water samples collected from this site. Survival tests conducted on fathead minnows, *Pimephales promelas*, showed mortality significantly greater that the control group. In sediment tests conducted using amphipods, *Hyallea azteca* growth was significantly lower than in the control group. No toxic responses were recorded for water fleas, *Ceriodaphnia dubia*, tests. State Parks data since 1997 is not currently available for inclusion in this watershed description.

Storm water data from this site (collected between winter 2000 and 2002) shows very high levels of total phosphorus, suspended solids and turbidity relative to ambient data. This is not uncommon during storm water flows. This data also shows elevated fecal coliform levels, with storm water levels over 10 times the geomean of ambient levels. Storm water monitoring also resulted in elevated levels of the pesticides diazanon and malathion.

Sand crab tissue data shows elevated levels of PAHs and metals including cadmium, chromium and selenium. Low levels of synthetic organic chemicals including DDT were also detected in samples collected near the creek mouth. The County of Santa Barbara beach water quality monitoring program data has shown numerous exceedances of water quality criteria for coliforms at Arroyo Burro State Beach, adjacent to the creek mouth. The Heal the Bay report card gives this site a F score during dry weather months and a D during wet weather months. The County was recently awarded a grant to install a UV treatment system at the creek mouth.

Mission Creek

The Mission Creek watershed drains approximately 7,800 acres from the western slopes of the Santa Ynez Mountains to the ocean at Stearns Warf in the City of Santa Barbara. The two main tributaries to Mission Creek are Rattlesnake and Old Mission Creeks. The upper reaches of the watershed are within the Los Padres National Forest, and have relatively undisturbed channel and continuous riparian corridors. Between National Forest Lands and Foothill Road there are scattered residential areas. Downstream of Foothill Road the creek has been modified and channelized for most of its length and it flows through the residential and urban areas within the City of Santa Barbara. Steelhead trout were historically common in this watershed and there are currently efforts underway to restore reaches of this creek to increase steelhead numbers.

Mission Creek is currently on the 303(d) list of impaired waterbodies due to elevated pathogen levels and toxicity of unidentified origin. CCAMP and the Long Term Ecological Research (LTER) program have collected ambient water quality data. On East Beach, where Mission Creek flows to the ocean, the county collects bacterial data as required under AB 411. The coastal confluence site is located near the Amtrak Station in downtown Santa Barbara. There is also a watershed rotation area site located upstream in the foothills near the edge of the residential influence. CCAMP data shows elevated levels of fecal coliform and depressed dissolved oxygen levels at the coastal confluence site, where the biological integrity score is poor. The upstream site, however, does not have water quality problems, and the biological integrity of this site is good relative to other sites in Region 3. Sediment and water toxicity tests were also conducted at the coastal confluence site. Growth of amphipods, *Hyallea azteca* was impaired in sediment samples collected from this site, however a survival hit was not observed. No toxicity responses (survival, growth or reproduction) were observed in water toxicity tests conducted on fathead minnows, *Pimephales promelas* and water fleas, *Ceriodaphnia dubia*. Data collected by the LTER program will be available following publication.

The County of Santa Barbara beach water quality monitoring from East Beach shows numerous exceedances of water quality criteria. The Heal the Bay report card score grades this site a D during dry weather months and F during wet season monitoring.

Atascadero Creek

The Atascadero Creek watershed drains approximately 12,000 acres. Major tributaries include Maria Ygnacio Creek and its tributary San Antonio Creek. Atascadero Creek flows to the Goleta Slough and the Pacific Ocean at Goleta Beach County Park. The watershed originates in the steep western slopes of the Santa Ynez Mountains, within the National Forest boundaries. Downstream of the National Forest area, Atascadero Creek and its tributaries flow through rural residential, urban, agricultural and some industrial areas.

The coastal confluence site is located at Ward Drive, just above the tidal lagoon, and there are also two additional CCAMP watershed rotation areas sites upstream. Monitoring data is also collected at Ward Drive by Project Clean Water and volunteers from Santa Barbara Channel Keepers. CCAMP data collected at the coastal confluence site indicates elevated levels of fecal coliform and depressed dissolved oxygen levels during summer. Thick algal mats were observed in this creek throughout summer; however, nutrient levels never exceeded Basin Plan objectives. Santa Barbara Channel Keepers data from this site has similar findings. Sediment chemistry data did not show elevated

levels of organic chemicals or metals. Benthic macroinvertebrate data indicated poor biological integrity relative to other sites in Region 3. Sediment and water toxicity tests were also conducted at the coastal confluence site. No toxicity responses (survival, growth or reproduction) were observed in tests conducted on fathead minnows, *Pimephales promelas*, water fleas, *Ceriodaphnia dubia,* or amphipods, *Hyallea azteca*.

The County's Project Clean Water storm water data from 2001 and 2002 show elevated levels of *E. coli*, total phosphorus, suspended solids, dissolved solids and turbidity in all samples. This is not unusual for storm event data. Metals including mercury, copper and zinc were also measured at elevated levels. In at least one storm water sample elevated levels of malathion, diazinon and chlorpyrifos were observed.

Santa Barbara County also collects bacterial data at Goleta Beach County Park, near the creek mouth. Data collected at this site shows several exceedances of water quality criteria for coliforms; however, the majority of the data is within acceptable limits. The Heal the Bay report card gives this site an A^+ grade for both dry and wet season monitoring.

Carpinteria Creek

The Carpinteria Creek watershed drains approximately 9,400 acres originating in the steep western slopes of the Santa Ynez Mountains within Los Padres National Forest. The creek channel has been modified in areas of bridge crossings; however, the majority of the creek flows through a natural channel with a continuous riparian corridor. Just upstream of the City the watershed is divided into two subwatersheds, Carpinteria Creek and Gobernador Creek, which is further subdivided into Steer and Eldorado Creeks. Downstream of National Forest boundary the major land uses are rural residential and orchards; the lowest mile of creek flows through the residential areas within the city limits of Carpinteria. The creek flows to the ocean at Carpinteria State Beach. Carpinteria Creek is listed on the 2002 303(d) list for pathogen indicators.

Several agencies and researchers have collected water quality data in this watershed. Ambient water quality data has been collected by CCAMP and by volunteers for State Parks; the County of Santa Barbara's volunteers for Project Clean Water have collected storm water data; and UCSB researchers with the Long Term Ecological Research Program (LTER) have collected flow and nutrient data. Monitoring is also conducted at Carpinteria State Beach. DFG-UCSB staff collected sand crab tissue bioaccumulation data in 2000 and the County conducts AB 411 bacteria monitoring along the beach.

The CCAMP coastal confluence site is located downstream of Carpinteria Avenue at the foot bridge. This is the same location where the Long Term Ecological Research (LTER) team and the Project Clean Water volunteers are collecting data. The CCAMP coastal confluences data shows elevated levels of fecal coliform and depressed dissolved oxygen levels during summer months. Toxicity responses (survival, growth or reproduction) were observed in both sediment and water testes at this site. Survival and reproduction hits were recorded for the water flea, *Ceriodaphnia dubia,* and significant mortality was observed in the amphipod, *Hyallela azteca,* test. However no toxic responses were observed in water tests conducted using fathead minnow, *Pimephales promelas*. LTER data collected as part of a study on nutrient loading shows Carpinteria Creek is contributing over 4000 kg/yr of nitrate (as N) and over 700 kg/yr of phosphate (as P) to the ocean (Robinson et.

al., in press). State Parks data since 1997 is not currently available for inclusion in this watershed description.

