SWAMP
Surface Water Ambient Monitoring Program

SWAMP Annual Work Plan for the Central Coast Region	2009-10

Central Coast Ambient Monitoring Program Annual Work Plan

September 2009

California Water Boards

www.waterboards.ca.gov/swamp

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Five Year Plan

Introduction

Fiscal Year (FY) 2009-10 will mark the eighth year of the coordinated implementation of the Surface Water Ambient Monitoring Program (SWAMP). The Central Coast Ambient Monitoring Program (CCAMP) conducts SWAMP monitoring for the Central Coast Water Board and receives much of its funding through SWAMP. A general description of the monitoring efforts that is being implemented in Region 3 through CCAMP is provided in this document. Specific monitoring planned for 2010 is described in more detail.

The basic CCAMP study design has been in place since the inception of the CCAMP program in 1998. CCAMP employs a tributary-based approach to characterize all major waterbodies in the Region, as well as larger tributary inputs to those waterbodies. Long-term monitoring sites are selected at major tributary inputs and at the mainstem upstream of each tributary input, and "focused" monitoring sites are placed at other locations of interest in the watershed (such as above and below specific land uses, point sources, best management practices, or other areas in need of characterization).

The CCAMP program monitors and assesses all major waterbodies in the Region using two monitoring strategies: 1) coastal confluences monitoring, which involves long term trend monitoring at the lower ends of all of the larger coastal streams and rivers in the Region, and 2) watershed rotation area monitoring, where the Region is divided into five watershed areas and tributary based sampling is conducted each year in one of the areas. Over a five-year period all of the Hydrologic Units in the Region are monitored and evaluated. Watershed sites are revisited on a five year basis and coastal confluence sites are monitored continuously, allowing detection of change over time.

CCAMP's second full five-year rotation of watershed monitoring was completed in December, 2009. We have elected to postpone initiation of the third series of watershed rotations for one year, due to budgeting and other considerations. In 2010 we will continue coastal confluence trend monitoring and will revise our web assessment tools. Our watershed rotation monitoring will restart in 2011 in the Pajaro and Big Basin watersheds.

One of the primary purposes of CCAMP is to support the Clean Water Act 303(d) listing process and the 305(b) water quality assessment report. Assessment is consistent with the State's 303(d) Listing Policy (2004), in following one of two decision-making approaches to determine if beneficial uses are supported: 1) percent exceedance of water quality criteria or other accepted standards, using a binomial distribution or 2) a weight-of-evidence approach, where data from multiple types of monitoring (biological, physical and chemical) are considered to evaluate beneficial use support. This latter approach is particularly important when evaluating problems for which no water quality criteria exist.

CCAMP data is also heavily used by permit staff, enforcement staff, and others for regulatory and management decision-making. The CCAMP program addresses a wide variety of water quality parameters and beneficial use questions with the intent providing information to inform further action by agency staff. The sampling design strives to provide a maximal amount of information within one sampling framework to support this broad mission. Further follow-up through enforcement staff, TMDL staff or others provides additional detail to understand the full scope of problems identified by CCAMP.

Vision and Goals of the Central Coast Water Board and CCAMP Program Objectives

CCAMP serves as the primary information gathering entity for the Central Coast Water Board. The Water Board has recently developed an agency vision of "Healthy Watersheds". Three goals support this mission. The first goal in particular drives a number of CCAMP assessment activities, including development of multi-metric health "indices" from the various data types collected by the program.

Central Coast Water Board Goals

- By 2025**,** 80% of aquatic habitat is healthy**,** and the remaining 20% exhibits positive trends in key parameters**.**
- By 2025**,** 80% of lands within any watershed will be managed to maintain proper watershed functions, and the remaining 20% will exhibit positive trends in key watershed parameters**.**
- By 2025**,** 80% of groundwater will be clean, and the remaining 20% will exhibit positive trends in key parameters**.**

The CCAMP program mission 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. There are several CCAMP programmatic objectives:

- Assess watershed condition on a five-year rotational basis, using multiple indicators of health.
- Assess long-term water quality trends at the lower ends of coastal creeks.
- Conduct periodic assessments of harbors, estuaries, lakes and near-shore waters using multiple indicators of health.
- Support investigations of other water quality problems, including emerging contaminants, sea otter health, pathogenic disease, toxic algal blooms and others.
- Provide water quality information to users in accessible forms to support decision-making (www.ccamp.org).
- Collaborate with other monitoring programs to promote effective and efficient monitoring.

The scope of CCAMP monitoring activities in estuarine and marine areas is minimal because of program funding constraints. Characterization of these areas is being undertaken primarily through grant funding, restructured permit monitoring and collaboration with other agency programs. Within the five year period addressed by this work plan, no SWAMP funds are anticipated for regional assessment work in estuaries or marine areas.

CCAMP Monitoring Questions and Objectives

CCAMP monitoring questions have been adapted from those posed in the 1999 SWAMP Site-Specific Monitoring Guidance related to beneficial use support. For each question, we have identified objectives, one or more associated beneficial uses, applicable water quality criteria that address these objectives, and the monitoring approach we are following. In addition, we have identified the limitations associated with our monitoring approach. We are screening widely for beneficial use support under a uniform monitoring strategy that is consistent with the requirements of the 303(d) listing policy. Given program funding and staffing, this maximizes the information we provide to decision-makers for their use and further investigation.

Is there evidence that it is unsafe to swim?
Are swimming conditions improving or getting worse?
Beneficial Use: Water Contact Recreation (REC-1)
Monitoring 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 and EPA mandated objectives. CCAMP data as well as data collected by local agencies and organizations will be used to assess shoreline and creek conditions.
Monitoring Approach: Monthly monitoring for indicator organisms (e.g. *E. coli*, fecal coliform); compilation of other data sources
Assessment Limitations: CCAMP sampling approach does not meet the frequencies identified in the Central Coast Basin Plan of 5 times in a 30-day period.
Criteria:

- Fecal coliform exceeding 400 MPN/100 ml
- *E. coli* exceeding 235 MPN/100 ml
- Application of the binomial test to sample exceedance rate according to the SWRCB Listing Policy (2004), where
    - Null Hypothesis: Actual exceedance proportion is <=10%
    - Alternate Hypothesis: Actual exceedance proportion >25%
- Geometric mean of fecal coliform samples greater than 200 MPN/100mL

Interpretation: A minimum of five exceedances is required to determine impairment. If the site has exceedances, but there are fewer than five, site is considered partially impaired. The geomean criterion is compared to the geomean of data from the entire sampling year. If a site geomean exceeds the geomean criterion, the site is considered impaired. Trend data will be evaluated using non-parametric approaches, including Seasonal Mann-Kendall and Kruskall-Wallace tests, and by evaluating change in exceedance rate over time.

Is there evidence that it is unsafe to drink the water?
Is there evidence that drinking water quality is improving or getting worse?
Beneficial Use: Municipal and Domestic Water Supply (MUN)

Objective(s): At sites throughout water bodies that are sources of drinking water or recharge ground water, determine percent of samples that exceed drinking water standards or adopted water quality objectives used to protect drinking water quality.
Monitoring Approach: Monthly sampling for nitrate and pH.
Assessment Limitations: CCAMP does not typically sample for metals or organic chemicals in water; assessment is based only on conventional parameters that have drinking water standards.
Criteria:

- Nitrate (as N) exceeding 10 mg/L (as N)
- pH under 6.5 or over 8.3
- The binomial test is applied to sample exceedance rate according to the SWRCB Listing Policy (2004), where
  - Null Hypothesis: Actual exceedance proportion is <=10%
  - Alternate Hypothesis: Actual exceedance proportion >25%

Interpretation: For nitrate and pH<6.5 or > 8.3, a minimum of five exceedances is required to determine impairment. If the site has exceedances, but there are fewer than five, site is considered partially impaired. Because of the naturally high pH levels in some Region 3 watersheds, site where there is not urban, agriculture or rangeland uses will not be listed as impaired based on high end pH exceedance alone. Trend data will be evaluated using parametric (t-tests and regression analysis) and non-parametric approaches (Seasonal Mann-Kendall and Kruskall-Wallace tests, and change in exceedance rate over time).

Is there evidence that it is unsafe to eat fish or other aquatic resources?
Beneficial Uses: Commercial and Sport Fishing (COMM), Shellfish Harvesting (SHELL)
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).
Monitoring Approach: Fish and bivalve tissue collection and chemical analysis
Assessment Limitations: CCAMP has not routinely collecting bioaccumulation samples since California Mussel Watch Program funding was lost in 2000; however, we are periodically able to sample at high priority sites. Due to limited sample count at most locations, this data is typically not evaluated for trends.
Criteria:

- Exceedance of Office of Environmental Health Hazard Assessment Criteria for fish and shellfish tissue. In the absence of OEHHA criteria, use U. S. Food and Drug Administration Action Levels, or Median International Standards, in that order.
- The binomial test is applied to sample exceedance rate according to the SWRCB Listing Policy (2004), where
  - Null Hypothesis: Actual exceedance proportion is <=3%
  - Alternate Hypothesis: Actual exceedance proportion >18%

Interpretation: A minimum of two exceedances of a chemical criterion from two or more separate samples is required for a site to be considered impaired. If there is one exceedance, the site is considered partially impaired.

Is there evidence that aquatic life is not protected?

Are there significant trends in conditions for aquatic life?
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)
Objective(s): At sites along the main-stem 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, biostimulation, benthic community condition, habitat condition, and physical and chemical condition.
Monitoring Approach: Spring synoptic sampling for sediment and water column toxicity, sediment chemistry, benthic invertebrate assemblages, and associated habitat quality. Toxicity Identification Evaluation and/or chemistry follow-up for toxic sites. Monthly conventional water quality monitoring for nutrients, dissolved oxygen, pH, turbidity and water temperature. Pre-dawn or 24-hour continuous sampling for dissolved oxygen sags.
Assessment Limitations: CCAMP does not have the funding to sample all sites for benthic invertebrates, sediment chemistry or water and sediment toxicity. When sediment chemistry is analyzed, an array of metals and organic chemicals is sampled that does not contain all currently applied pesticides, pharmaceuticals, and numerous other synthetic organic chemicals. Habitat sampling is conducted only in association with benthic invertebrate sampling and is not spatially comprehensive.
Criteria:

<u>Toxicity</u>

- Sediment or water toxicity effects significantly greater than reference tests and survival, growth, or reproduction less than 80% of control
- For sediment and water toxicity, the binomial test is applied to sample exceedance rate according to the SWRCB Listing Policy (2004), where
    - Null Hypothesis: Actual exceedance proportion is <=3%
    - Alternate Hypothesis: Actual exceedance proportion >18%

<u>Sediment and Tissue Chemistry</u>

- Sediment concentrations over Probable Effects Levels (MacDonald, et al, 1996) or NOAA Effects Range Medium values (ERMs) (Long, et al, 1998) (for marine sediments) for chemicals with available criteria.
- Tissue concentrations of organic chemicals over established U.S. Fish and Wildlife and National Academy of Sciences guidelines for protection of aquatic life.
- For sediment and tissue chemistry exceedances, the binomial test is applied to sample exceedance rate according to the SWRCB Listing Policy (2004), where
    - Null Hypothesis: Actual exceedance proportion is <=3%
    - Alternate Hypothesis: Actual exceedance proportion >18%

<u>Conventional Water Quality</u>

- Dissolved oxygen samples below 7.0 mg/L (cold water streams) or 5.0 mg/L (warm water streams) – for data collected using 24-hour probes, only the lowest value is considered.
- pH samples under 7.0 or above 8.5
- Un-ionized ammonia samples over 0.025 mg/L NH_3 as N
- For conventional chemistry exceedances in the water column, the binomial test is applied to sample exceedance according to the SWRCB Listing Policy (2004), where

    - Null Hypothesis: Actual exceedance proportion is <=10%
    - Alternate Hypothesis: Actual exceedance proportion >25%

Ecological Indicators

- Bio-stimulatory risk rank falls within scoring range of lower quality sites (above 0.4)
- CCAMP Index of Biotic Integrity falls within scoring range of lower quality sites (below 3.0)

Interpretation: For toxicity, sediment chemistry or tissue chemistry**,** a minimum of two exceedances from two or more separate samples is required for a site to be considered impaired. If there is one exceedance, the site is considered partially impaired.   For conventional parameters, a minimum of five exceedances is required for a site to be considered impaired. If the site has exceedances, but there are fewer than five, the site is considered partially impaired. Because of the naturally high pH levels in Region 3, no site will be listed as impaired based on high end pH exceedance alone. Sites that fall within the scoring range of lower quality sites for Bio-stimulatory Risk or Index of Biotic Integrity are considered partially impaired. Professional judgment is used to determine whether multiple lines of evidence of partial impairment justify a determination of full impairment. Trend data will be evaluated using parametric (t-tests and regression analysis) and non-parametric approaches (Seasonal Mann-Kendall and Kruskall-Wallace tests, and change in exceedance rate over time), as appropriate.

Is there evidence that water is unsafe for agricultural use?
Is there evidence of trends in water quality for agricultural uses?
Beneficial Use: Agricultural supply (AGR)
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.
Monitoring Approach: Monthly sampling for nutrients and salts.
Assessment Limitations: CCAMP does not typically sample for all of the parameters identified in the Central Coast Water Quality Control Plan for protection of agricultural beneficial uses.
Criteria:

- pH below 6.5 or above 8.3
- Chloride over 106 mg/L
- Electrical conductivity results over 3000 uS/cm
- Boron over 0.75 mg/L
- Sodium over 69 mg/L
- Nitrate samples over 30 mg/L as N
- For all conventional chemistry exceedances in the water column, the binomial test is applied to sample exceedance according to the SWRCB Listing Policy (2004), where
    - Null Hypothesis: Actual exceedance proportion is <=10%
    - Alternate Hypothesis: Actual exceedance proportion >25%

Interpretation: Minimum of five exceedances of any criterion are required to determine impairment. If the site has exceedances, but there are fewer than five, site is considered partially impaired.