Project Clean Water storm water data shows elevated levels of *E. coli*, total phosphorus, suspended solids, dissolved solids and turbidity in all samples. This is not unusual for storm event data. Metals including mercury, copper and zinc were also measured at elevated levels. Organic chemicals including malathion, diazinon and chlorpyrifos were consistently elevated in storm water samples collected at this location.

County of Santa Barbara beach water quality monitoring includes data at Carpinteria State Beach, adjacent to the creek mouth. Data collected at this site shows several exceedances of the water quality criteria, particularly during wet season. The Heal the Bay report card grades for this site are A^+ for dry weather monitoring and F for wet season monitoring. Sand crab data collected by DFG-UCSB staff at Carpinteria State Beach have shown bioaccumulation of metals, PAHs and organic chemicals including DDT; however, no exceedances of existing water quality criteria were observed in sand crab tissue.

Franklin Creek

The Franklin Creek watershed drains approximately 2866 acres and flows into Carpinteria Marsh, one of the last remaining intact coastal salt marshes in our Region. The creek has been completely modified and flows through a cement box channel for approximately three-quarters of its length. Franklin Creek originates in the lower elevations of the western slopes of the Santa Ynez Mountains within the Los Padres National Forest. The majority of this watershed is developed and its drainage downstream of National Forest land is dominated by intensive multi-use agriculture in the form of greenhouses and nurseries, as well as residential and light commercial development within the city limits of Carpinteria. Several of the nurseries and greenhouses in this watershed have direct discharge points to the creek channel.

Several agencies and researchers have collected water quality data in this watershed. Ambient water quality data has been collected by CCAMP and UCSB's LTER researchers have collected flow and nutrient data in the creek at Carpinteria Avenue. Coastal confluences and LTER program data have shown extremely high levels of nitrate in this creek. Coastal confluences data also shows elevated levels of orthophosphate and fecal coliform bacteria. Toxicity responses (survival, growth or reproduction) were observed only in sediment tests to *Hyallea azteca*. Significant mortality of *H. azteca* was observed. However, no toxic responses were observed in water tests using fathead minnows *Pimephales promelas*, or water fleas *Ceriodaphnia dubia*.

LTER data collected as part of a study on nutrient loading shows Franklin Creek is contributing over 11,000 kg NO_3-N / yr and over 1,000 kg PO_4-P / yr to Carpinteria Marsh and the ocean (Robinson et. al. in press). This is the more than four times the amount measured in any other creek on the Carpinteria Coast.

The County's Project Clean Water storm water data shows elevated levels of total phosphorus, suspended solids, dissolved solids and turbidity in all samples. This is not unusual for storm event data. Storm water data shows elevated nitrate levels, but these are greatly reduced from non-storm

levels. Glyphosphate concentrations are near criteria levels in all samples, and chlorpyrifos and diazinon levels are elevated in all samples. Project Clean Water data also shows elevated levels of mercury, copper and zinc.

Rincon Creek

The Rincon Creek watershed drains approximately 10,000 acres of both Santa Barbara and Ventura counties. For much of its length Rincon creek is the boundary between the two counties and flows to the ocean at Rincon point and Rincon County Beach. Rincon Creek originates in the steep western slopes of the Santa Ynez Mountains within Las Padres National Forest. Land uses in the watershed downstream of the National Forest boundary include rural residential and orchards, and below Highway 101, residential. There are several small tributaries to Rincon Creek, with Casitas Creek being the largest.

Rincon Creek is not currently listed on the 2002 303(d) list of impaired waterbodies; however, Rincon County Beach is listed for fecal and total coliforms.

Several agencies and researchers have collected water quality data in this watershed. Ambient water quality data has been collected by CCAMP, the stormwater data has been collected by the County of Santa Barbara's volunteers for Project Clean Water and UCSB's researchers with the Long Term Ecological Research Program (LTER) have collected flow and nutrient data in the creek. LTER data is not yet available for this site. The County is also collecting bacteria data at Rincon County Beach.

The coastal confluence site is located upstream of Highway 101. Data collected at this site has shown elevated levels of fecal coliform bacteria and boron. The benthic macroinvertebrate data relative rank of this site resulted in scores ranging from good to fair biological integrity relative to other sites in Region 3. Sediment and water toxicity sampling was also conducted at the coastal confluence site. Toxicity responses (survival, growth or reproduction) were observed from all test organisms. Significant mortality was observed in two water tests conducted using fathead minnows *Pimephales promelas*. Significant reductions in reproductive success were recorded in one test conducted using water fleas *Ceriodaphnia dubia*. In the sediment test, *Hyallea azteca* growth was significantly reduced relative to the control group.

The Project Clean Water storm water monitoring data collected in 2001 and 2002 indicate elevated levels of total phosphorus, suspended solids, dissolved solids and turbidity in all samples. This is not unusual for storm event data. *E. coli* levels consistently exceeded numeric criteria in all samples. Organic chemicals and petroleum products were not elevated, with the exception of a single chlorphrifos sample. Mercury, copper and zinc were also measured in elevated levels.

County of Santa Barbara beach water quality data for Rincon Beach at Rincon Creek show recent (2003- present) data for this location having only a few exceedances of water quality criteria. The Heal the Bay report card gives this site and A^+ grade for both wet and dry weather monitoring.

Intra-agency Coordination

CCAMP staff is coordinating with other Region 3 staff to ensure SWAMP consistency in data gathering methods, data quality objectives, and data reporting formats. The following tables summarize monitoring activities Region 3.

Table 6. Intra agency monitoring in coordination with CCAMP.

Intra agency group	Monitoring Program description	Available Data Format	Using SWAMP QAPP	Data format SWAMP compatible	Data used for 303(d) and 305(b) analysis
CCAMP	CCAMP watershed rotation monitoring .	R3 has data in electronic format (SWAMP compatible)	X	X	X
CCAMP	CCAMP coastal confluences monitoring at creek mouths	Ongoing. R3 has data in electronic format (SWAMP compatible)	X	X	X
TMDL	TMDL monitoring for loading assessments in Region 3 streams including Pajaro, Aptos, San Lorenzo, Chorro, Los Osos, San Luis Obispo, Santa Maria and a number of tributary streams.	Data currently being collected and planned over the next several years. R3 has most data available in electronic format (SWAMP compatible)		X	X
Ag Waiver Replacement	Agriculture monitoring is required in association with waivers	Program is being initiated. This program will be utilizing the EDF data format and will provide data to SWAMP	X	X	X
Grant Projects	Contractors are required to meet with Region 3 staff in the first quarter of the grant, to discuss development of the QAPP, Monitoring Plan, and data management.	Data will be submitted in electronic format using SWAMP templates.		X	X

Inter-agency and organizational coordination

CCAMP staff are currently in coordination with several local agencies and organizations collecting data from coastal streams and in nearshore areas. Table 7 summarizes monitoring activities which are underway in watersheds monitored by CCAMP under the coastal confluence program.

Table 7. Monitoring organizations and activities at work in coastal confluence watersheds.

Federal		
NOAA Status and Trends	Several mussel monitoring sites are maintained in nearshore areas of Monterey and Santa Cruz Counties. The CCLEAN program will collect data.	Data requested.
EMAP	23 sites monitored in surface waters of Region 3. Data collected by DFG staff, 2003.	Data requested. Report pending.
EMAP	30 sites monitored in Morro Bay. Data collected by DFG staff, September 2003.	Data requested. Report pending.
NOAA Monterey Bay Marine Sanctuary Integrated Monitoring	Ecological monitoring program which primarily coordinates existing research, and initiates new monitoring in Monterey Bay. CCAMP is coordinated with the program and is the	Information sharing. CCAMP data available to SIMON

Network (SIMON)	primary water quality data gathering program within SIMON.	
Vandenberg Air Force Base	Water quality monitoring on San Antonio Creek and Santa Ynez River. Several long term sites maintained. CCAMP coordinating on site selection, water quality information, data sharing and monitoring training.	Technical support. Annual data acquired.
State		
State Mussel Watch Program (SMW) and Toxic Substances Monitoring Program (TSM)	Monitoring in association with CCAMP watershed rotation area program through 2003. Program terminated in 2003 due to budget cuts.	Data acquired.
CDFG and UC Santa Barbara	Sand crab tissue bioaccumulation monitoring coast wide.	Preliminary data acquired.
SMW	Bivalve tissue bioaccumulation. 3 sites in Region 3 (using SMW Endowment funds). Ongoing.	Annual data acquired.
SMW	Carmel Area WWTP monitoring. Recently terminated due to MRP changes.	Data acquired.
Department of Health Services (DHS)	DHS samples Morro Bay as part of the National Shellfish Protection Program for toxic phytoplankton (in coordination with volunteers) and also samples commercial shellfish growing operation. Ongoing.	Data acquired. (Hard copy format)
California Cooperative Fisheries Investigations	CalCOFI has conducted marine surveys for basic water quality parameters offshore southern and central California for many years. Ongoing.	Data available online.
California State Parks Santa Barbara region	Monitoring basic water quality parameters and benthic macroinvertebrates in Santa Barbara State Parks.	Technical support. Data acquired.
Local		
San Mateo County AB 411 monitoring	Collection of shoreline bacteria data at Gazos Creek State Beach. Ongoing.	Data available online.
Santa Cruz County Environmental Health Department	Extensive network of conventional water quality monitoring sites throughout Santa Cruz County with many years of record.	Data obtained through 1999.
Santa Cruz County AB 411 monitoring	Collection of shoreline bacteria data. Numerous sites. Ongoing.	Data available online.
City of Santa Cruz , Watsonville, Monterey Regional and Carmel Area Municipal WWTPs	Discharge to nearshore areas. Dischargers participate in regional monitoring activities through the CCLEAN Program. Includes shoreline mussel and coliform sampling, river mouth monitoring, and nearshore sediment monitoring.	Annual data aquired.
Monterey County AB 411 monitoring	Ongoing collection of shoreline bacteria data.	Data available online.
City of Watsonville	Surface water quality monitoring for conventional pollutants and pesticides in Pajaro River and some tributaries. Ongoing.	Some data obtained.
Hollister WWTP	Percolation ponds monitoring adjacent to San Benito River.	Data acquired. (Hard copy)
South County Municipal Wastewater Treatment Authority	Percolation ponds monitoring adjacent to Llagas Creek. Monitoring sites on Llagas Creek above and below ponds. Data used for TMDL development.	Data acquired.
San Luis Obispo County AB 411 monitoring	Collection of shoreline bacteria data. Numerous sites. Ongoing.	Data available online.
Cambria Sanitary District	Percolation ponds monitoring adjacent to San Simeon Creek. Limited monitoring of San Simeon Creek and lagoon.	Data acquired. (Hard copy)
California Men's Colony WWTP	Discharges directly to Chorro Creek. Monitoring data includes upstream and downstream sites. Ongoing. Data used for TMDL development.	Data acquired.
City of Morro Bay	Discharges to Pacific Ocean. Extensive nearshore monitoring	Data acquired.

WWTP	as a result of 301(h) waiver.	(Hard copy)
City of San Luis Obispo WWTP	Discharges to San Luis Obispo Creek. Monitors 7 creek sites in addition to effluent monitoring. Data used for TMDL development.	Data acquired.
Pismo and South County WWTPs	Discharge to nearshore areas. Plants have minimal receiving water monitoring activities.	Data acquired. (Hard copy)
Pacific Gas and Electric Company	Many years of intensive monitoring of Diablo Cove for impacts associated with the Diablo Canyon Nuclear Power Plant.	Data acquired. (Hard copy)
County of Santa Barbara AB 411 monitoring	Collection of shoreline bacteria data. Numerous sites. Ongoing.	Data available online.
County of Santa Barbara Project Clean Water Project	Storm event volunteer monitoring at several creeks in the county.	Data acquired.
City of Lompoc WWTP	Monitoring of effluent discharges and of the Santa Ynez River.	Data acquired. (Hard copy)
University		
PISCO – UC Santa Cruz and UC Santa Barbara	Intertidal and subtidal ecological monitoring along the California Coast. Ongoing. CCAMP hopes to coordinate by adding mussel bioaccumulation data at these sites (funding pending).	Data will be available online at PISCO website.
UC Santa Cruz	Nutrients in the Pajaro watershed, particularly related to surface/groundwater interactions. Data to be used for TMDL development. Multiple year project.	Data not yet acquired.
Cabrillo College Geography Dept.	Basic water quality, fecal coliform and salinity monitoring in Aptos Creek.	Data not yet acquired.
UC Monterey Bay-Watershed Institute	Basic water quality, pesticide, sediment and flow monitoring in the lower Salinas River watershed.	Data acquired. Report completed.
UC Monterey Bay-Watershed Institute	Basic water quality monitoring in the Carmel and Salinas River lagoons.	Data acquired. Report completed.
California Polytechnic State University, SLO	Buoyed multi-analyte probe monitoring in real time. Avila Bay. Program initiation 2003. Monitoring will be ongoing.	Data not yet acquired; will be available online.
Long Term Ecological Research-UC Santa Barbara	Nutrient loading to coastal wetlands and the ocean. Bi-weekly monitoring in Carpinteria and Santa Barbara area creeks. Several sites at the same location as CCAMP coastal confluence sites. Ongoing.	Data Requested. (Pending publication)
Volunteer		
Monterey Bay Citizen Monitoring Network	Coordination of volunteer monitoring activities in coastal waters throughout the Sanctuary. First Flush, Urban Watch and Snap Shot Day data. Volunteer coordinator is acquiring local data. Ongoing. CCAMP provides technical support for data and website management.	Data acquired and in CCAMP format.
Arana Gulch Watershed Alliance	Watershed education. Data collected in coordination with the National Marine Sanctuary (NMS) Volunteer Coordinator.	
Scott Creek Watershed Council	Basic water quality monitoring on Scott and Little Creek. Data collected in coordination with the NMS Volunteer Coordinator.	Data to be acquired via NMS Volunteer Coordinator.
Santa Cruz Blue Water Task Force	Ocean monitoring of E coli and total coliform.	
Friends of Soquel Creek	Summer baseflow monitoring. In coordination with the NMS Volunteer Coordinator.	Data to be acquired via NMS Volunteer Coordinator.
California Dept. of Fire and Forestry	Benthic macroinvertebrates and steelhead counts in Soquel Creek.	Data not acquired
San Lorenzo Valley	Visual assessment of riparian corridor, flow, benthic	Data to be acquired via