Is there evidence of impairment to aesthetics or other non-contact recreational uses?
Beneficial Use: Non-Contact Water Recreation (REC-2)

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.
Monitoring Approach: Monthly sampling for pathogen indicator organisms (*E. coli*, total and fecal coliform); monthly qualitative assessment of % algal cover, presence of scum, odor, etc.
Assessment Limitations: CCAMP does not currently conduct a formal assessment for trash.
Criteria:

- pH samples under 7.0 or over 8.3
- Fecal coliform over 400 MPN/100 ml
- *E. coli* over 400 MPN/100 ml
- For pH, fecal coliform, and *E. coli* exceedances, the binomial test is applied to sample exceedance according to the SWRCB Listing Policy (2004), where
    - Null Hypothesis: Actual exceedance proportion is <=10%
    - Alternate Hypothesis: Actual exceedance proportion >25%
- Dry weather turbidity persistently over 10 NTU
- Filamentous algal cover persistently over 25%
- Scum, odor, trash, oil films persistently present

Interpretation: Minimum of five exceedances of pH, fecal coliform, or *E. coli* criteria are required to determine impairment. If the site has exceedances, but there are fewer than five, site is considered partially impaired. Because of the naturally high pH levels in Region 3, no site will be listed as impaired based on high end pH exceedance (>8.3) alone. Professional judgment is used to determine whether dry weather turbidity, algal cover, scum, odor, trash, or oil films are present at levels sufficient to represent a nuisance or hazard.

General Characterization of the Central Coast Region

A summary of water quality and general characteristics of each of the Hydrologic Units of the Central Coast Region is provided in Appendix A. Each of these Hydrologic Units (and several larger Hydrologic Subareas) is monitored continuously (monthly) at a long-term coastal confluence site, just above saltwater influence.

Intra- and Inter-agency Coordination

CCAMP staff is coordinating with other Region 3 staff and other programs to ensure consistency with SWAMP in data gathering methods, data quality objectives, and data reporting formats. Table 1 summarizes coordinated monitoring activities in Region 3.

Table 1. Intra- and Inter-agency monitoring in coordination with CCAMP. **Note: ***TMDL data collected by SWAMP contractors has followed SWAMP QAMPs and had SWAMP comparable QAPPs. Other data has not always been SWAMP comparable. Some but not all TMDL data has been obtained and reformatted by CCAMP.

Monitoring Activity	Monitoring Program description	Available Data Format	Using SWAMP QAMP	Using SWAMP reviewed QAPP	Data format SWAMP compatible	Data used for 303(d) and 305(b) analysis
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	*	*	*	X
Cooperativ e Monitoring Program for Agriculture	Agriculture monitoring is required in association with irrigation discharge waiver	Program provides data to CCAMP in SWAMP batch upload format and has a SWAMP reviewed QAPP		X	X	X
Grant Projects	Grants support a variety of monitoring ranging from regionalized monitoring for agriculture to site specific implementation monitoring.	Data is submitted in electronic format using CalDUCS batch upload templates. Most QAPPs are SWAMP reviewed and are comparable.		X	X	X
Sanctuary Integrated Assessment and Monitoring Project (SAM)	This project is continues to aid data providers in reformatting and submitting data to the CalDUCS system.	CalDUCS batch upload format; data sources are evaluated for consistency with SWAMP QAPP		X	X	X
Central Coast Long-term Environme ntal Asssessmen t Network (CCLEAN)	This discharger organization monitors several nearshore sites for sediment quality, benthic infauna, mussel tissue chemistry, and other parameters.	Program is required to use the CalDUCS batch upload system for data delivery and has a SWAMP reviewed QAPP.		X	X	X
City of Salinas Stormwater Monitoring	Monitors upstream and downstream of City of Salinas for toxicity, nutrients, coliform, and benthic invertebrates.	Program is required to use the CalDUCS batch upload system for data delivery and has a SWAMP reviewed QAPP.				
Morro Bay National Estuary Program	Ongoing Chorro and Los Osos Creek and Morro Bay water quality sampling, some habitat sampling.	Data currently being entered by volunteers into CCAMP format and is being adapted for		X	X	X

Volunteer Monitoring Program		CalDUCS delivery. QAPP is SWAMP comparable.					
Timber Harvest Waiver Program	Turbidity, temperature and photographic monitoring takes place before, during, and after timber harvest.	Data is submitted electronically in a SWAMP compatible format.				X	X
USGS	Continuous flow monitoring at several locations monitored by CCAMP. Water quality monitoring at a few sites.	Data available on web and acquired annually.					X

CCAMP Monitoring Approaches

The CCAMP strategy of establishing and maintaining permanent long term monitoring sites provides a framework for trend analysis and detection of emerging water quality problems. CCAMP uses a variety of monitoring approaches to characterize status and trends of watersheds. The CCAMP program design includes monthly monitoring for conventional water quality (CWQ) and flow at all sites. At a subset of sites, generally selected based on availability of funds and hydrogeomorphological considerations or special interest (such as known discharges or existing TMDLs) other monitoring approaches are applied. Historically, these have included toxicity, sediment chemistry, tissue chemistry, benthic macroinvertebrate assemblages and habitat assessment. When funding increases these additional monitoring approaches will be applied to more sites.

In order to develop a broad picture of the overall health of waters in Region 3, a similar baseline monitoring approach is applied in each watershed and coastal confluence site. This provides data comparability across the Region and allows for prioritization of problems across a relatively large spatial scale. 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. Data sources include Department of Health Services, USGS, Department of Fish and Game, Department of Pesticide Regulation, Toxic Substances Monitoring Program, NPDES discharge data, and others. Data from local agencies and other selected programs are also acquired. CCAMP also utilizes previous CCAMP data as well as data collected by other Regional Board monitoring programs, including the irrigated agriculture waiver monitoring program, stormwater monitoring programs and TMDL monitoring. Selected data is compiled into the CCAMP data base format and used along with current data collected by CCAMP to evaluate criteria exceedances, pollutant levels which warrant attention, beneficial use impairment, and other pertinent information. These data are also evaluated prior to initiation of monitoring in a watershed rotation area to determine if the site list needs to be modified.

General monitoring design
Monitoring site selection is based on several factors. For all sites (rotation area and coastal confluence) safe, all-weather access is a priority for monthly conventional water quality monitoring activities. Many sites are located at bridges where sampling devices can be suspended during periods of high flow. Watershed site selection targets the primary discharge point of the watershed, the discharge of major tributaries which drain the watershed, and multiple locations along the main stem usually upstream from major tributary inputs. Some sites are also located above and below areas of significant human activity, including urban development, agriculture, and point source discharges.

At a subset of the watershed rotation area sites, additional monitoring is conducted. Bioassessment for benthic invertebrates is conducted at or upstream of conventional water quality sites (approximately 100m), out of the immediate influence of bridges in two consecutive springs (April – June). This assessment follows the SWAMP Standard Operatign Procedure (SWAMP 2007). Sediment toxicity is collected once during bioassessment sampling. Water column toxicity is conducted at conventional water quality sampling locations twice annually, in wet and dry season flows. As funding allows, sediment chemistry is conducted at the end of the fiscal year, in June, using unspent laboratory contract funds.

Coastal confluence monitoring was initiated in 2001 at 33 of the Region's coastal streams and rivers. Coastal confluences program sites were selected based on watershed size and/or known water quality concerns in the watershed. All of the larger watersheds are sampled, with the exception of the Carrizo Plain watershed (HU 311), which has no outlet. The coastal confluence watersheds represent the vast majority of acreage draining Region 3. Sampling sites are located on the lowest reach of the creek or river but above the coastal lagoon and tidal influence whenever possible. Site selection is constrained by site accessibility. Monthly conventional water quality monitoring is ongoing at these sites (with the exception of April -December 2003 due to SWAMP budget constraints). When funding allows additional monitoring includes bioassessment for benthic invertebrates, toxicity and sediment chemistry. Continuous monitoring of these waters just upstream of their confluence with the Pacific Ocean is used for long term trend analysis, information on pollutant loading to the ocean, and regular information on watersheds that are not the focus of the current watershed rotation area monitoring.

Monitoring Methods

CCAMP uses a variety of monitoring approaches to characterize status and trends at monitoring sites. The CCAMP program design includes monthly monitoring for conventional water quality (CWQ) and flow at all sites. At a subset of sites other monitoring approaches are applied. These include sediment chemistry and toxicity, tissue chemistry, benthic macroinvertebrate assessment and habitat assessment.

Conventional Water Quality
Basic conventional pollutants are monitored monthly at all coastal confluence and watershed rotation sites following Standard Operating Procedures (SOPs) for CCAMP field sampling (CCAMP 2009). Conventional water quality monitoring will be conduced monthly at all 33

coastal confluence sites between July 2009 and June 2010. In addition, conventional water quality monitoring will be conducted monthly at all 31 Santa Lucia Watershed Rotation Area sites between July 2009 and December 2010. Monthly sampling provides an opportunity to evaluate seasonal variability as well as a variety of flow conditions. Sampling is maintained on an even monthly interval without regard for timing of weather events. Even-interval sampling can be evaluated for long-term trends using time-series analysis techniques, such as the Mann-Kendall or seasonal Kendall tests described by the U.S. EPA in its guidance on Nonpoint Source Monitoring (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, currently BC Laboratories in Bakersfield, CA. A Hydrolab DS4a multi-analyte probe is used to collect data for dissolved oxygen, pH, water temperature, turbidity, conductivity, salinity and chlorophyll *a*. All field equipment is calibrated using certified calibration standards and following the manufacturer specifications and the CCAMP SOP (2009) prior to and following each sampling event. Calibration records are maintained at the Region 3 laboratory and are used to determine instrument accuracy. Field probe measurements are stored electronically in the field and downloaded directly to the database. All field measurements (100%) are checked against the field data sheet for accuracy. In addition, calibration data is used to determine if instrument drift on a given day is within the Method Quality Objectives (MQOs) specified in Table B42 of the SWAMP QAPP (2008). Any data collected when instruments are not meeting MQO's are flagged appropriately. In the field, observations of air temperature, algal growth, scum, trash, odors, 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. At other sites, flow is directly measured using a top setting rod and (since 2007) a Marsh McBirney flow meter. Flow measurements are taken at a minimum of ten locations across a transect; if the wetted width is more than 20 feet additional measurements are taken. When flow is not measurable it is estimated using stream profiles, stage gages and flow calibration curves. 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. Blind field replicates are collected for 5% of samples collected. Water samples are bottled as appropriate and held at 4^{o}C, before being transferred to the laboratory for analysis. Chain-of-Custody (COC) documentation is maintained for all samples. Samples are analyzed for parameters shown in Table 2. Samples collected in the Monterey Bay area are also analyzed for urea and silicate, to help answer research questions related to algal blooms in the bay. Quality assurance procedures at the laboratory are consistent with SWAMP approved quality assurance requirements and follow U.S. EPA approved methods (BC Laboratories 2006). The SWAMP Quality Assurance Program Plan list target reporting limits for specific analyses (Puckett 2002).

Table 2. Conventional water quality parameters and methods.

Analyte	**Method**
Nitrate as N	EPA 300.0

Nitrite as N	EPA 353.2
Total Ammonia as N	EPA 350.1
Unionized ammonia as N	Calculated
Total Kjeldahl Nitrogen	EPA 351.2
Total Nitrogen	Calculated
Total Phosphorus as P	EPA 365.4
Orthophophate as P	EPA 365.1
Total Dissolved Solids	EPA 160.1
Fixed and Volatile Dissolved Solids	EPA 160.4
Hardness as CaCO3	SM 2340B
Total Suspended Solids	EPA 160.2
Fixed and Dissolved Suspended Solids	EPA 160.4
Calcium	EPA 200.7
Magnesium	EPA 200.7
Boron, dissolved	EPA 200.7
Sodium	EPA 200.7
Chloride	EPA 300.0
Total and Fecal Coliform	25-tube dilution
E. coli	Colilert
Urea	Mulvenna & Savid
Silicon as Sio_2	EPA 200.7

Benthic Macroinvertebrate and Physical Habitat Sampling
Benthic macroinvertebrate (BMI) 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 16 Coastal Confluence and 14 Santa Lucia rotation area monitoring sites in spring of 2010. In addition to CCAMP monitoring, there are also several sites in the Region that are monitored by the Cooperative Monitoring Program (CMP) for Ag (as required by the Agricultural Waiver regulatory program. Benthic invertebrates are collected each spring at these CMP sites and this data is available in SWAMP importable formats. If additional funding becomes available to CCAMP this monitoring will be added.

Benthic macroinvertebrate communities are sampled using the SWAMP protocol which was modified from Western Environmental Monitoring and Assessment Program (WEMAP) protocols was adopted for use Statewide in 2007. These standard operating procedures are available on the SWAMP website (http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures). At all sites, a composite sample is collected using a multi-habitat approach in which one sample is collected at each of eleven transects evenly spaced throughout a 150 or 250 meter reach (depending on the average width of the creek). When stream morphology limits riffle habitat and substrate is dominated by fines, the composite sample targets stream margins. One grab is collected at each of eleven transects evenly spaced throughout a 150 or 250 meter reach; each of these is collected by alternating between margin and center habitats.

Physical habitat quality is assessed at each sampling reach according to State protocols, using the habitat assessment scoring methods adopted by SWAMP, and modeled after the WEMAP protocol for physical habitat. The habitat of the creek reach of interest is characterized according to geomorphic parameters, including bankful width, slope, particle size, sinuosity, depth and other features. In addition, estimates of canopy cover, riparian vegetation size classes and human influence is also recorded. Geomorphic characteristics, drainage area and upstream river miles are considered during data evaluation.

Sediment Chemistry
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 CCAMP utilizes several peer-reviewed criteria to evaluate sediment data for probable effects, including NOAA Effects Range Medium values (ERMs) (Long, et al, 1998) and Florida Probable Effects Levels (PELs) (MacDonald et al., 1992, 1996). Laboratory analysis includes polyaromatic hydrocarbons, organochlorine and organophosphate chemicals, metals, particle size distribution, and total organic carbon. The SWAMP Quality Assurance Management Plan (QAMP) contains detailed information on QAQC procedures, methods and reporting limits (Puckett 2002).

No sediment chemistry monitoring is planned for the 2009-2010 fiscal year. However, if funds are available at the end of the laboratory contract year (July 2008) sediment chemistry monitoring will be conducted in the lower ends of watersheds. Site selection will be based on known concerns and size of watershed.

Toxicity Sampling
Toxicity monitoring refers to the aggregate toxic effect to aquatic organisms from all pollutants in the sample water or sediment. Standard test organisms are exposed to sample water or sediment samples under controlled environmental conditions. The percent of organisms that survive to the end of the test is reported and compared for statistical significance relative to a control test.

CCAMP staff will conduct toxicity monitoring at 12 sites in the 2009-2010 fiscal year. Water samples will be collected twice from each site, targeting both wet weather (November – February) and base flows (May – August). Three test species are used for each water toxicity sampling event; 1) invetebrates, typically *Ceriodaphnia dubia* (water fleas*),2*) larval fish, typically *Pimephales Promelas*, (fathead minnows) and 3) an algal species, typically *Selanastrum capricornatum*. Water collection follows SWAMP Standard Operating Procedures (SOP). Five percent of samples are collected in duplicate for quality assurance purposes. Samples are stored at 4°C and shipped with appropriate COC and handling procedures to the analytical laboratories.

This fiscal year, CCAMP will not conduct any sediment toxicity monitoring as 12 of the Coastal Confluence sites will be monitored for toxicity under the SWAMP Statewide study. CCAMP will be conducting water toxicity monitoring at each of these sites.

Beneficial Use Assessment
In the Central Coast Region's Basin Plan (CCRWQCB 1994), virtually all major rivers and streams and their immediate tributaries are designated for commercial and sport fishing, contact and non-contact recreation, groundwater recharge, municipal and domestic supply, cold water fisheries, 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 applied uniformly to all sites.

CCAMP Monitoring Sites

Locations to be monitored for each of five watershed rotation years and for ongoing coastal confluences monitoring are shown in Table 3. All sites are monitored for conventional water quality. At subset of these sites additional monitoring is conducted.

Table 3. Central Coast Ambient Monitoring Program Site List

Year	HSA	Waterbody	Site Tag	Site Description
Ongoing	30413	Aptos Creek	304APT	304APT-Aptos Creek @ Spreckles Drive
Ongoing	30420	Gazos Creek	304GAZ	304GAZ-Gazos Creek above lagoon @ Highway 1
Ongoing	30412	San Lorenzo River	304LOR	304LOR-San Lorenzo above estuary @ Laurel Street
Ongoing	30411	Scott Creek	304SCO	304SCO-Scott Creek Lagoon @ Highway 1

Ongoing	30413	Soquel Creek	304SOK	304SOK-Soquel Creek @ Knob Hill
Ongoing	30411	Waddell Creek	304WAD	304WAD-Waddell Creek Lagoon @ Highway 1
Ongoing	30510	Pajaro River	305THU	305THU-Pajaro River @ Thurwachter Bridge
Ongoing	30700	Carmel River	307CML	307CML-Carmel River @ Highway 1
Ongoing	30800	Little Sur River	308LSR	308LSR-Little Sur River @ Highway 1
Ongoing	30800	Big Creek	308BGC	308BGC-Big Creek above Highway 1
Ongoing	30800	Big Sur River	308BSR	308BSR-Big Sur River @ Andrew Molera foot bridge
Ongoing	30800	Willow Creek	308WLO	308WLO-Willow Creek @ Highway 1
Ongoing	30910	Salinas River (Lower)	309DAV	309DAV-Salinas River @ Davis Road
Ongoing	30910	Old Salinas River	309OLD	309OLD-Old Salinas River @ Monterey Dunes Way
Ongoing	30910	Tembladero Slough	309TDW	309TDW-Tembladero Slough @ Molera Road
Ongoing	31012	Arroyo de la Cruz Creek	310ADC	310ADC-Arroyo de la Cruz @ Highway 1
Ongoing	31031	Arroyo Grande Creek(below res.)	310ARG	310ARG-Arroyo Grande Creek @ 22nd Street
Ongoing	31026	Pismo Creek	310PIS	310PIS-Pismo Creek above Highway 101
Ongoing	31025	San Luis Obispo Creek	310SLB	310SLB-San Luis Obispo Creek @ San Luis Bay Drive
Ongoing	31014	Santa Rosa Creek	310SRO	310SRO-Santa Rosa Creek @ Moonstone Drive
Ongoing	31013	San Simeon Creek	310SSC	310SSC-San Simeon Creek @ State Park foot bridge
Ongoing	31022	Chorro Creek	310TWB	310TWB-Chorro Creek @ South Bay Boulevard
Ongoing	31210	Santa Maria River	312SMA	312SMA-Santa Maria River above Estuary
Ongoing	31300	San Antonio Creek	313SAI	313SAI-San Antonio Creek @ San Antonio Road West
Ongoing	31410	Santa Ynez River(below res.)	314SYN	314SYN-Santa Ynez River @ 13th Street
Ongoing	31532	Arroyo Burro Creek	315ABU	315ABU-Arroyo Burro Creek @ Cliff Drive
Ongoing	31531	Atascadero Creek(315)	315ATA	315ATA-Atascadero Creek @ Ward Drive
Ongoing	31534	Carpinteria Creek	315CRP	315CRP-Carpinteria Creek below Carpenteria Ave
Ongoing	31534	Franklin Creek	315FRC	315FRC-Franklin Creek @ Carpenteria Avenue
Ongoing	31510	Canada de la Gaviota	315GAV	315GAV-Canada de la Gaviota @ State Park entrance
Ongoing	31532	Mission Creek	315MIS	315MIS-Mission Creek @ Montecito Street
Ongoing	31534	Rincon Creek	315RIN	315RIN-Rincon Creek @ Bates Road, u/s Highway 101
Ongoing	31510	Jalama Creek	315JAL	315JAL-Jalama Creek u/s County Park @ Rail Road Trussels
2011	30600	Carneros Creek	306CAR	306CAR-Carneros Creek in Los Lomas @ Blohm Road
2011	30910	Salinas Reclamation Canal	309ALD	309ALD-Salinas Reclamation Canal @ Boranda Road
2011	30910	Salinas Reclamation Canal	309ALU	309ALU-Salinas Reclamation Canal @ Airport Road
2011	30981	Atascadero Creek(309)	309ATS	309ATS-Atascadero Creek @ Highway 41
2011	30910	Salinas Reclamation Canal	309AXX	309AXX-Salinas Reclamation Canal Storm Drain @ Airport Road
2011	30940	Salinas River (Mid)	309DSA	309DSA-Salinas River d/s San Ardo @ Cattleman Road
2011	30920	Gabilan Creek	309GAB	309GAB-Gabilan Creek @ Independence and East Boranda
2011	30930	Salinas River (Mid)	309GRN	309GRN-Salinas River @ Elm Road in Greenfield
2011	30940	Salinas River (Mid)	309KNG	309KNG-Salinas River @ Highway 101 in King City
2011	30940	San Lorenzo Creek	309LOK	309LOK-San Lorenzo Creek @ First Street in King City
2011	30970	San Lorenzo Creek	309LOR	309LOR-San Lorenzo Creek @ Bitterwater Road east of King City
2011	30981	Nacimiento River(below res.)	309NAC	309NAC-Nacimiento River above Highway 101
2011	30981	Salinas River (Upper)	309PSO	309PSO-Salinas River @ 13th Street in Paso Robles

2011	30920	Quail Creek	309QUA	309QUA-Quail Creek @ Potter Road
2011	30910	Santa Rita Creek	309RTA	309RTA-Santa Rita Creek @ Santa Rita Park
2011	30910	Salinas River (Lower)	309SAC	309SAC-Salinas River @ Chualar bridge on River Road
2011	30981	San Antonio River(below res.)	309SAN	309SAN-San Antonio River @ Highway 101
2011	30981	Salinas River (Upper)	309SAT	309SAT-Salinas River @ Highway 41 bridge
2011	30910	Salinas River (Lower)	309SDR	309SDR-Salinas Storm Drain u/s Davis Road
2011	30910	Salinas River (Mid)	309SAS	309SAS-Salinsa River @ Soledad Highway 101 bridge
2011	30960	Arroyo Seco River	309SEC	309SEC-Arroyo Seco River @ Elm Street
2011	30930	Arroyo Seco River	309SET	309SET-Arroyo Seco River @ Thorne Road
2011	30981	Salinas River (Upper)	309SUN	309SUN-Salinas River u/s Nacimiento @ Bradley Road
2011	30910	Tembladero Slough	309TEM	309TEM- Tembladero Slough @ Preston Road
2011	30981	Salinas River (Upper)	309USA	309USA-Salinas River u/s San Ardo @ the Bradley Bridge
2011	31700	Cholame Creek	317CHO	317CHO-Cholame Creek @ Bitterwater Road
2011	31700	Estrella River	317ESE	317EST-Estrella River @ Estrella Road
2011	31700	Estrella River	317EST	317EST-Estrella River @ Airport Road
2012	31100	Soda Lake	311SLN	311SLN-Soda Lake Culverts @ Seven Mile Road
2012	31230	Alamo Creek	312ALA	312ALA-Alamo Creek at Alamo Creek Road
2012	31210	Blosser Channel	312BCD	312BCD-Blosser Channel d/s of groundwater recharge ponds
2012	31210	Bradley Canyon Creek	312BCF	312BCF-Bradley Canyon diversion channel @ Foxen Canyon Road
2012	31210	Bradley Channel	312BCU	312BCU-Bradley Channel u/s of ponds @ Magellan Drive
2012	31220	LaBrea Creek	312BRE	312BRE-LaBrea Creek u/s Sisquoc River
2012	31230	Cuyama River(above res.)	312CAV	312CAV-Cuyama River @ Highway 33
2012	31230	Cuyama River(above res.)	312CCC	312CCC-Cuyama River d/s Cottonwood Canyon
2012	31230	Cuyama River(below res.)	312CUT	312CUT-Cuyama River below Twitchell @ White Rock Lane
2012	31230	Cuyama River(above res.)	312CUY	312CUY-Cuyama River d/s Buckhorn Road
2012	31230	Huasna River	312HUA	312HUA-Husana River @ Husana Townsite Road
2012	31210	Green Valley Creek	312GVS	312GVS-Green Valley Creek @ Simas Road
2012	31210	Orcutt Creek	312GVT	312GVT-Orcutt Creek @ Brown Road
2012	31210	Main Street Canal	312MSD	312MSD-Main Street Canal u/s Ray Road @ Highway 166
2012	31210	Main Street Canal	312MSS	312MSS-Main Street Canal East of Hansen Street
2012	31210	Nipomo Creek	312NIP	312NIP-Nipomo Creek @ Highway 166
2012	31210	Nipomo Creek	312NIT	312NIT-Nipomo Creek @ Tefft Street
2012	31210	Oso Flaco Creek	312OFC	312OFC-Oso Flaco Creek @ Oso Flaco Lake Road
2012	31210	Oso Flaco Lake	312OFL	312OFL-Oso Flaco Lake @ culvert
2012	31210	Oso Flaco Creek Triutary	312BSR	312BSR-Oso Flaco Creek Tributary at Bonita School Road
2012	31210	Little Oso Flaco Creek	312OFN	312OFN-Little Oso Flaco Creek
2012	31210	Orcutt Solomon Creek	312ORB	312ORB-Orcutt-Solomon Creek @ Black Road
2012	31210	Orcutt Solomon Creek	312ORC	312ORC-Orcutt-Solomon Creek u/s Santa Maria River
2012	31210	Orcutt Solomon Creek	312ORI	312ORI-Orcutt-Solomon Creek @ Highway 1
2012	31210	Orcutt Solomon Creek	312ORS	312ORS-Orcutt-Solomon Creek @ Solomon Road

2012	31210	Santa Maria River	312SBC	312SBC-Santa Maria River @ Bull Canyon Road
2012	31220	Sisquoc River	312SIS	312SIS-Sisquoc River @ Santa Maria Way
2012	31220	Sisquoc River	312SIV	312SIV-Sisquoc River u/s Tepusquet Road
2012	31210	Santa Maria River	312SMI	312SMI-Santa Maria River @ Highway 1
2013	31300	San Antonio Creek	313SAB	313SAB-San Antonio Creek @ Rancho de las Flores Bridge, Hwy 135
2013	31300	San Antonio Creek	313SAC	313SAC-San Antonio Creek @ RR Bridge - Lagoon
2013	31410	San Miguelito Creek	314MIG	314MIG-San Miguelito Creek @ W. North Ave
2013	31410	Salsipuedes Creek(314)	314SAL	314SAL-Salsipuedes Creek @ Santa Rosa Road
2013	31410	Santa Ynez River(below res.)	314SYC	314SYC-Santa Ynez River d/s Lake Cachuma @ Highway 154
2013	31410	Santa Ynez River(below res.)	314SYF	314SYF-Santa Ynez River d/s Lompoc @ Floordale
2013	31410	Santa Ynez River(below res.)	314SYI	314SYI-Santa Ynez River @ Highway 101
2013	31410	Santa Ynez River(below res.)	314SYL	314SYL-Santa Ynez River u/s Lompoc @ Highway 246
2013	31410	Santa Ynez River(above res.)	314SYP	314SYP-Santa Ynez River @ Paradise Road
2013	31532	Arroyo Burro Creek	315ABH	315ABH-Arroyo Burro Creek @ Hope Street
2013	31531	Glenn Annie Creek	315ANN	315ANN-Glenn Annie Creek u/s Holister Road
2013	31534	Arroyo Paredon	315APC	315APC-Arroyo Paredon Creek @ Via Real
2013	31531	Atascadero Creek(315)	315ATU	315ATU-Atascadero Creek @ Patterson Avenue
2013	31510	Bell Creek	315BEL	315BEL-Bell Creek on Bacara Resort Access Road
2013	31510	El Capitan Creek	315CAP	315CAP-El Capitan Creek d/s Highway 101
2013	31534	Carpinteria Creek	315CAU	315CAU-Carpenteria Creek @ Highway 192
2013	31531	Devereux Slough	315DEV	315DEV-Devereux Slough @ the Golf Course culvert
2013	31510	Dos Pueblos Canyon Creek	315DOS	315DOS-Dos Pueblos Canyon Creek @ Highway 101
2013	31510	Canada de la Gaviota	315GAI	315GAI-Canada de la Gaviota @ Highway 1
2013	31531	Los Carneros Creek	315LCR	315LCR-Los Carneros Creek @ Hollister Road
2013	31532	Mission Creek	315MIU	315MIU-Mission Creek @ Cathedral Oaks Road
2013	31532	Montecito Creek	315MTC	315MTC-Montecito Creek @ Jamison Lane
2013	31531	Maria Ygnacio Creek	315MYC	315MYC-Maria Ynacio Creek @ Patterson Avenue
2013	31533	Romero Creek	315ROM	315ROM-Romero Creek @ Jamison Lane
2013	31510	Canada del Refugio	315RSB	315RSB-Canada del Refugio u/s Highway 101
2013	31533	Sycamore Creek	315SCC	315SCC-Sycamore Creek @ Punta Gorda Street
2013	31531	San Jose Creek	315SJC	315SJC-San Jose Creek @ Kellogg Boulevard
2013	31534	Santa Monica Creek	315SMC	315SMC-Santa Monica Creek @ Carpenteria Avenue
2013	31531	San Pedro Creek	315SPC	315SPC-San Pedro Creek d/s of Holister Road
2013	31510	Tecolote Creek	315TCI	315TCI-Tecolote Creek @ Bacara Resort access Road
2013	31534	Toro Canyon Creek	315TOR	315TOR-Toro Canyon Creek @ Via Real
2013	31532	San Ysidro Creek	315YSI	315YSI-San Ysidro Creek @ Jamison Lane
2009	31022	Chorro Creek	310CAN	310CAN-Chorro Creek @ Canet Road
2009	31023	Warden Creek	310TUR	310TUR-Warden Creek @ Turri Road
2009	30700	Carmel River	307CMD	307CMD-Carmel River @ Schulte Road
2009	30700	Carmel River	307CMN	307CMN-Carmel River @ Nason Road, Community Park
2009	30700	Carmel River	307CMU	307CMU-Carmel River @ Esquiline Road
2009	30700	Tularcitos Creek	307TUL	307TUL-Tularcitos Creek @ Carmel Valley Road