Unified School District Charter 25-Home School Program	invertebrate communities in Soquel Creek	NMS Volunteer Coordinator.
San Lorenzo Valley High School Watershed Academy	Water quality, fecal coliform, riparian birds	
San Lorenzo Watershed Caretakers	Watershed education and implementation	
City of Santa Cruz Urban Watch Program	Stormwater monitoring using EPA pollution detection kit. CCAMP is coordinating with the National Marine Sanctuary Volunteer Coordinator.	Data acquired.
Coastal Watershed Council	Water quality, flow, benthic invertebrates, stream morphology – Arana, Soquel, and Gazos Creek	Data to be acquired via NMS Volunteer Coordinator.
Big Creek Ecological Reserve	Watershed education and water quality monitoring for CWQ and benthic invertebrate community assemblages.	Data available online.
Garrapata Creek watershed council	Watershed education	Information sharing.
Carmel River Watershed Council	Watershed education; currently gathering existing data and information under Prop. 13 grant	Metadata will be available through SIMoN
Upper Salinas Las Tablas Resource Conservation District	Watershed education and collection of water quality and flow data in Upper Salinas watershed	Annual data acquired.
Morro Bay Volunteer Monitoring Program	Ongoing Chorro and Los Osos Creek and Morro Bay water quality sampling, some habitat, BMI and flow sampling. Ongoing. CCAMP provides technical support for data management.	Annual data acquired.
San Luis Obispo Land Conservancy	Watershed education and water quality data for San Luis Obispo Creek.	Annual Data acquired.
Central Coast Salmon Enhancement	Watershed education and water quality monitoring in Arroyo Grande and Nipomo Creeks. Future monitoring planned for Pismo Creek. Ongoing. CCAMP provides technical support for data management.	Annual Data acquired.
Monterey and San Luis Obispo County Surfrider Foundations	Monitoring shoreline for pathogen indicators. Ongoing.	Data not yet acquired.

Table 8 outlines the monitoring schedule and report-writing schedule for monitoring in Fiscal Year 2003-04. The proposed monitoring schedule has been identified in Region 3's work order with the CDFG Master Contract, and has already been scheduled for sampling. Conventional water quality monitoring will take place monthly, Benthic Macroinvertebrate samples and sediment samples will be collected in spring and 24 hour dissolved oxygen monitoring will occur monthly in the summer, targeting peak algal growth season.

Table 8. Monitoring schedule and deliverables.

Start of conventional water quality sampling at coastal confluence sites	March 1, 2004 (dependent on lab contract)
Start of flow measurements at coastal confluence sites	March 1, 2004
Benthic invertebrate sampling at coastal confluence sites	April 1, 2004 – April 15, 2004
24 hour DO measurements (hourly)	July, August, September 2004
Sediment Sampling at coastal confluence sites	April 1-April 15 2004
Coastal confluences hardcopy data report (draft)	April 2005
Coastal confluences data delivery (final)	July 2005 (depends on delivery schedule from Master Contractor)
Coastal confluences report delivery (draft)	Within 3 months of final data delivery
Coastal confluences report delivery (final)	Within 3 months of data delivery

Table 9. Desired milestone schedule for FY 2003-04coastal confluence monitoring. Report writing is dependent on data delivery from the various laboratories. Conventional water quality sampling will commence when private laboratory contract is finalized. Draft reports will be completed within 6 months of final data delivery.

Table 9. Desired sample throughput schedule.

Conventional water chemistry (Commercial lab)	30 days from collection (contract required)
Benthic invertebrate data (Master Contract)	6 months from time of delivery
Fish and mussel tissue data (Master Contract)	9 months from time of collection
Sediment chemistry data (Master Contract)	9 months from time of collection
Sediment chemistry data (Commercial lab)	2 months from time of collection
Toxicity data (Master Contract)	4 months from time of collection

Budget

The Region 3 allotment from the SWAMP program for FY 2003-04 is $310,000. Other funding sources applied toward monitoring activities include State Mussel Watch endowment, CCAMP Guadalupe endowment, and the Region 3 laboratory contract. Budget allocations to different elements of the program are shown. The budget reflects initiation of the coastal confluences monitoring in January 2004. Table ? shows the CCAMP budget for FY 2003-04, including all currently available funding sources.

Table ?. CCAMP 2003-04 Budget

CCamp Budget 03/04 (monitoring Jan 2003 through June 2004)	Sites	Duplicates	$/Sample	Samples events/yr	Total Samples	Total	**Funding**	**CCAMP Endowment**	**SWAMP funds**	**Monterey County Foundation Endowment (JO's POed)**	**State Mussel Watch Endowment**	**RWQCB Lab Contract**	**SubTotal**
Pajaro Watershed													
Conventional Water Quality			$182	6	#REF!	#REF!			#REF!				#REF!
Sediment Chemistry (walk)			$2,918	1	#REF!	#REF!			#REF!				#REF!
Sediment grain size – full analysis (phi scale)			$130	1	#REF!	#REF!			#REF!				#REF!
Sed Tox (10d) with ELISA when collected with Sed Chem samples			$952	1	#REF!	#REF!			#REF!				#REF!
Fresh water Toxicity (7d Cerio) with ELISA, (CCAMP collects)			$787		#REF!	#REF!			#REF!				#REF!
Bioaccumulation bivalvs collection and analysis			$4,185		#REF!	#REF!			#REF!		#REF!		#REF!
Bioaccumulation Fish (fresh), collection and analysis			$4,154		#REF!	#REF!			#REF!				#REF!
Rapid Bioassessment Taxonomy only (3 replicates)			$1,113	1	#REF!	#REF!			#REF!				#REF!
					#REF!								
Watershed Characterization subtotal						**#REF!**		**$0**	**#REF!**	**$0**	**#REF!**		**#REF!**
Coastal Confluences													
Conventional Water Quality	31	3	$222	6	204	$45,288			$28,000			$17,288	$45,288
Collection & analysis-walk (TOC, pesticides, metals, PAHs, PCBs)	31	2	$2,918	1	33	$96,294			$96,294				$96,294
Sediment grain size – full analysis (phi scale)	31	2	$130	1	33	$4,290			$4,290				$4,290

Sed Tox (10d) with ELISA when collected with Sed Chem samples	31	2	$952	1	33	$31,416			$31,416				$31,416
Fresh water Toxicity (7d Cerio) with ELISA, (CCAMP collects)			$787		0	$0			$0				
Bioaccumulation Fish (fresh), collection and analysis			$4,154		0	$0			$0				
Bioaccumulation bivalvs collection and analysis			$4,185		0	$0			$0				
Rapid Bioassessment Taxonomy only (3 replicates)	24	2	$1,113	1	26	$28,938			$28,938				$28,938
Coastal Confluences subtotal						**$206,226**		**$0**	**$188,938**	**$0**	**$0**	**$17,288**	**$206,226**
Nearshore													
SMW 3 sites monitored anualy						$10,254					$10,254		$10,254
Nearshore Subtotal						**$10,254**		**$0**	**$0**	**$0**	**$10,254**		**$10,254**
Special Studies													
Special Studies Subtotal						**$0**		**$0**	**$0**	**$0**	**$0**		
Misc													
SWAMP Overhead						$3,300			$3,300				$3,300
Misc Subtotal						**$3,300**		**$0**	**$3,300**	**$0**	**$0**		**$3,300**
Hardware													
Misc.						$5,000		$5,000					$5,000
Hardware Subtotal						**$5,000**		**$5,000**	**$0**	**$0**	**$0**		**$5,000**
Support Staff	**#**	**Wks**	**$/Hr**	**Hrs**									
CCAMP Field team leader	1	25	$15	20		$7,500		$7,500					$7,500
Students						$0							
CCAMP Tech Support						$30,000		$30,000					$30,000
MBNMS Volunteer Monitoring Support						$15,000				$15,000			$15,000

Support Staff Subtotal					**$52,500**	**$37,500**	**$0**	**$15,000**	**$0**		**$52,500**
CCamp Total Expenditures						**$42,500**	**$192,238**	**$15,000**	**$10,254**	**$17,288**	**$277,280**
Sources of Funding											
SWAMP Funding (03-04)							$310,000				
SWAMP Funding (02-03 carryover)							$0				
CCAMP Endowment(NFWF)						$50,000					
State Mussel Watch Endowment									$10,254		
Monterey County Foundation Endowment (JO's POed)								$75,000			
RWQCB lab Contract (stolen and borrowed funds)										$18,000	
Total Sources of Funding					**$445,254**	**$50,000**	**$310,000**	**$75,000**	**$10,254**	**$18,000**	**$463,254**
Total Costs					**$554,560**	**$42,500**	**$192,238**	**$15,000**	**$10,254**	**$17,288**	**$277,280**
Net					**-$109,306**	**$7,500**	**$117,762**	**$60,000**	**$0**	**$712**	**$185,974**
Contract allocations											
Laboratory							$20,000	$0	$0	$25,000	$45,000
SWAMP master contract							$290,000	$0	$0	$0	$290,000
Volunteer support							$0	$15,000	$0	$0	$15,000

Attachemnts

Attachment 1 – Bibliographic References

Attachment 2– Master Contract Needs Form

Attachment 3 – Other Contract needs Form

Attachment 4 – FY 03-04 Work Order

Attachment 1 – Bibliographic References

Anderson, B. S., J. W. Hunt, B. M. Phillips, P. A. Nicely, V. deVlaming, V. Conner, N. Richard, and R. S. Tjeerdema 2003. Integrated assessment of the impacts of agricultural drainwater in the Salinas River (California, USA). Environmental Pollution 124, p 523-532.

Applied Science Engineering, Fall Creek Engineering, Inc. 1999. Water quality management plan for the Pajaro watershed. Prepared for Association of Monterey Bay Area Governments.

Association of Monterey Bay Area Governments (AMBAG). 1984. Steelhead habitat management plan & institutional/financial analysis.

Balance Hydrologics and Habitat Restoration Group. 1990. Location, sources and supply of spawning gravels in the middle Pajaro River between Betabel and Aromas, California: a reconnaissance assessment. Prepared for Granite Rock Company.

BC Laboratories. 1998. BC Analytical laboratories quality assurance program plan. Bakersfield, California.

Beck, N.G. and M. Mathias. 2003. Aptos Creek Watershed assessment and enhancement plan hydrologic and water quality analysis. Coastal Watershed Council. Santa Cruz, CA.

Big Creek Ecological Reserve. http://www.redshift.com/~bigcreek/creek/water_quality/index.html

Cafferata, P.H. and C. Poole. 1993. Watershed assessment for the east branch of Soquel Creek. California Department of Forestry and Fire Protection.

Caffrey, J., S. Shaw, M. Silberstein, A. De Vogalaere, and M. White. 1997. Water

California Department of Fish and Game (CDFG). 1990. Laboratory quality assurance program plan (October 12, 1992 update). Environmental Services Division, California Department of Fish and Game. Sacramento, California.

California Department of Fish and Game (CDFG). 1996. Stream-specific Coho Salmon habitat deficiencies and limitations: Coastal streams of San Mateo and Santa Cruz counties currently supporting Coho Salmon or under consideration for Coho Salmon recovery efforts. Internal document.

California State Department of Public Health 1970. Sanitary Engineering Investigations of Twelve Waste Water Treatment Facilities in the Monterey Bay Area and Quality of Nearby Waters.

CAMP. 2003. Pajaro River watershed. 1998. Summary of findings, May 2003. Regional Water Quality Control Board, San Luis Obispo, CA.

CCAMP (Central Coast Ambient Monitoring Program). Central Coast Regional Water Quality Control Board. Summary data presented on our web page. www.ccamp.org

CCoWS. Anderson, T, F. Watson, W. Newman, J. Hager, D. Kozlowske, J. Casagrande, and J. Larson. 2003. Nutrient Sources in Monterey Bay Watersheds. Central Coast Watershed Studies Publication # WI-2003-11.

Central Coast Ambient Monitoring Program (CCAMP). 1998. Central Coast Ambient Monitoring Program Strategy. Central Coast Regional Water Quality Control Board. Internal document.

Central Coast Ambient Monitoring Program (CCAMP). 2000, Central Coast Ambient Monitoring Program, Available at http://www.ccamp.org/ca/3/305/305.htm.

Central Coast Regional Water Quality Control Board. 1999a. Salinas River Watershed Management Action Plan. Internal document.

Coates, Rober et al. 1982. Land sliding, channel change, and sedimentation transport in Zayante Creek and the lower San Lorenzo River, 1982 Water Year, and implications for management of the stream resource. The Center for Natural Resource Studies.

Conrad, M. 2002. Roads and land use survey of the Gazos Creek Watershed. Coastal Watershed Council. Santa Cruz, CA

County of Santa Cruz Planning Department. 1979. The San Lorenzo River watershed management plan.

Danner, S. 2000. Clean Streams Program: Aptos Creek qatershed data report: March – August, 2000. Coastal Watershed Council.

Downing, J., R. Fairey, C. Roberts, E. Landrau, R. Clark, J. Hunt, B. Anderson, B. Phillips, C.J. Wilson, F. LeCaro, G. Kapahi, K. Worcester, M. Stephenson, M. Puckett. 1998. Chemical and Biological Measures of Sediment Quality in the Central Coast Region, Final Report. State Water Resources Control Board.

Dynamac. 1998. Clear Creek management area water quality monitoring narrative report. Conducted for the U.S Department of Interior, Bureau of Land Management Hollister Resource Area Office.