2009	30800	Big Sur River	308BSU	308BSU-Big Sur River @ Pfeiffer Big Sur State Park
2009	30800	Garrapata Creek	308GAR	308GAR-Garapata Creek @ Garapata Creek Road
2009	30800	Limekiln Creek	308LIM	308LIM-Limekiln Creek @ Limekiln State Park
2009	30800	Little Sur River	308LSU	308LSU-Little Sur River @ Old Coast Road
2009	30800	Mill Creek	308MIL	308MIL-Mill Creek @ Mill Creek Picnic Area
2009	30800	San Jose Creek	308SJC	308SJC-San Jose Creek @ Private Road Access
2009	31031	Arroyo Grande Creek(below res.)	310AGB	310AGB-Arroyo Grande Creek @ Biddle Park
2009	31031	Arroyo Grande Creek(below res.)	310AGF	310AGF-Arroyo Grande Creek @ Fair Oaks
2009	31031	Arroyo Grande Creek(below res.)	310AGS	310AGS-Arroyo Grande Creek @ Strother Park
2009	31031	Los Berros Creek	310BER	310BER-Los Berros Creek @ Valley Road
2009	31016	Cayucos Creek	310CAY	310CAY-Cayucos Creek @ Cayucos Creek Road and Highway 1
2009	31025	Coon Creek	310COO	310COO - Coon Creek @ Pecho Valley Road
2009	31021	Morro Creek	310MOR	310MOR-Morro Creek @ Lila Keiser Park
2009	31017	Old Creek(above res.)	310OLD	310OLD-Old Creek @ Cottontail Creek Road
2009	31013	Pico Creek	310PCO	310PCO-Pico Creek @ Highway 1
2009	31024	Prefumo Creek	310PRE	310PRE-Prefumo Creek @ Calle Joaquin
2009	31024	Stenner Creek	310SCN	310SCN-Stenner Creek @ Nipomo street
2009	31011	San Carpoforo Creek	310SCP	310SCP-San Carpoforo Creek @ Highway 1
2009	31024	San Luis Obispo Creek	310SLC	310SLC-San Luis Obispo Creek @ Cuesta Park
2009	31024	San Luis Obispo Creek	310SLM	310SLM-San Luis Obispo Creek @ Mission Plaza
2009	31024	San Luis Obispo Creek	310SLV	310SLV-San Luis Obispo Creek @ Los Osos Valley Road
2009	31014	Santa Rosa Creek	310SRU	310SRU-Santa Rosa Creek @ Ferrasci Road
2009	31013	San Simeon Creek	310SSU	310SSU-San Simeon Creek @ San Simeon Road
2009	31018	Toro Creek	310TOR	310TOR-Toro Creek u/s Highway 1
2009	31015	Villa Creek	310VIA	310VIA-Villa Creek u/s Highway 1
2010	30413	Aptos Creek	304APS	304APS-Aptos Creek at Nisene Marks park road
2010	30412	Arana Gulch Creek	304ARA	304ARA-Arana Gulch below golf course
2010	30412	Bear Creek	304BEP	304BEP-Bear Creek @ Elks Park
2010	30412	Boulder Creek	304BH9	304BH9-Boulder Creek @ Highway 9
2010	30412	San Lorenzo River	304RIV	304RIV-San Lorenzo River @ Crossing Road
2010	30411	Scott Creek	304SCM	304SCM-Scott Creek above Mill Creek
2010	30412	San Lorenzo River	304SL9	304SL9-San Lorenzo River @ Highway 9
2010	30412	San Lorenzo River	304SLB	304SLB-San Lorenzo River @ Big Trees
2010	30412	San Lorenzo River	304SLE	304SLE-San Lorenzo @ Elks Park above Bear Creek
2010	30413	Soquel Creek	304SOU	304SOU-Soquel Creek @ Soquel Creek Road
2010	30413	Valencia Creek	304VAL	304VAL-Valencia Creek u/s Aptos Creek Confluence
2010	30412	Zayante Creek	304ZAY	304ZAY-Zayante Creek @ Graham Hill Road
2010	30550	San Benito River	305BRI	305BRI-San Benito River, Bridge d/s Willow Creek
2010	30530	Carnadero Creek	305CAN	305CAN-Carnadero Creek above Pajaro River
2010	30510	Pajaro River	305CHI	305CHI-Pajaro River @ Chittenden Gap
2010	30510	Salsipuedes Creek	305COR	305COR-Salsipuedes Creek d/s of Corralitos Creek
2010	30510	Corralitos Creek	305COR2	305COR2-Upper Corralitos Creek
2010	30530	Pajaro River	305FRA	305FRA-Miller's Canal @ Frazier Lake Road
2010	30510	Furlong Creek	305FUF	305FUF-Furlong Creek @ Fraiser Lake Road

2010	30510	Harkins Slough	305HAR	305HAR-Harkins Slough @ Harkins Slough Road
2010	30530	Llagas Creek(below res.)	305HOL	305HOL-Llagas Creek @ Holsclaw and Leavesley Roads
2010	30530	Llagas Creek(below res.)	305LLA	305LLA-Llagas Creek @ Bloomfield Avenue
2010	30510	Pajaro River	305MUR	305MUR-Pajaro River @ Murphy's Crossing
2010	30540	Pacheco Creek	305PAC	305PAC-Pacheco Creek @ San Felipe Road
2010	30520	Pajaro River	305PAJ	305PAJ-Pajaro River @ Betabel Road
2010	30550	San Benito River	305SAN	305SAN-San Benito @ Y Road
2010	30510	San Juan Creek	305SJN	305SJN-San Juan Creek @ Anzar
2010	30510	Struve Slough	305STL	305STL-Struve Slough @ Lee Road
2010	30550	Tres Pinos Creek	305TRE	305TRE-Tres Pinos Creek
2010	30530	Uvas Creek(below res.)	305UVA	305UVA-Uvas Creek @ Bloomfield Avenue
2010	30510	Watsonville Slough	305WSA	305WSA-Watsonville Slough @ San Andreas Road

Deliverables

A schedule of the monitoring plan deliverables is provided in Table 4. This timeline is dependent on delivery of final data from the various contract laboratories. However, the desired delivery dates are shown below. Annual workplans will follow SWAMP specified formats. CCAMP is revising our assessment and reporting approach and will not be developing Hydrologic Unit assessment reports as we have in the past. New State requirements to assess all data for the 303(d)/305(b) Integrated Report have vastly reduced our staff time available for report writing. Instead, we plan to revise and upgrade our data availability through our website (www.CCAMP.org), link 303(d)/305(b) assessment information to the website, and also implement a report card approach on the web to address questions of key importance to our Region related to aquatic health, proper land management, and clean groundwater. This report card will integrate large amounts of data collected by CCAMP with information related to land management and groundwater pollution,

Table 4. Monitoring schedule and deliverables.

Task Deliverable	Time line / target date	Task completed
2006 - Salinas rotation area TOX and BMI final data delivery	April 2008	Yes
FY 08-09 Annual R3 workplan	September 2008	Yes
SWAMP annual report 2005 - Pajaro & North Coast rotation area to peer review	December 2008	No (task eliminated)
Coastal confluences annual report (with 05-06 data) to peer review	April 2009	No (task eliminated or postponed)
SWAMP annual report 2006 - Salinas watershed rotation area	December 2009	No (task eliminated)
2007 – Santa Maria rotation area TOX and BMI final data delivery	April 2009	Yes

SWAMP annual report 2007 - Santa Maria watershed rotation area	December 2010	No (task eliminated)
CCAMP data and all data submitted for 2008 Integrated Report formatted into SWAMP compatible templates for scanning	December 2008	Yes
303(d)/305(b) Integrated Report approved by Regional Board	July 2009	Yes (task added)
Revised CCAMP website	July 2010	
CCAMP 2007 – 2009 CWQ data delivered to SWAMP through CalDUCS	July 2010	
All data submitted for 2010 Integrated Report formatted for submittal to CalDUCS	Date not yet determined by SWRCB	

Annual Plan

CCAMP will continue monitoring at the 33 coastal confluence trend sites which have been monitored continuously since April 2001. We will also complete monitoring in the Santa Lucia watershed rotation, which ends in December, 2009. CCAMP plans to wait until 2011 to initiate the third full watershed rotation, which begins in the Pajaro and North Coast rotation area. This is partly necessary because the Pajaro watershed is complex and expensive to monitor, and we plan to reserve some 2009-10 funding for use in 2010-11. Also, the CCAMP Monitoring Endowment, held at the Bay Foundation of Morro Bay, requires some recovery time from the financial crisis of 2008, and we feel it is prudent to wait another year before placing demands on it for support of CCAMP staff.

Monitoring Approach

The general timing of monitoring types associated with the various overlapping monitoring projects is shown in Table 5. SWAMP funds from Fiscal Year 09-10 will be used to complete the monthly conventional water quality monitoring in the Santa Lucia area rotation sampling and to continue coastal confluences trend monitoring (monthly CWQ, water toxicity and benthic macroinvetebrates). SWAMP funds for this fiscal year will be used for the following monitoring activities and projects.

- Conventional Water Quality (Monthly)
    - Coastal confluences - 12 monthly samples at 33 sites (July 09- June 10)
    - Santa Lucia rotation area – 6 monthly samples at 32 sites (July 09 - December 09)
- Benthic Macroinvertebrates and Habitat Assessment (April – June)
    - Coastal confluences - 16 sites (Spring10)
    - Santa Lucia rotation area - 14 sites (Spring 10)
- Water Toxicity (two water samples in summer and winter at SWAMP's Stream Pollution Trends (SPoT) sites)
    - Coastal confluences – 12 sites

Table 5. Time schedule of monitoring types at CCAMP sites showing conventional water quality (CWQ), benthic macroinvertebrates (BMI), sediment toxicity (S Tox) and water toxicity (H20 Tox).

Monitoring Types	2009				2010				2011	
	Jan-09	Mar-09	June-09	Sept-09	Jan-10	Mar-10	June-10	Sept-10	Jan-11	Mar-11
	Coastal Confluences									
CWQ										
BMI										
STox										
H2OTox										
	Santa Lucia Rotation									
CWQ										
BMI										
STox										
H2OTox										
	Pajaro Rotation									
CWQ										
BMI										
STox										
H2OTox										

Site-specific Monitoring Activities

CCAMP will complete Santa Lucia watershed rotation monitoring in the second half of 2009. Santa Lucia sites are shown in Figures 2 through 4. CCAMP monitoring conducted during 2010 will consist of continued monthly monitoring at coastal confluences sites. Figure 5 shows location of coastal confluence sites. Monitoring activity schedules for specific coastal confluence sites are shown in Table 6.

CCAMP coordinates with monitoring activities of the Cooperative Monitoring Program for Irrigated Agricultural (Ag Monitoring) and SWAMP's Stream Pollution Trends (SPoT) Program. Monitoring conducted by the Ag Monitoring program includes monthly conventional monitoring for a subset of the CCAMP analyte list (probe measurements, nutrients and TDS), spring benthic macroinvertebrate collection following newly adopted SWAMP protocols, and water and sediment toxicity monitoring during both wet and dry seasons at all sites. Three coastal confluence sites are co-located with Ag Monitoring program sites; CCAMP will sample these site for conventional water quality to ensure that the full complement of CCAMP parameters is collected, but will not conduct toxicity or bioassessment monitoring at those locations. The SPoT Program will be sampling twelve coastal confluence sites for sediment toxicity and chemistry. CCAMP will augment these samples with bioassessment and water toxicity data, as well as the usual conventional water quality sampling.

Table 6. FY 2009-10 monitoring activities planned for coastal confluence (CC) and Santa Lucia (SantaLucia) watershed rotation sites. (AG – Cooperative Monitoring Program for Agriculture, SPoT – Stream Pollution Trends Program).

Project	SiteTag	Conventional water quality	Water Column Toxicity	Sediment Toxicity	ELISA in Water	ELISA in Sediment	Rapid Bioassessment	Sediment Chemistry
CC	304APT	12						
CC	304GAZ	12						
CC	304LOR	12	2		2	2	1	
CC	304SCO	12						
CC	304SOK	12	2	SPoT	2	2	1	SPoT
CC	304WAD	12						
CC	305THU	12	2	SPoT	2	2		SPoT
CC	307CML	12	2	SPoT	2	2	1	SPoT
CC	308BGC	12						
CC	308BSR	12						
CC	308LSR	12						
CC	308WLO	12						
CC	309DAV	12	2	SPoT	2	2	1	SPoT
CC	309OLD	12	AG	AG			AG	
CC	309TDW	12	2	SPoT	2	2	1	SPoT
CC	310ADC	12						
CC	310ARG	12	2	SPoT	2	2	1	SPoT
CC	310PIS	12						
CC	310SLB	12	2	SPoT	2	2	1	SPoT
CC	310SRO	12						
CC	310SSC	12						
CC	310TWB	12						
CC	312SMA	12	AG	AG			AG	
CC	313SAI	12	2	SPoT	2	2	1	SPoT
CC	314SYN	12	AG	AG			AG	
CC	315ABU	12						
CC	315ATA	12	2	SPoT	2	2	1	SPoT
CC	315CRP	12	2	SPoT	2	2	1	SPoT
CC	315FRC	12						
CC	315GAV	12						
CC	315JAL	12						
CC	315MIS	12	2	SPoT	2	2	1	SPoT
CC	315RIN	12						

Project	SiteTag	Conventional water quality	Rapid Bioassessment
SantaLucia	307CMU	6	1
SantaLucia	307CMD	6	
SantaLucia	307CMN	6	1
SantaLucia	307TUL	6	
SantaLucia	308BSU	6	1
SantaLucia	308GAR	6	
SantaLucia	308LIM	6	1
SantaLucia	308LSU	6	
SantaLucia	308MIL	6	
SantaLucia	308SJC	6	1
SantaLucia	308SAM	6	
SantaLucia	310SCP	6	1
SantaLucia	310PCO	6	
SantaLucia	310SSU	6	1
SantaLucia	310SRU	6	1
SantaLucia	310VIA	6	
SantaLucia	310CAY	6	1
SantaLucia	310OLD	6	
SantaLucia	310TOR	6	
SantaLucia	310MOR	6	
SantaLucia	310CAN	6	1
SantaLucia	310TUR	6	
SantaLucia	310PRE	6	
SantaLucia	310SLC	6	1
SantaLucia	310SLV	6	
SantaLucia	310SCN	6	1
SantaLucia	310COO	6	1
SantaLucia	310AGB	6	
SantaLucia	310AGF	6	
SantaLucia	310AGS	6	1
SantaLucia	310SLM	6	
SantaLucia	310BER	6	

Figure 2. CCAMP monitoring sites located in the Carmel watershed rotation area

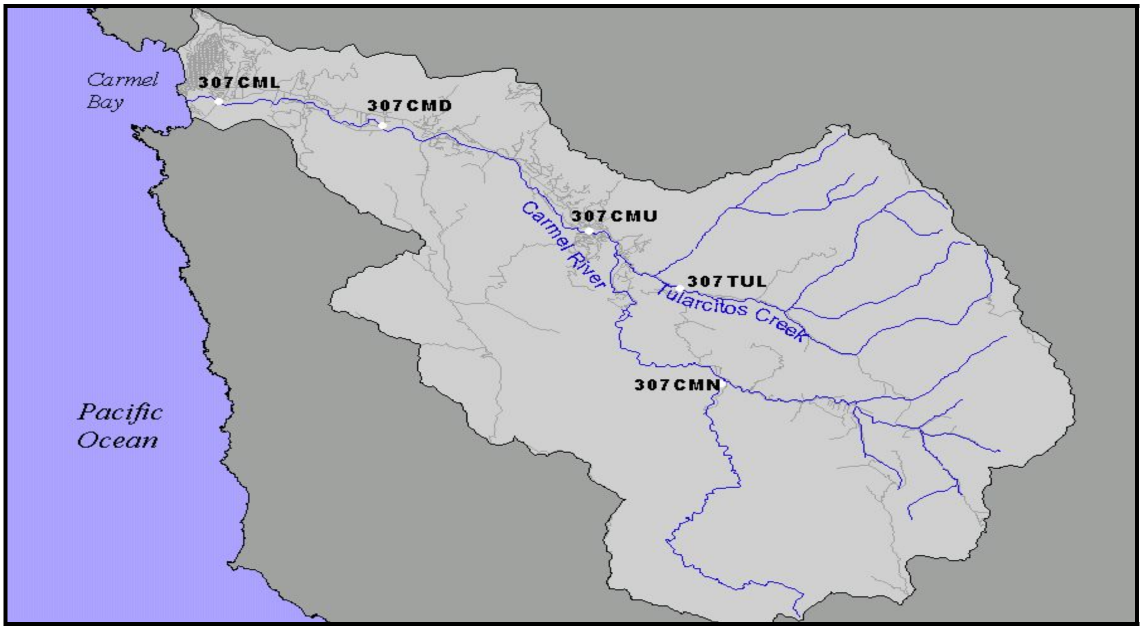


Figure 3. CCAMP monitoring sites located in the Santa Lucia watershed rotation area

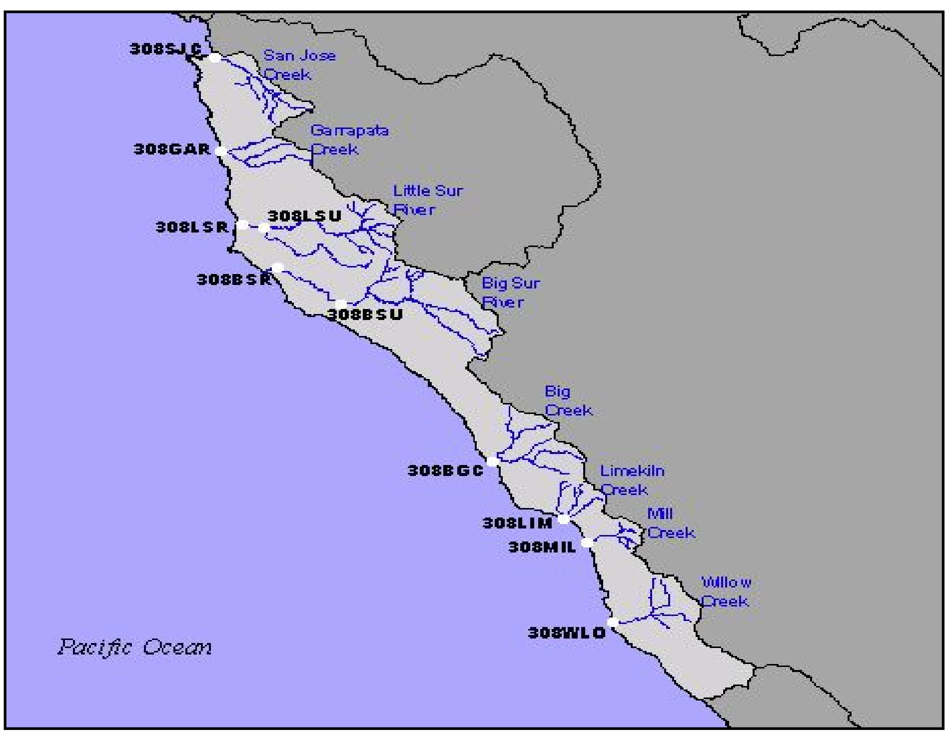
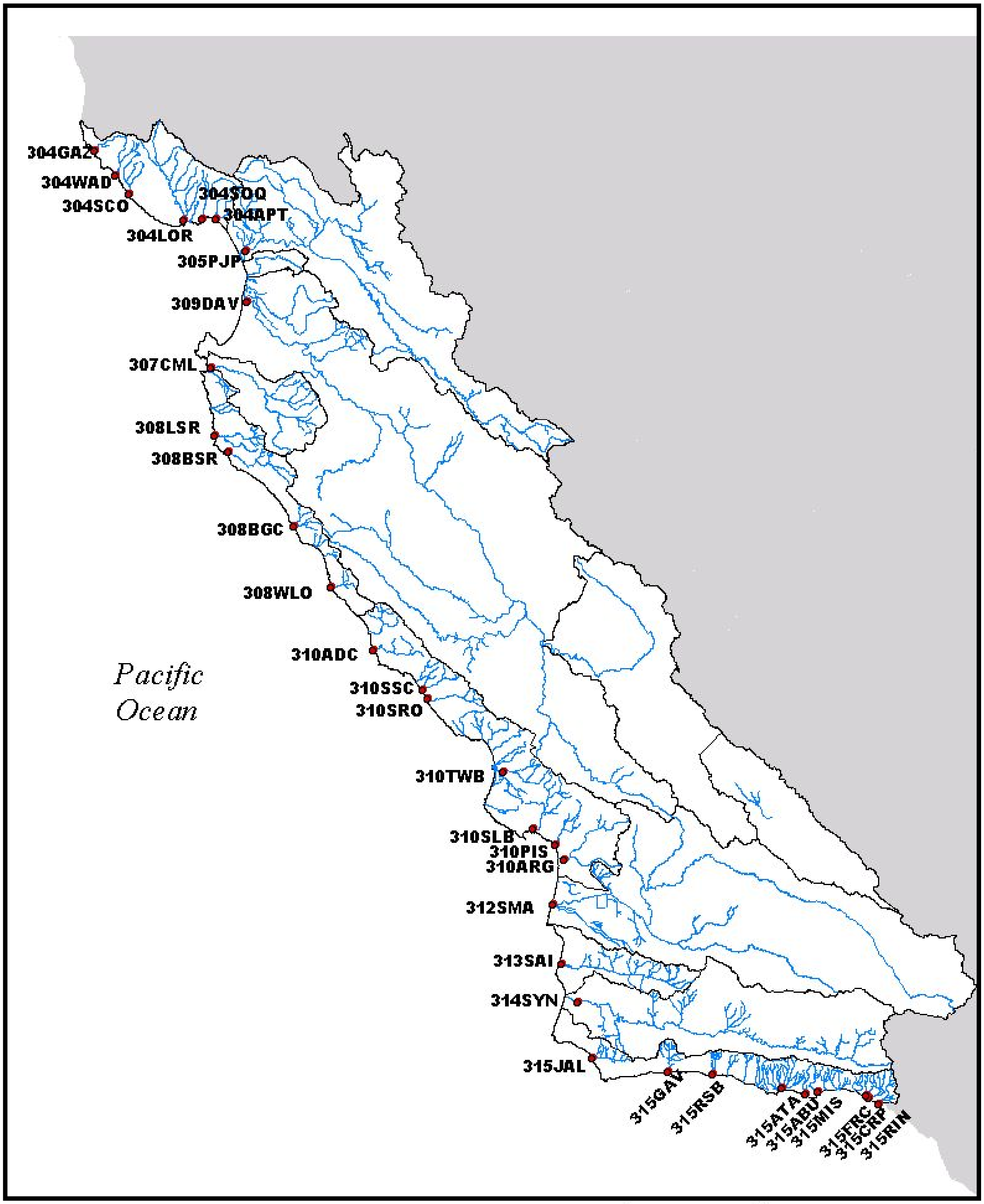


Figure 4. CCAMP monitoring sites located in the Estero Bay watershed rotation area

Figure 5. Coastal confluence site locations in the Region



Budget

The Region 3 allotment from the SWAMP program for FY 2009-10 is $306,000. Table 8 shows the SWAMP budget for FY –2009-10.. It is our intention to use very little of the CCAMP endowment fund, held by the Bay Foundation of Morro Bay, in 09-10 because of our efforts to restore the endowment principle following the financial crisis of 2008-09.

SWAMP FY08-09 RWQCB 3 State WDPF Funds--Work Order No. SJSURF-08-3-001	Work Order Title: "SJSURF Field and Lab Services for RWQCB 3 for FY09-10 State WDPF funds" (BIOASSESSMENT Spring 2009)		SWAMP Station Name and Number (please use required SWAMP conventions) ------>		
Analysis or Service to be Performed	**Description**	**Agency**	**Unit Cost (per sample)**	**Total units**	**Total Cost (Total Units x cost/unit)**
Conventional Water Quality	Suite of nutrients, pathogen indicators, salts, copper and zinc.	R3	$223	624	$139,152
	Urea and silicate	R3	$70	132	$9,273
Sediment Physical Characteristics	Total Organic Carbon (TOC) - ***sediment***	SCL	$57	0	$0
	Grain size (GS; %silt/clay = fines only) - ***sediment***	SCL	$70	0	$0
	Grain size (GS; full analysis = phi scale) - ***sediment***	SCL	$101	0	$0
Biological & Habitat Assessment	**Bioassessment lab services only** –cost is for taxonomy for one sample ***using 600-count SAFIT STE Level II taxonomy*** (sample sorting, taxonomy, QA, data report--no sample collection; sample must be provided by RWQCB or sample collection charges apply as appropriate). **REACH-WIDE BENTHOS (RWB) SAMPLE**	DFG-ABL	$674	31	$20,894
	Bioassessment lab services only –cost is for taxonomy for one sample ***using 600-count SAFIT STE Level II taxonomy*** (sample sorting, taxonomy, QA, data report--no sample collection; sample must be provided by RWQCB or sample collection charges apply as appropriate). **TARGETED-RIFFLE COMPOSITE (TRC) SAMPLE**	DFG-ABL	$674	0	$0
	Taxonomy Quality Control - External checks on validity identifications (includes shipping costs) ***using 600-count SAFIT STE Level II taxonomy*** by external, approved lab not performing primary identifications; required for 20% of samples.	SJS BMI QA Vendor	$531	6	$3,186
	Algae - Diatoms (characterization of diatom assemblages)	UnivColo	$355	0	$0
	Algae - Soft (documentation of filamentous algal growth)	CSUSM	$355	0	$0
Toxicity Testing - Fresh Water Origin (TOX)	**Water (fresh water)**				
	Ceriodaphnia 7-day Survival & Reproduction (one of EPA 3-spp)	UCD-ATL	$751	28	$21,028
	Pimephales (fathead minnow) 7-day test (one of EPA 3-spp)	UCD-ATL	$775	28	$21,700
	Selenastrum (algae) test (one of EPA 3-spp)	UCD-ATL	$620	28	$17,360
Other Toxicity Testing Services (TOX)	ELISA for Diazinon	UCD-GC	$91	28	$2,548
	ELISA for Chlorpyrifos	UCD-GC	$91	28	$2,548
SJSURF Miscellaneous	Regional proportional share of statewide cost of SJSURF pass-thru subcontract ovrhd, coordination/logistics/management cost (*will calculate after know total $ each region in each subcontract)	SJSURF		0	$0
	Bay Foundation employee technical assistance (amount includes 26% SJSURF overhead)	MPSL-MLML		0	$0
	Regional Annual Interpretive Report / Publication		Negotiate	0	$0
	Cooler shipping to ATL	MPSL-DFG	$80	0	$0
	Cleaned scoops	MPSL-DFG	$11	0	$0
TOTAL COST FOR ALL SERVICES/ANALYSES DESCRIBED ABOVE:					$89,264