EXTOXNET, 1996. Extension toxicology network pesticide information profiles. http://ace.ace.orst.edu/info/extoxnet.

Golder and Associates Inc. 1997. Qualitative and quantitative analysis of degradation of the San Benito River. Prepared for the city of Hollister.

Hansen, Randy. USGS. Pajaro study.

Harrington, J.M. 1996. California stream bioassessment procedures. California Department of Fish and Game, Water Pollution Control Laboratory. Rancho Cordova, CA.

Heal the Bay Beach water quality report card. www.healthebay.org

Hecht, Barry and G. Kittleson. 1998. An assessment of streambed conditions and erosion Control efforts in the San Lorenzo River watershed, Santa Cruz County, California.

Hynes, H. B. N. 1970. The ecology of eunning waters. University of Toronto Press, Canada.

J.M. Montgomery Consulting Engineers. 1979. Review of Soquel/Aptos watershed literature for a CEQA compliance document related to an Aptos Creek reclamation study.

J.M. Montgomery Engineers. 1993. Long term wastewater management plan final report: Pajaro River Discharge Evaluation. Completed for South County Regional Wastewater Authority.

Jagger, P. 1981. Impact of Agricultural Return Flows an Surface Water Quality in the Monterey Bay Area. Association of Monterey Bay Area Governments.

Jagger, P., H. Kolb, S. Capitain. 1993. Final Report: Literature review of nonpoint Ssource impacts in the San Lorenzo River watershed.

Jones, K.R., Leonard, W.R., Briggs, R.W., and Charpentier, A.. 1983. Consideration of Basin Plan Nutrient Objectives for Pajaro River and Llagas Creek. Staff Report, Central Coast Regional Water Quality Control Board.

Leonard, William R. 1972. Water quality conditions of the San Lorenzo River. Central Coast Regional Water Quality Control Board.

Long, E.R., and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 62. National Oceanic and Atmospheric Administration, Seattle, WA. 86 pp.

Long, E.R., D.L. MacDonald, S.L. Smith and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management. 19(1):81-97.

Long, E.R., L.J. Field, and D.L. MacDonald. 1998. Predicting toxicity in marine sediments with numerical sediment quality guidelines. Environmental Toxicology and Chemistry 17:714-727.

Mearns, A. J., et al. 1991. NOAA Technical Memorandum NOS ORCA 62. Contaminate trends in the Southern California Bight, inventory and assessment. Seattle WA.

Metcalf and Eddy. 1979. Water resources and environmental engineering,. McGraw-Hill, Inc., San Francisco.

Montgomery, J.M., Consulting Engineers, (1993), South County Regional Wastewater Authority, Long Term Wastewater Management Plan, Final Report, Pajaro River Discharge Evaluation

Morgan, Norman L. and Turner, John L. 1977. Calculation of un-ionized ammonia for fresh water. Fish and Wildlife Water Pollution Control Laboratory. Environmental Services Branch, Administrative Report No. 77-1.

Moyle, Peter B. 1976. Inland fishes of California. University of California Press, Berkeley.

National Academy of Sciences-National Academy of Engineering. 1973. Water Quality Criteria 1972 (Blue Book). EPA Ecological Research Series. EPA-R3-73-033. U.S. Environmental Protection Agency, Washington, D.C.

Nelson, J. 2000. California Department of Fish and Game memorandum to file re: results of electro-fishing surveys conducted on Aptos Creek, November 1999.

Phillip Williams and Associates and John Stanley and Associates. 1989. San Lorenzo River enhancement plan: a plan for biological enhancement on the lower San Lorenzo River. Prepared for the City of Santa Cruz.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989 Rapid Bioassessment Protocols for use in streams and rivers: benthic macroinvertebrates and fish. EPA 444/4-89-001. U.S. Environmental Protection Agency, Washington, D.C.

Powell, R. G. 1986. A saga of logging and railroading above Aptos and Soquel: 1881 – 1921.

Questa Engineering. 1997. Water Resources Management Plan for the Watsonville Slough System, Santa Cruz County. Prepared for Association of Bay Area Governments.

Rasmussen, D. 2000. State Mussel Watch Program 1995 –1997 data report. State Water Resources Control Board, California Environmental Protection Agency.

Regional Water Quality Control Board (RWQCB). 1994. Central Coast Region Water Quality Control Plan.

Regional Water Quality Control Board (RWQCB). 2001. Regional stormwater monitoring program data summary, 1999-2000. Work files of Central Coast Regional Water Quality Control Board, San Luis Obispo.

Ricker, J., S. Peters and R. Golling. 2001. Evaluation of urban water quality task 4 report; San Lorenzo river watershed management plan update. County of Santa Cruz.

Ronibson, T.R., A. Leydecker, J.M. Melack, and A.A. Keller. 2003. Santa Barbara Coastal Long Term Ecological Research (LTER): Nutrient concentrations in coastal streams and variations with land use in the Carpinteria Valley, California. California and the World Oceans '02 Conference, Santa Barbara, California, American Society of Civil Engineers.

RWQCB. 1999. Salinas River Watershed Management Action Plan.

Santa Cruz County Resource Conservation District. April 2003. Soquel Creek Watershed Assessment and Enhancement plan.

Smith, Jerry. 2002 Distribution and abundance of juvenile Coho and Steelhead in Gazos, Waddell and Scott creeks in 2002.

Smith, Jerry. 2003. Water quality concerns and central coast Steelhead and Coho. Unpublished summary of findings. http://www.swrcb.ca.gov/rwqcb3/Facilities/Timber%20Harvest/WATER%20QUALITY%20CONCERNS.pdf

Snider, B., K.A. Urquhart and D. Marston. 1995. The relationship between instream flow and Coho Salmon and Steelhead habitat availability in Scott Creek, Santa Cruz County, California. California Department of Fish and Game.

Soil Conservation Service. 1990. County Resources Inventory, water bodies impaired by nonpoint sources. Santa Cruz County.

State Mussel Watch program. 2000. State Mussel Watch Program 1995-1997 Data Report.

State Water Resources Control Board 1999. Consolidated Toxic Hot Spots Cleanup Plan Volume 1: Policy, Toxic Hot Spots List, and Findings. June 1999.

State Water Resources Control Board. 1999. Consolidated toxic hot spots cleanup plan. Volume II: Regional Cleanup Plans.

State Water Resources Control Board. 2000. Policy for implementation of toxics standards for inland surface waters, enclosed bays, and estuaries of California (Phase 1 of the Inland Surface Waters Plan and Enclosed Bays and Estuaries Plan). March 2, 2000. State Water Resources Control Board, California Environmental Protection Agency, Sacramento, California.

Stephenson, M.D., 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.

Swanson Hydrology and Geomorphology. 2001. Zayante area sediment source study. Prepared for County of Santa Cruz Department of Environmental Health.

Swanson, M. and Habitat Restoration Group. 1993. Final Pajaro River lagoon management plan (SCH#9302-3035). Prepared for the Pajaro Valley Water Management Agency.

Titus, Robert, D.C. Erman, and W. M. Snider. 1994. History and Status of Steelhead in Califoroia Coastal Drainages South of San Francisco Bay. Manuscript as of Septeber 27, 1994.