Station columns (units per station):

Analysis	307CMU-Carmel River @ Esquiline Road (307CMUxxx)	307CMD-Carmel River @ Schulte Road (307CMDxxx)	307CMN-Carmel River @ Nason Road, Community Park (307CMNxxx)	307TUL-Tularcitos Creek @ Carmel Valley Road (307TULxxx)	308BSU-Big Sur River @ Pfeiffer, Weyland camp (308BSUxxx)	308GAR-Garapata Creek @ Garapata Creek Road (308GARxxx)	308LIM-Limekiln Creek @ Limekiln State Park (308LIMxxx)	308LSU-Little Sur River @ Coast Road (308LSUxxx)	308MIL-Mill Creek @ Mill Creek Picnic Area (308MILxxx)	308SJC-San Jose Creek @ Private Road Access (308SJCxxx)	308SAM-Salmon Creek upstream of Highway 1 (308SAMxxx)	310SCP-San Carpoforo Creek @ Highway 1 (310SCPxxx)	310PCO-Pico Creek @ Highway 1 (310PCOxxx)	310SSU-San Simeon Creek @ San Simeon Road (310SSUxxx)	310SRU-Santa Rosa Creek @ Main St (310SRUxxx)	310VIA-Villa Creek @ Private Road Access (310VIAxxx)
Suite of nutrients, pathogen indicators, salts, copper and zinc.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Bioassessment – RWB sample	1		1		1		1			1		1		1	1	

Analysis	310CAY-Cayucos Creek @ Cayucos Creek Road (310CAYxxx)	310OLD-Old Creek @ Old Creek Road (310OLDxxx)	310TOR-Toro Creek @ Toro Creek Road (310TORxxx)	310MOR-Morro Creek @ Quintana Road (310MORxxx)	310CAN-Chorro Creek @ Canet Road (310CANxxx)	310TUR-Los Osos Creek @ Turri Road (310TURxxx)	310PRE-Prefumo Creek @ Calle Joaquin (310PRExxx)	310SLC-San Luis Obispo Creek @ Cuesta Park (310SLCxxx)	310SLV-San Luis Obispo Creek @ Los Osos Valley Road (310SLVxxx)	310SCN-Stenner Creek @ Nipomo street (310SCNxxx)	310COO - Coon Creek @ Pecho Valley Road (310COOxxx)	310AGB-Arroyo Grande Creek @ Biddle Park (310AGBxxx)	310AGF-Arroyo Grande Creek @ Fair Oaks (310AGFxxx)	310AGS-Arroyo Grande Creek @ Strother Park (310AGSxxx)	310SLM-San Luis Obispo Creek @ Mission Plaza (310SLMxxx)	310BER-Los Berros Creek @ Valley Road (310BERxxx)
Suite of nutrients, pathogen indicators, salts, copper and zinc.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Bioassessment – RWB sample	1				1			1		1	1			1		

Analysis	304APT-Aptos Creek @ Spreckles Drive (304APTxxx)	304GAZ-Gazos Creek Lagoon @ Highway 1 (304GAZxxx)	304LOR-San Lorenzo Estuary @ Laurel Street (304LORxxx)	304SCO-Scott Creek Lagoon @ Highway 1 (304SCOxxx)	304SOK-Soquel Creek @ Knob Hill (304SOKxxx)	304SOQ-Soquel Creek Lagoon @ RR trussels (304SOQxxx)	304WAD-Waddell Creek Lagoon @ Highway 1 (304WADxxx)	305THU-Pajaro River @ Thurwachter Bridge (305THUxxx)	307CML-Carmel River @ Highway 1 (307CMLxxx)	308BGC-Big Creek @ Highway 1 (308BGCxxx)	308BSR-Big Sur River @ Andrew Molera foot bridge (308BSRxxx)	308WLO-Willow Creek @ Highway 1 (308WLOxxx)	309DAV-Salinas River @ Davis Road (309DAVxxx)	309OLD-Old Salinas River @ Monterey Dunes Way (309OLDxxx)	309TDW-Tembladero Slough @ Monterey Dunes Way (309TDWxxx)	310ADC-Arroyo de la Cruz @ Highway 1 (310ADCxxx)	310ARG-Arroyo Grande Creek @ 22nd Street (310ARGxxx)
Suite of nutrients, pathogen indicators, salts, copper and zinc.	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Urea and silicate	12	12	12	12	12	12	12	12	12		12						
Bioassessment – RWB sample			1		1				1				1		1	1	1
Ceriodaphnia			2		2			2	2				2		2		2
Pimephales			2		2			2	2				2		2		2
Selenastrum			2		2			2	2				2		2		2
ELISA for Diazinon			2		2			2	2				2		2		2
ELISA for Chlorpyrifos			2		2			2	2				2		2		2

Analysis	310PIS-Pismo Creek above Highway 101 (310PISxxx)	310SLB-San Luis Obispo Creek @ San Luis Bay Drive (310SLBxxx)	310SRO-Santa Rosa Creek @ Moonstone Drive (310SROxxx)	310SSC-San Simeon Creek @ State Park foot bridge (310SSCxxx)	310TWB-Chorro Creek @ South Bay Boulevard (310TWBxxx)	312SMA-Santa Maria River @ Estuary (312SMAxxx)	313SAC-San Antonio Creek @ San Antonio Creek Road West (313SAIxxx)	314SYN-Santa Ynez River @ 13th Street (314SYNxxx)	315ABU-Arroyo Burro Creek @ Cliff Drive (315ABUxxx)	315ATA-Atascadero Creek @ Ward Drive (315ATAxxx)	315CRP-Carpinteria Creek down stream Carpenteria Ave (315CRPxxx)	315FRC-Franklin Creek @ Carpenteria Avenue (315FRCxxx)	315GAV-Canada de la Gaviota @ State Park entrance (315GAVxxx)	315MIS-Mission Creek @ Montecito Street (315MISxxx)	315RIN-Rincon Creek @ Bates Road, u/s Highway 101 (315RINxxx)	315JAL-Jalama Creek at RR bridge (315JALxxx)
Suite of nutrients, pathogen indicators, salts, copper and zinc.	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Bioassessment – RWB sample		1	1	1	1		1			1	1			1		
Ceriodaphnia		2					2			2	2			2		
Pimephales		2					2			2	2			2		
Selenastrum		2					2			2	2			2		
ELISA for Diazinon		2					2			2	2			2		
ELISA for Chlorpyrifos		2					2			2	2			2		

Analysis	Field Duplicate 1 (FIELDQA)	Field Duplicate 2 (FIELDQA)	Field Duplicate 3 (FIELDQA)	FIELDQA	Lab QA (LABQA)	Lab QA (LABQA)	Lab QA (LABQA)	Lab QA (LABQA)	Lab QA (LABQA)
Suite of nutrients, pathogen indicators, salts, copper and zinc.	12	12	6	6					
Urea and silicate	12								
Bioassessment – RWB sample	2								
Taxonomy Quality Control									6
Ceriodaphnia	4								
Pimephales	4								
Selenastrum	4								
ELISA for Diazinon	4								
ELISA for Chlorpyrifos	4								

Total FY 0910 wdpf funds in SJSURF master contract available for services above: **$156,000**
Minus total cost of services shown above: **$89,264**
Equals FY0910 wdpf funds in SJSURF Master Contract not yet allocated: **$66,736**

Total FY 0910 wdpf funds in Region 3 Master Contract **$150,000**
Minus total cost of planned sampling **$148,425**
Equals FY0910 funds remaining in lab contract for other uses **$1,575**

Total FY0910 wdpf funds in Regional Board lab contract

Remaining Master Contract funds are planned for use in the Pajaro rotation in 2011.

Table 8. CCAMP Budget for 0910 SWAMP funds

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Appendix A. Summary of Central Coast Watershed Characteristics and Conditions

Big Basin Hydrologic Area 304

The Big Basin Hydrologic Area is characterized by smaller coastal watersheds draining out of the Santa Cruz mountains directly to the ocean. In most areas the creeks drain through a coastal plain area that is relatively narrow. For some of the watersheds, particularly in the southern portion of this area, this coastal plain is heavily developed (around the towns of Santa Cruz, Aptos, and Soquel). In the northern portion of the region, the plain is narrower and development is minimal. Irrigated agriculture is relatively limited in this area.

Major issues in the Big Basin area include siltation, water diversions, migration barriers and loss of riparian habitat. The County of Santa Cruz Water Resources Program (CSCWRP) has gathered data at various locations in the smaller watersheds of this area for a number of years. In addition, several volunteer monitoring programs are collecting data in various watersheds. CCAMP data for most of the other smaller watersheds along the coast indicate few water quality problems. However, the CCAMP program is not currently geared to assess in-stream sediment impacts, which are some of the more likely impacts in these watersheds. Several waterbodies in the Big Basin Hydrologic Unit (304) are on the 303(d) list of impaired waterbodies due to specific pollutants and or stressors. These waterbodies are listed below:

Big Basin Hydrologic Unit waters currently identified as impaired on the 303(d) list.

Waterbody	Pollutant/stressor	Pollutant/stressor	Pollutant/stressor
San Lorenzo Watershed			
Branciforte Creek	Siltation		
Carbonera Creek	Nutrients	Pathogens	Siltation
Boulder Creek	Siltation		
Bear Creek	Siltation		
Fall Creek	Siltation		
Kings Creek	Siltation		
Lompico Creek	Nutrients	Pathogens	Siltation
Love Creek	Siltation		
Mountain Charlie Gulch	Siltation		
Newell Creek	Siltation		
Shingle Mill Creek	Nutrients	Siltation	
San Lorenzo Lagoon	Boron	Fecal Coliform	
San Lorenzo River	Nutrients	Pathogens	Siltation
Aptos Watershed			
Aptos Creek	Pathogens	Siltation	
Valencia Creek	Pathogens	Siltation	
Other watersheds			
Soquel Lagoon	Nutrients	Pathogens	Siltation
Waddell Creek East Branch	Pathogens	Siltation	

Aptos Creek – Hydrologic SubArea 304.13

Aptos Creek is located in southern Santa Cruz County and is approximately 24.5 square miles in size. It drains to Monterey Bay south of the City of Santa Cruz. Its main tributaries are Valencia Creek, Mangles Gulch, and Bridge Creek. Both Aptos and Valencia Creeks are listed on the 303(d) impaired waterbodies list for siltation and pathogens, and are the subject of a Total Maximum Daily Load analysis.

The entire upper watershed was logged during the late 1800s, and 140 million board feet of first-growth redwood was removed. The California Department of Fish and Game (1977) conducted inventories of fisheries resources and found that factors limiting steelhead populations in the creek include temperature, sedimentation, barriers to fish passage, inadequate woody debris, and inadequate canopy cover. Titus et al. (1994) indicate that declining fish populations are primarily caused by sedimentation in Aptos Creek. He indicated that a disastrous flood in 1982 created landslides and mass wasting, as well as debris jams, which blocked fish passage. The 1982 steelhead year-class was essentially eliminated. Surveys in 1999 (Nelson 2000) documented a number of steelhead once again present in the creek

The CSCWRP has monitored sites on Aptos and Valencia Creek since 1975. Their data shows that both creeks are fairly alkaline compared to other creeks they monitor, averaging 242 and 229 mg/L, respectively. Conductivity is also higher than on many of the other coastal streams monitored.

One of the County's sites, at the Spreckels Drive bridge, had elevated fecal coliform 57% of the time relative to the Basin Plan objective of 200MPN/100mL (a criteria which is applied to 5 samples collected within a 30 day period). Other sites in the watershed were relatively clean. CCAMP coastal confluence monitoring data for fecal coliform at the Aptos Creek site had a geomean which exceeded the Central Coast Basin Plan objective of 400 MPN/100 ml. Nitrate levels were relatively low, averaging less than 0.2 mg/L (NO_3 as N). Orthophosphate (as P) levels were slightly elevated, averaging somewhat less than 0.2 mg/L. This compares well with the County's data. Oxygen levels were fully saturated with a relatively narrow range of values.

Conventional water quality has been monitored by volunteer monitors from the Coastal Watershed Council. Findings from the spring and summer of 2000 indicate that most parameters met water quality standards. However, turbidity was elevated on Valencia Creek, and flow was low at the confluence of Valencia Creek with Aptos Creek.

Mussel Watch data shows no exceedances of FDA action levels for metals or organic chemicals in fish tissue collected from Aptos Creek.

Soquel Creek – Hydrologic SubArea 304.13

The Soquel Creek Lagoon is listed on the 303(d) impaired waterbodies list for pathogens, nutrients, and siltation. Montgomery (1979) indicated that water quality influences on the watershed are primarily from urban runoff and residential development in the upper watershed with associated septic system use. Forestry activities in the upper watershed contribute to the sedimentation problem. Cafferata and Poole (1993) completed a watershed assessment of sediment impacts to the East Branch of Soquel Creek.

USGS conducted water sampling at their gaging station between 1953 and 1966, which gives an indication of general mineral composition of Soquel Creek water; hardness and dissolved solids are relatively high, but are comparable to ground water supply in the area. CSCWRP data show that Soquel Creek, along with Aptos and Valencia, have among the highest alkalinity levels of all creeks sampled by their program, averaging 210 mg/L in Soquel Creek.

Past CCAMP monitoring for fecal coliform at the Soquel Creek coastal confluence site has showed a geomean of all samples of 401 MPN/100 ml, with 33% of measurements exceeding the Central Coast Basin Plan single sample maximum of 400 MPN/100 ml. Nitrate levels were very low, averaging less than 0.1 mg/L (NO_3 as N). Orthophosphate (as P) averaged 0.11 mg/L. Dissolved oxygen levels showed no signs of depression. However, the maximum value was 13.88, which may indicate super-saturation. pH occasionally exceeded 8.3 (the Basin Plan criteria for domestic supply), but averaged 8.17. Multiple years of data collected by Santa Cruz County generally supports these findings.

Mussel Watch data shows no exceedances of FDA action levels for metals or organic chemicals in bivalve tissue collected from Soquel Creek.