Toxic Substances Monitoring Program. 1999. unpublished data

U.S. EPA. 2000. Nutrient Criteria Technical Guidance Manual: Rivers and Streams. United States Environmental Protection Agency, Office of Water. EPA-822-B-00-002, July 2000.

U.S. EPA. 1991. Handbook: remediation of contaminated sediments. EPA/625/6-91/028. April, 1991.

U.S. EPA. 1993. Manual: nitrogen control. Office of Research and Development. EPA/625/R-93/010.

U.S. EPA. 1997. Monitoring guidance for determining the effectiveness of nonpoint source controls. EPA / 841-96-004.

U.S. EPA. 1999. 1999 Update of ambient water quality criteria for ammonia. Office of Water 4304, EPA/822/R-99/014.

U.S. EPA. 1999. Protocol for developing nutrient TMDLs. United States Environmental Protection Agency, Nov 1999.

U.S. Food and Drug Administration. 1984. Shellfish Sanitation Interpretation: Action Levels for Chemical and Poisonous Substances, June 21, 1984. U.S.F.D.A, Shellfish Sanitation Branch, Washington, D.C.

US Environmental Protection Agency. 1992 (Feb. 4). Ethyl Parathion, correction to the amended cancellation order. OPP, USEPA, Washington DC.

Williamson, R. L. (1994), San Jose State University Department of Civil Engineering and Applied Mechanics and Merritt Smith Consulting, The Establishment of Nutrient Objectives, Sources, Impacts, and Best Management Practices for the Pajaro River and Llagas Creek

Williamson, R. San Jose State University. 1994. The establishment of nutrient objectives, sources, impacts, and best management practices for the Pajaro River and Llagas Creek. February 28, 1994.

Attachment 2– Master Contract Needs Form

Region: 3	**"Level of Effort"/Cost Estimate**
Contact:	
Study design assistance: *No*	
Site reconnaissance: *No*	
Field Sampling: *Yes* *Collect sediment (walk in)*	**Cost:** $11,000
Lab Analyses • **Organics** *Yes* • **Metals** *Yes* • **Toxicity** *Yes* • **Biological Assessment** *Yes*	**Cost:** $256,000 (Most of this will be spent during 05-06)
Data Validation/QA verification	included
Database entry	included
Data Analysis	CCAMP will do analysis
Reporting: *Yes*	Write up of Harbors results (02-03 monitoring) **Cost:** $15,000
Total	Amount: $ 282,000

Attachment 3 – Other Contract needs Form

Region: Region 3
Contract # (if an amendment): 03-035-130-0 (PCA code 157-01)
Proposed Contractor: BC Laboratories
Contract Amount: $28,000
Contract Manager: Karen Worcester
Duration of Contract: September 22, 2003 – June 30, 2004
Contract Request Package will be submitted to DWQ no later than: *12//03* **All FY 03-04 contract packages must be received by 12/03; FY 04-05 contract packages by 7/04**
How will you comply with Civil Service Constraints? Contract has gone through full bid process, including distribution to small and minority owned businesses, etc.
How will you insure compliance with SWAMP QMP? Contract bid solicitation assessed lab ability to meet SWAMP Target Reporting Limits. Lab may be required to participate in an inter-calibration exercise. (budget $5000)
Who/when will data be entered into SWAMP database? **Metadata:** 1. Field Data: CCAMP electronic uptake Lab Data: CCAMP electronic uptake
Will you include SWAMP QA and data reporting requirements in contract boilerplate? Contract has already been let, but includes language about reporting in EDF format
Why is the contract needed? (Why can't you use the Master Contract?) CCAMP most efficiently utilizes resources for conventional water quality monitoring through private lab contract using electronic uptake and QA checking tools. The Regions contract lab is also available to pick up samples and meet short holding times.
Do you anticipate amending this contract w/ FY 04-05 funds? Yes

Attachment 4 – FY 03-04 Work Order

SWAMP DFG Work Order No. DFG-03-3-001
for CCAMP/SWAMP FY 03/04 DFG field and analytical laboratory services for RWQCB 3

1. **Work Order No.**: **DFG-03-3-001** (in support of SWRCB Contract No.????????).

2. **Work Order Title**: CCAMP/SWAMP FY03-04 DFG field and analytical services for RWQCB 3.

3. **Contractor**: California Department of Fish and Game.

4. **Regional Board contact for this Work Order**: Karen Worcester (805-549-3333)
   Email: kworcest@rb3.swrcb.ca.gov

5. **Term of this Work Order**: 07/01/03 through 3/31/05.

6. **The maximum amount for this Work Order**: 164,238

   Funding for the collection and analysis of samples specified in this task order is provided for by Region 3 FY03-04 funds in the DFG Master Contract.

7. **Signatures authorizing work to proceed within this Work Order**: The signatures below indicate that the parties agree to the scope, deliverables, and budget specified in this Work Order. This Work Order is not effective until the Project Director and the Contract Manager sign the Work Order. If the work identified in this Work order can not be completed for the budgeted amount, the Work Order must not be signed. Under no circumstances is any work to be completed in excess of the budgeted amount unless there is a formal written amendment to the Work Order.

For Contractor:

_____ _____
Signature Date
Max Puckett, Contractor Project Director

For SWRCB:

_____ _____
Signature Date
Del Rasmussen, SWRCB Contract Manager

8. WORK TO BE PERFORMED:

1. PURPOSE AND OBJECTIVES OF PROPOSED WORK:

This Work Order implements a monitoring and assessment program under the Surface Waters Ambient Monitoring Program (SWAMP) and the Central Coast Ambient Monitoring Program (CCAMP) for RWQCB 3. The work described in this Work Order will focus on monitoring numerous coastal confluence sites - in the Central Coast Region, which has occurred annually since April 2001. Sample collection and analysis conducted through this Work Order will complement monthly conventional water quality sampling and analyses conducted by RWQCB 3 staff and its contract laboratory

There are two main sampling components to this Work Order. First, RWQCB 3 staff will conduct sampling for benthic macroinvertebrate (BMI) assemblages on a subset of 31 conventional water quality monitoring sites in Spring 2004 and samples will be sent to the California Aquatic Bioassessment Laboratory for storage and analysis at a later date. The second component involves sampling by CDFG staff for sediment chemistry and toxicity analyses. The sampling team will target fine grain sediments as some organic chemicals are found adhered to fine sediments; metals can also be found at elevated concentrations in sediment.

Synoptic monitoring for sediment chemistry and toxicity with benthic macroinvertebrates and conventional water quality using FY 03-04 funding will contribute to a weight of evidence approach that will enable Region 3 to evaluate several types of data to determine beneficial use impairment.

CCAMP Mission Statement

Collect, assess, and disseminate water quality information to aide decision-makers and the public in maintaining, restoring, and enhancing water quality and associated beneficial uses in the Central Coast Region.

Program Goals

- Characterize the status and trends of water quality and associated beneficial uses in the Region's watersheds, estuaries, and near-shore areas through ambient monitoring;
- Identify localized effects and probable pollutant sources through focused monitoring;
- Determine whether water quality standards are being met and beneficial uses are being supported;
- Provide scientifically based water quality information to users in accessible forms to support decision-making;
- Coordinate with other monitoring programs to promote an effective and efficient regional monitoring effort.

2. SCOPE OF WORK:

NOTE: This Work Order funds the collection of samples as shown in Table A, and provides funding for the analysis of samples as outlined in Table A.

a) SAMPLE COLLECTION

Bottom-sediment sample collection for sediment chemistry and toxicity: Contractor (CDFG) shall collect bottom sediment samples at 31 sample locations specified in Table A, using either a clean scoop to collect the top 2-3 cm of sediment or using a Young-modified Van Veen sediment grab, according to SWAMP protocol. Samples are collected into a pre-cleaned homogenization jar and subsequently aliquoted to the appropriate pre-cleaned and labeled jars for analysis. Sediment samples shall be analyzed using "freshly collected sediment" for sediment TOC, polyaromatic hydrocarbons (PAH's), organic chemicals, sediment grain size (phi scale), sediment toxicity testing (*Hyallea azteca* 10-day sediment survival), and sediment trace metals as shown in Table A. Actual location of stations will be determined by Region 3 and submitted to CDFG with latitude and longitude coordinates.

LAB ANALYTICAL SERVICES (paid for through this Work Order):

a) Sediment analyses: Sediment samples from each station will be analyzed for sediment grain size (phi scale; using Plumb method), PAH's, organic chemicals, sediment TOC and trace metal chemistry. Sediment samples from each station will also be analyzed by the UC Davis-Granite Canyon Lab for toxicity using the 10-day bedded sediment test for survival with *Hyallea azteca* amphipods (EPA method 2000). Specific analyses to be conducted on sediment samples from each site are identified in Table A.

b) Benthic macroinvertebrate analysis:

Benthic Macroinvertebrate samples from each site will be analyzed following the California Stream Bioassessment Protocol (CDFG 2003) for level III or professional level identification to the genus and/or species level. Each sample is randomly sub-sampled until 300 organisms have been identified to the standard level of taxonomy using the appropriate keys. Sites to be monitored for BMI assemblages are identified in Table A.

Quality Assurance and Quality Control (QA/QC):

Chemistry data will include the analytical result, method detection limit, reporting limit, and relevant quality assurance (QA) information (or metadata information within the data report) on surrogate recovery, duplicate relative percent difference (RPD), matrix spike percent recovery and RPD, and blank spike percent recovery and RPD.
Any deviations from QA goals established in the QAPP will be noted. Data will be made available in electronic format unless otherwise requested.

3. REPORTS:

Upon completion of the Work Order, the Regional Board and State Board shall receive an electronic copy of all data reports, data and quality assurance information, as well as any other products requested, as specified in each respective Work Order. The Project Director or his/her authorized representative shall verify and ensure the accuracy of all data before it is transmitted.

9. MAXIMUM WORK ORDER COST/BUDGET:

The maximum cost of all SWAMP services in this Work Order shall not exceed **$164,238**. Funding for the collection and analysis of samples specified in this Work Order is provided for by Region 3 FY03-04 funds in the DFG Master Contract. Actual billing for this Work Order may be done on a total Work Order cost basis, with the work described and budgeted in Table A herein as the basis for the cost.

Table A. SWAMP Work Order FY 30-04

Analysis or Service Performed	Unit Cost (per sample)	304APT-Aptos Creek lagoon	304GAZ-Gazos Creek Lagoon @ Highway 1	304LOR-San Lorenzo Estuary @ Laurel St.	304SCO-Scott Creek Lagoon @ Highway 1	304SOQ-Soquel Creek lagoon	304WAD-Waddell Creek Lagoon @ Highway 1	305PJP-Pajaro River @ Main Street	307CML-Carmel River at Highway 1	308BGC-Big Creek at Highway 1	308BSR-Big Sur River @ Andrew Molera foot bridge	308WLO-Willow Creek @ Highway 1	309DAV-Salinas River @ Davis Road	309OLD-Old Salinas River @ Monterey Dunes Way	309TDW-Tembladero Slough @ Monterey Dunes Way	310ADC-Arroyo de la Cruz @ Highway 1	310ARG-Arroyo Grande Creek @ 22nd Street	310PIS-Pismo Creek above Highway 101	310SLB-San Luis Obispo Creek @ San Luis Bay Drive	310SRO-Santa Rosa Creek @ Moonstone Drive	310SSC-San Simeon Creek @ State Park foot bridge	**310TWB-Chorro Creek @ South Bay Boulevard**	312SMA-Santa Maria River @ Estuary	313SAI-San Antonio Creek at San Antonio Creek Road	314SYN-Santa Ynez River @ 13th Street	315ABU-Arroyo Burro Creek @ Cliff Drive	315ATA-Atascadero Creek @ Ward Drive	315CRP-Carpinteria Creek down stream Carpenteria Ave	315FRC-Franklin Creek @ Carpenteria Avenue	315GAV-Canada de la Gaviota @ State Park entrance	315MIS-Mission Creek @ Montecito Street	315RIN-Rincon Creek @ Bates Road, u/s Highway 101	**Total number of samples**	**Total Cost (# of samples X cost per unit)**	**# of QA Samples (5% field duplicates)**	**Total QA cost**	**Total with QA**
	Station name and number ------>																																					
Conventional Water Quality	$ 222	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**124**	41,292	2	$3,996	$27,972
Fresh Water Toxicity																																	0	0		$0	$0
Fresh water Toxicity (7d Cerio) with ELISA, (CCAMP collects)	$ 787																																0	0		$0	$0
Pimephales minnow test in Fresh Water	$ 717																																0	0		$0	$0
Phase I Toxicity Identification Evaluation (TIE)(1)	$ 3,885																																0	0		$0	$0
ELISA Analysis of Diazinon	$ 35																																0	0		$0	$0
ELISA Analysis of Chlorpyrifos	$ 35																																0	0		$0	$0
Walk up sediment collection	$ 788	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	24,428	2	$1,576	$26,004
Sediment suite: (metals)	$ 246	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	7,626	2	$492	$8,118
Total Mercury	$ 96	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	2,976	2	$192	$3,168
Full Scan (pesticide and Aroclors)	$ 872	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	27,032	2	$1,744	$28,776
PAH (including substituted PAHs)	$ 856	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	26,536	2	$1,712	$28,248
Sediment grain size – full analysis (phi scale)	$ 130	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	4,030	2	$260	$4,290

Sediment TOC	$ 60	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	1,860	2	$120	$1,980
Hyalella 10-d (acute toxicity)	$ 882	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	27,342	2	$1,764	$29,106
ELISA Analysis of Diazinon	$ 35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	1,085	2	$70	$1,155
ELISA Analysis of Chlorpyrifos	$ 35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	1,085	2	$70	$1,155
BMI Taxonomy only (3 replicates)	$ 1,113	1	1					1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	24	26,712	2	$2,226	$28,938
R3 proportion of CDFG pass-thru overhead	$ 3,000																																	$3,300			$3,300
																																					<$27,972>
TOTAL COST OF ALL SERVICES AS SHOWN ABOVE:																																					$164,238