San Lorenzo River Watershed – Hydrologic Subarea 304.12

The San Lorenzo River is listed on the 1998 303(d) list as impaired by nutrients, pathogens and sedimentation. The San Lorenzo River estuary is also listed for pathogens and sedimentation. Carbonera and Lompico Creeks, tributaries to the San Lorenzo River, are also listed for pathogens, nutrients and sedimentation. Shingle Mill Creek is listed for nutrients and siltation. Schwan Lake, which is also in the watershed, is listed for nutrients and pathogens. Revisions to the list currently under consideration would add a number of the tributaries specifically for sediment, but would delist the San Lorenzo for nutrients.

<u>General Watershed Description</u> – 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 a 115 square mile watershed, which is mostly a steep, heavily forested landscape on the west slope of the central Santa Cruz mountains. Average rainfall is about 47 inches, most of which falls between December and April (CSCWRP 1979; Phillip Williams & Assoc. 1989).

The San Lorenzo River is a perennial stream with average summer flows typically under 10 cfs but flood flows recorded as high as 35,000 cfs. The lower 2.2 miles of the stream have been channelized and levied for flood control purposes, as the stream flows through downtown 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. 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.

As of 1970, 23.2% of the watershed was in urban and suburban land use. Besides the City of Santa Cruz, the San Lorenzo River and its tributaries flow past the communities of Boulder Creek, Ben Lomond, Felton, Lompico, Zayante, Mount Hermon, and the City of Scotts Valley (CSCWRP 1979). In addition to urban, suburban and timber harvest uses, others include recreation (including golf courses), range and pasture land, and small animal holding facilities.

The main tributaries to San Lorenzo River include Carbonera Creek (7.4 sq. mi.), Zayante Creek (13.8 sq. mi.), Bear Creek (16.2 sq. mi.), Boulder Creek (10.2 sq. mi.), Newell Creek (9.7 sq. mi.), and Branciforte Creek (18.1 sq. mi.). Branciforte Creek is channelized in its lowest mile before it joins the San Lorenzo River. Loch Lomond is an impoundment on Newell Creek, formed in 1961 (CSCWRP 1979).

<u>Conventional Water Quality Findings</u> - Though nitrate levels in the San Lorenzo system are relatively low compared to other agriculture dominated watersheds in the area (such as the Pajaro River), the river was listed as impaired by nitrate based on impacts to taste and odor in the municipal water supply.

CCAMP coastal confluences monitoring rank the San Lorenzo River among the lowest in the Region for nitrate concentrations; it averaged 0.19 mg/L (NO3 as N) and never exceeded 0.8 mg/L. The San Lorenzo watershed has relatively rich natural sources of phosphorus (CSCWRP 1979); coastal confluence monitoring indicated an average value of 0.45 mg/L phosphorus as P. The low nitrogen to phosphorus ratio indicates that the watershed is nitrate limited. Therefore, controls on nitrate are important in the watershed to reduce taste and odor problems originating from algal growth.

The CCAMP program has acquired and reviewed the extensive water quality data collected by the Santa Cruz County Environmental Health Department. Virtually no indications of problems from nitrite or ammonia were found. An examination of dissolved oxygen levels over a twenty-year period of record showed only three excursions below 7.0 mg/L (the Basin Plan criteria for cold water fish) on tributaries. Violations were on Bear Creek, Gold Gulch and Kings Creek. No measurements were recorded below 6.4 mg/L. On the main stem of the San Lorenzo violations were more common, with measurements dropping below 7.0 mg/L 10.3% of the time. However, most violations were from one of the 18 sites monitored on the San Lorenzo; this was Station 1-01-002 below Boulder Creek, which violated 52% of the time, but never dropped below 5.3. Two violations were recorded at Waterman Gap and one at Irwin Way check dam. Overall, dissolved oxygen levels in the watershed appear to be in good condition.

CCAMP data show the San Lorenzo River to have the highest fecal coliform levels of all coastal confluences measured, which include 33 major watershed systems of the Central Coast. The fecal coliform geomean at the lower end of the river was 953 MPN/100 ml, with single sample maximums ranging as high as 92,000. This site violated the Central Coast Basin Plan objective (single sample maximum of 400 MPN/100ml) in 71% of the 17 samples taken (between April 2001 and March 2003). Fecal coliform appears to be a significant problem in almost all tributaries, according to data collected by the CSCWRP Environmental Health Department. Fall Creek and Clear Creek rarely or never exceeded 200 MPN/100 ml, the basin plan objective for the geomean of all samples. All other tributaries and the San Lorenzo River itself exceeded this value regularly. For example, of the 100 samples taken along the main stem over the twenty-five year period of record, 49 samples exceeded 200 MPN/100 ml and the geometric mean of all samples was 6749 MPN/100 ml. The worst site on the San Lorenzo River main stem was at Big Trees, where 67% of all samples violated the standard. Branciforte Creek, Carbonera Creek, Camp Evers tributary, and Schwann Lake also had relatively high percent violations. High fecal coliform levels are attributable at least in part to old and failing septic systems in the upper watershed.

Metals - State Mussel Watch Program data indicates that some metals may exceed Median International Standards (MIS) in mussel tissue in the Santa Cruz area (Rasmussen,). Samples have been collected from a number of locations in the San Lorenzo watershed and in the Santa Cruz Harbor. The MIS for copper was exceeded on the San Lorenzo River at Big Trees in the early 1980's. Santa Cruz Harbor exceeded MIS standards in shellfish on several occasions for cadmium, chromium, copper, and zinc. Fish tissue samples from Corcoran Lagoon and Moran Lake also had elevated levels of cadmium and chromium. In freshwater clam and fish tissue samples collected by Department of Fish and Game staff throughout the watershed, cadmium and copper levels did exceed the MIS levels on occasion.

The CSCWRP sampled for metals in water throughout the San Lorenzo watershed on a number of occasions. The Basin Plan standard in cold water fish habitat for both cadmium and chromium is 0.03 ppm and 0.05 ppm respectively. These values were exceeded on several occasions in urban runoff. Sediment chemistry data collected at the CCAMP coastal confluences site in 1998 did not show levels of these or any other metals elevated above the effects range medium (ERM) value.

<u>Habitat</u> – Sediment is a problem in a number of locations in the watershed and is the subject of several TMDL analyses. Fine sediment in spawning gravels results in reduction in carrying capacity for anadromous fish, and can severely reduce fish populations. Several studies describe the problem in detail (Leonard 1972, CSCWRP 1979, Swanson Hydrology 2001, and Soil Conservation Service 1990) and Regional 3 staff has compiled a literature review of studies related to the problem (Jagger et al. 1993). Sedimentation sources are various and the problem is a complex one. The major sources of erosion defined in the Zayante Creek sedimentation study (Swanson Hydrology 2001) are from roads (from timber harvest, private, and public purposes), active timber harvest, mass wasting, channel erosion and other urban and rural land uses. This study estimated that the Zayante watershed yielded 115,116 tons per year of sediment, of which 23% is potentially controllable. Hecht (1998) indicates that stream conditions have not improved since the Watershed Management Plan, developed in 1979 by the CSCWRP, was written. The proportion of bed material composed by baserock used for road surfacing has increased over the years, indicating significant wasting of roads in the upper watershed. The bed material is generally composed of finer material, with proportionally less material originating in the upper watershed, and more from the lower, sandier areas.

Algal growth has been documented in excessive amounts in the lower San Lorenzo River. Studies have been done to assess the extent of the algal growth problem in the watershed. Species found at Boulder Creek and Ben Lomond were particularly indicative of a nutrient enrichment problem. Relatively low dissolved oxygen levels at Boulder Creek support this finding. As the river moves downstream through Henry Cowell State Park this condition improves substantially (CSCWRP 1979).

Fish and Game surveys (CDFG 1996) indicate that water diversions by the City Water Department and by riparian users significantly impact summer stream flow, to the point that dewatering occurs at times. Water impoundment by Loch Lomond Reservoir also results in a reduction of flows to the lagoon. Channelization, riparian habitat removal, and lack of wood debris greatly reduce habitat quality in the lower reaches of the river. The same surveys describe numerous problems in tributary streams, including siltation, degradation of stream flow from water diversion, removal of riparian vegetation, improper placement of culverts, and degradation of water quality from septic systems.

Pajaro River Hydrologic Unit 305

The Pajaro River watershed was the focus of CCAMP watershed rotation monitoring in 1998 and 2005. Much of the following description of water quality issues stems from data collected by CCAMP in 1998.

Several waterbodies in the Pajaro watershed are listed on the CWA 303(d) list of impaired waterbodies, as follows:

Water Body	Pollutant	Pollutant	Pollutant	Pollutant	Pollutant
Pajaro River	Sedimentation	Nutrients			
Watsonville Slough	Sedimentation	Pathogens	Oil and Grease	Metals	Pesticides
Llagas Creek	Sedimentation	Nutrients			
Rider Gulch	Sedimentation				
San Benito River	Sedimentation				
Clear Creek	Mercury				
Hernandez Reservoir	Mercury				
Schwan Lake	Nutrients	Pathogens			

General Watershed Description - The Pajaro River watershed encompasses over 1,300 square miles of central California. The major direct tributaries to the Pajaro River include San Benito River, Tequisquita Slough/Santa Ana Creek, Pacheco Creek, Llagas Creek, Uvas Creek, and Corralitos Creek. The Pajaro River flows to Monterey Bay north of Moss Landing Harbor.

The Pajaro River watershed encompasses 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). 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, 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.

Pajaro River watershed flow patterns are characteristic of a Mediterranean climate, with higher flows during the wetter, cooler winter months and low flows during the warmer, drier summer months. Principal water sources for the Pajaro River and its tributaries are surface runoff, springs, subsurface flow into the channels, and reclaimed water entering the creek through percolation from water discharged by South County Regional Wastewater Authority (SCRWA). The first three water sources are subject to large flow variations due to climatic influences, while the discharge from the SCWRA tends to influence flow year-round.

Water Quality Findings - The Pajaro River watershed was monitored (water, sediment, and tissue samples) by the Central Coast Regional Water Quality Control Board (RWQCB) and subcontract laboratories from December 1997 through January 1999 to assess the relative contributions of conventional pollutants (nutrients, sediment, etc.), toxins, metals, and other pollutants from major tributary streams to document ambient water quality.

Conventional Water Quality - CCAMP has documented levels of pH, nutrients (nitrate and ammonia), dissolved oxygen, and total dissolved solids in the Pajaro River watershed that do not meet Central Coast Water Quality Control Plan (Basin Plan) water quality criteria. CCAMP has also determined that other water quality parameters of concern include temperature, algae (attached and suspended), sediment, and bacteria.

Sedimentation has been documented as a problem in portions of the watershed in other studies (Balance Hydrologics 1990 and Golder 1997). Much of this is due to bank sloughing, land slides of sandstone and shales in headwater areas, and sheet and rill erosion from adjacent land uses. The lower portion of the San Benito River is degrading as a result of gravel mining, and is in a state of disequilibrium, which can result in erosion of banks (Applied Science Engineering et al. 1999). CCAMP monitoring in 1998 did not address instream impacts of sedimentation in a detailed way, but did assess sediment impacts as part of bioassessment habitat analysis. That ”snapshot” view indicated that lower Llagas Creek and the Pajaro River at Betabel Road were most severely impacted by sediment.

CCAMP monitoring documented specific violations of Basin Plan pH criteria (mean values greater than standard of 8.3 pH units) at two sites in the Pajaro River watershed (Tres Pinos Creek and Pajaro River at Frazier Lake Road). Limited pH data has been collected on the San Benito and Pajaro Rivers. Dynamac Corporation (1998) reported “background concentrations” of pH data collected in the San Benito River up stream and down stream of the confluence with Clear Creek (upper San Benito River) exceeded regulatory limits (pH values from 8.4 to 8.8). Similarly, Williamson (1994) documented a pH range of 7.8 to 9.3 at the Frazier Lake Road site. A report by Greenlee (1981) contained 1978 Pajaro River surface water data collected by the State Water Resources Control Board showing pH values ranging from 6.6 to 9.4. This range of pH values in the Pajaro River is supported by historical data from the Chittenden stream gauge station (USGS and DWR data summarized by Williamson (1994)).

Water samples from three stations along the southern portion of Llagas Creek exceeded the State nitrate drinking water objective of 10 mg/L (NO_3 as N) on multiple occasions, and ranged as high as 31.7 mg/l at Holsclaw Road. Williamson (1994) reported similar elevated nitrate levels at two sampling stations (17.7 and 19.0 mg/L NO_3 as N) on Llagas Creek. Similarly, James Montgomery Consulting Engineers

(1993) documented nitrate levels on Llagas Creek between 4.5 and 17.0 mg/L NO_3 as N. Historical data (1955 through 1991) from various stations on Llagas Creek show nitrate levels on Llagas Creek ranging between 0.1 and 10.3 mg/L NO_3 as N (sources include USGS 1982 – 1990 Water Resources Data Reports, Regional Water Quality Control Board 1983 Staff Report). Haase (Appled Science Engineering et al., 1999) theorized that a reducing substance was infiltrating into the reach where seepage from the City of Gilroy's treatment plant is prevalent (from Holsclaw Road downstream to Bloomfield Road), because of the declining nitrate levels and sometimes increased ammonia levels across this reach.

The Basin Plan unionized ammonia objective of 0.025 mg/L NH3 as N was exceeded once at the Tequisquita Slough site reaching 0.072 mg/L NH3 as N. Limited ammonia data has been collected in the Pajaro River watershed. James Montgomery Consulting Engineers (1993) documented ammonia levels on Llagas Creek between 0.0007 and 0.0014 mg/L NO_3 as N. Williamson (1994) reported similar ammonia levels (a limited review of the data revealed ammonia levels from 0.011 to 0.032 mg/L NH3 as N) at six sampling stations in the Pajaro River watershed. The levels documented are typically below the 0.025 mg/l NH3 as N limit and indicate no problem with ammonia toxicity.

Over 35 violations of Basin Plan dissolved oxygen criteria for the COLD beneficial use (minimum values less than standard of 7.0 mg/L) were observed at twelve sites in the Pajaro River watershed. Williamson (1994) reported similar dissolved oxygen levels (a limited review of the data revealed 11 dissolved oxygen measurements below 7.0 mg/L) at six sampling stations (four on Llagas Creek and two on the Pajaro River) in the Pajaro River watershed. James Montgomery Consulting Engineers (1993) also documented 16 dissolved oxygen measurements below 7.0 mg/L on Llagas Creek, Miller Canal, and Pajaro River. The Greenlee (1981) report containing 1978 Pajaro River surface water data collected by the State Water Resources Control Board documented one instance of dissolved oxygen below 7.0 mg/L.

Three violations of Basin Plan dissolved oxygen criteria for the WARM beneficial use (minimum values less than standard of 5.0 mg/L for WARM) were observed at the Tequisquita Slough site in the Pajaro River watershed. Of the data reviewed, no others documented dissolved oxygen levels lower than this value in water bodies designated as WARM.

All but two sites sampled in the Pajaro River watershed had at least one dissolved oxygen measurement depressed below 85% saturation, however the Basin Plan objective is applied to the median dissolved oxygen saturation value of 85%. Both Tequisquita Slough and the Pajaro River sites at Betabel Road and Thurwachter Bridge violated the oxygen saturation criteria 50 percent of the time. Of other data sources reviewed, none recorded oxygen saturation levels.

Average total dissolved solids (TDS) levels, at all Llagas Creek sites, exceeded the Basin Plan waterbody specific objective of 200 mg/L. On the San Benito River, at the Y Road site, TDS levels exceeded the Basin Plan surface water quality objective of 1400 mg/L in September and October 1998. TDS values at the lower Pajaro River sites at Chittenden Gap and Murphy's Crossing reached or exceeded the Basin Plan surface water quality objective of 1000 mg/L for TDS in August, September, and October 1998.

James Montgomery Consulting Engineers (1993) documented a range of average TDS values of 736 to 848 mg/L on Llagas Creek. Only two samples out of 25 collected were below the water quality objective of 200 mg/L. James Montgomery Consulting Engineers (1993) also observed an average range of TDS values of 829 to 839 mg/L on Pajaro River. Average TDS values reported for this section of the Pajaro River were below the Basin Plan surface water quality objective of 1000 mg/L, but several individual measurements exceeded the objective.

Metals – State Mussel Watch Program tissue data collected during the 1998 CCAMP sampling from the San Benito River at Y Road had the highest values of all sites for several different metals, notably aluminum, cadmium, chromium, copper, mercury, nickel, silver, and zinc, implying metals may be a problem in this watershed. Chromium, copper and zinc levels in tissue were high throughout the watershed compared to Median International Standards. Chromium levels were also elevated throughout the watershed in sediment samples. Chromium concentrations are commonly high in areas with serpentine soils.

Manganese levels in tissue were high throughout the Pajaro watershed overall compared to the Mussel Watch EDL 95 for transplanted freshwater clams, and in Llagas Creek samples were particularly high. Historical data from the Pajaro Valley Water Management Agency has shown manganese to also be elevated in Corralitos Creek (Applied Science Engineering et al. 1999)

On the Pajaro River at Betabel Road, several metals (lead, copper, nickel and zinc) were above cold water habitat Basin Plan criteria, in a single water sample taken in March. Metals data from the Chittendon Gap site on the Pajaro River have historically been elevated for both mercury and lead. Mercury and lead are also periodically elevated on Llagas Creek (Applied Science Engineering et al. 1999).

A management plan developed for Watsonville Slough identified copper, nickel and zinc at high levels in tissue and sediment in the Slough (Questa Engineering 1995). Lead at potentially toxic levels has also been detected repeatedly over the years (Applied Science Engineering et al. 1999).

Mercury was elevated (over the California Toxics Rule water quality objective) at sites on the San Benito watershed, in water samples collected for CCAMP by the State Mussel Watch Program. Sediment samples from the upper San Benito watershed also had elevated mercury levels (exceeding the NOAA ERL). There are a number of historical references to elevated mercury levels in this watershed (Applied Science Engineering 1999). Both Clear Creek and Hernandez Reservoir are listed on the 303(d) list for mercury.

A Clear Creek study conducted for the Bureau of Land Management (Dynamac 1998) found elevated levels of chromium, nickel and copper in water quality samples. Sediment samples were high in cobalt, nickel and mercury at several sites, and antimony, chromium, cadmium, copper, and arsenic at a few sites. Some references also indicate elevated levels of barium in Clear Creek (Applied Science Engineering 1999).

Synthetic Organic Chemicals - Legacy organochlorine pesticides and several currently applied organophosphate pesticides can be found in most tributaries of the Pajaro River system. DDT compounds were widespread in CCAMP sediment and tissue samples. Several main stem sites had elevated levels of DDT, dieldrin, and chlordane compounds. The Betabel Road site had the highest values of dieldrin and toxaphene. Chittendon Gap had relatively high levels of dieldrin and toxaphene as well as chlordane compounds. Llagas Creek also had relatively high levels of chlordane compounds.

Salsipuedes Creek stands out in CCAMP data for the relatively large number of chemicals that were present in clam tissue. DDT compounds were found at levels exceeding several criteria at this site in sediment, water and tissue. Relatively low levels of diazinon and chlorpyrifos were found in sediment, water, and/or tissue. Other chemicals included dieldrin, chlordane, and oxadiazon (sediment and tissue); and toxaphene, heptachlor epoxide, and ethyl parathion (tissue only).

The most prevalent findings related to currently applied pesticides were relatively high values of diazinon in clam tissue collected in several main stem Pajaro River sites, particularly at Betabel Road. Pacheco Creek also had somewhat elevated levels of ethyl parathion, which though being phased out, is still applied to certain crops.

Toxicity Identification Evaluation studies conducted on samples from lower Pajaro watershed sites (by Granite Canyons Marine Polution Studies Laboratory staff in 1998) suggested the toxicity found on the main stem and in some of the agricultural drains were attributable to organochlorine pesticides. 78% of samples collected from drainage ditches were acutely toxic. Sampling by M. Swanson and the Habitat Restoration Group in the winter of 91/92 identified 4’4’DDE and endosulphan sulphate in the Pajaro lagoon. The Questa Engineering study (1995) confirmed elevated levels of diazinon and DDT/DDE in water quality samples. State Mussel Watch data confirms that Watsonville Slough has had extremely high levels of organochlorine pesticides in past years, particularly DDT, chlordane, dieldrin, endosulphan, toxaphene, hexachlorobenzene and PCBs; some of these levels are the highest documented in the State.

<u>Oil and Grease</u> **–** Recent stormwater data collected from Watsonville Slough (RWQCB, 2001) indicate that oil and grease are found there at levels that are sometimes of concern. Watsonville Slough is listed as impaired by oil and grease.

Bolsa Nueva Hydrologic Unit 306

The Bolsa Nueva Hydrologic Unit in located in Monterey County, east of Moss Landing Harbor and consists of Moro Cojo Slough and Elkhorn Slough. These largely tidal waters enter Monterey Bay through Moss Landing Harbor. Both the Elkhorn and Moro Cojo Sloughs are listed on the CWA 303(d) list of impaired waterbodies, as follows:

Waterbody	Pollutant
Elkhorn Slough	Pathogens Pesticides

	Sedimentation/Siltation
Moro Cojo Slough	Low Dissolved Oxygen Pesticides Sedimentation/Siltation

Water Quality findings

Historically, water quality data in the Bolsa Nuevo Hydrologic Unit is minimal. However, some data sources exist for nutrients, as summarized by Jaggeer (1981). More recently, the Elkhorn Slough Reserve employs two water quality monitoring programs. The volunteer monitoring program has been collecting monthly data since 1988 in both Elkhorn and Moro Cojo Sloughs. The National Estuarine Reserve System (NERR) system-wide program has been collecting data since 1995, including continuous probe data at multiple stations throughout the Elkhorn Slough. CCAMP is also collecting data at one location in Moro Cojo Slough and three locations in the Elkhorn Shough and it’s tributaries.

Conventional Water Quality

Historic nutrient data from Elkhorn Slough indicated that nitrate, phosphorus, and ammonia levels in Elkhorn Slough were uniformly low. Jagger (1981) also concluded that there was little impact from agricultural return waters on Elkhorn Slough, although it was not determined if this was due more to regular tidal flushing or to a lack of nutrient inputs. Elkhorn Slough is largely tidal, with some freshwater stratification in the rainy winter months.

The data report for volunteer monitoring data in the Elkhorn Slough Reserve summarized several findings including a significant increase in nitrate concentrations over the past thirty years (Caffey 1997). In general, volunteer monitoring data documented elevated nutrient concentrations throughout most of Elkhorn Slough, Bennett Slough and Moro during the rainy season. Volunteer data from Carneros Creek a tributary to Elkhorn Slough show nitrate concentrations in excess of 14 mg/l during the winter rainy season. The volunteer data summary report also reported relatively low concentrations of ammonium, despite potential inputs from dairy farms in watershed. Data analysis conducted by Caffrey et al (1997) show that nutrient concentrations in the slough have increased dramatically since the 1970s and when compared to historic data the authors have shown that nitrate concentrations have increased at all stations where both historic and current data exists.

Bacterial monitoring conducted in the Bolsa Nueva watershed between 1988 and 1994 for assessment of the feasibility of a commercial shellfish operation in Elkhorn Slough. The sites were largely marine and tidal, with generally low bacteria levels. Total coliform levels exceeded 10,000 MPN/100ml and fecal coliform exceeded 600 MPN/100ml in about 5 % of the samples, with the highest values occurring during rainy winter months (Cotter and Strnad 1997-secondary reference from SWRCB 1999).

Dissolved oxygen concentrations measured monthly by volunteer monitors ranged widely within Elkhorn Slough as in normal in estuaries. In addition to monthly monitoring continuous monitoring probes were deployed at several locations in the Slough. These results show that the Upper Pond becomes hypoxic or anoxic on a daily basis for several weeks in late summer or early fall, while the South Marsh does not.

Synthetic Organic Chemicals and Metals

Moss Landing Harbor and its tributaries are listed as a known Toxic Hot Spots for pesticides, PCBs, nickel, chromium, and tributyl tin (SWRCB 1999). Several beneficial uses for waterbodies in this Hydrologic Unit are impaired due to metal or pesticide concentrations. Data collected in Moss Landing Harbor identified multiple pollutants which exceed published criteria for sediment and tissue. These include pesticides (dieldrin, chlordane, DDT and toxaphene), PCB's and metals (tri-butyl tin and nickel). Sediment samples were also toxic to invertebrate test organisms. Moss Landing Harbor is now on the Clean Water Act section 303(d) list (Impaired Waters List) for pesticides. In Elkhorn Slough, elevated levels of dieldrin, endosulfan and nickel were reported and the Slough was added to the Impaired Waters List in 1999 for pesticides. Moro Cojo Slough data showed elevated dieldrin, DDT, toxaphene, PCB's and nickel in tissue and sediment. Sediment samples were also toxic to invertebrate test organisms.

Carmel River Hydrologic Unit 307

The Carmel River watershed is located in Monterey County just south of Monterey Bay, between the Santa Lucia mountains to the South and the Sierra del Salinas to the North and East. The river flows northwest through Carmel Valley to Carmel River lagoon and the Pacific Ocean near Carmel. The watershed drains approximately 199,570 acres. 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 purposes. The upper reaches of the Carmel River, above the Los Padres Dam, flow through the Los Padres National Forest.

CCAMP staff conducted monthly monitoring at five sites in this watershed in 2002. In general, the watershed is in good condition. One Carmel River site (near Carmel Village) had widely ranging dissolved oxygen values, with lows reaching 6.12 mg/L during summer 24 hour continuous monitoring. There were no other exceedances of Basin Plan objectivse at sites on the Carmen River. CCAMP staff also monitored one site on Turlarcitos Creek. Elevated phosphate levels were reported and 50% of all CCAMP monthly sample exceeded the Basin Plan Objective for contact recreation (400 MPN/100mL).

Santa Lucia Hydrologic Unit 308

The Santa Lucia Hydrologic Unit is located west of the Santa Lucia mountain ranges in Monterey County and is characterized by small coastal streams that flow directly to the ocean. Because this Hydrologic Unit is located along the remote Big Sur coastline, many of the watersheds have little or no disturbance by agricultural or urban activities. Upper watersheds originate in the Los Padres National Forest, on the steep northwestern slopes of the Santa Lucia mountains. Primary impacts in this forest stem primarily from roads, cattle grazing, fire management, inactive mines, and other sources of sediment. Rural residential uses are common at lower watershed elevations. Watersheds with these primary land use activities include San Jose Creek, Garrapata Creek and Little Sur River. Several of the larger creeks and rivers run through State and/or private parks at their lower ends. For example, the Big Sur River watershed, which is the largest in the Unit at 37,392 acres, includes National Forest Service land, Big Sur State Park, Andrew Molera State Park, small private parks, the community of Big Sur and scattered single family residences. Other creeks, such as Big Creek, have far less exposure to human activities; the upper reaches of this creek are in Forest Service land and the lower reaches are within the U.C. Santa Cruz Landels-Hill Big Creek Ecological Reserve.

In 2002, CCAMP staff conducted monthly monitoring at several creeks and rivers in this Hydrologic Unit including the following: San Jose Creek, Garrapata Creek, Little Sur River, Big Sur River, Big Creek, Limeklin Creek, Mill Creek and Willow Creek. Many of these are also coastal confluence sites. No site in this Hydrologic Unit exceeded Basin Plan objectives. However, nuisance algae and emergent aquatic plant growth was documented at San Jose Creek. These conditions occurred as the creek was drying up in the summer months.

Salinas River Hydrologic Unit 309

The 2002 303d list indicates that nutrients, pesticides, and fecal coliform bacteria are the most widespread pollutants in the lower Salinas watershed, while metals are the dominant pollutant in the upper Salinas watershed. The presence of some of these pollutants at problematic levels has been well documented for decades (Jagger 1981, Jagger et al. 1981, Cotter and Strnad 1997), and recent sampling by CCAMP and others suggests that these problems persist today (CCoWS 2003, CCAMP 2003, Rasmussen and Blethrow 1990, Downing et al. 1998).

Twenty-four water bodies within the Salinas River watershed have been listed by the Regional Board on the 2002 Clean Water Act's 303(d) list of impaired water bodies due to specific pollutants as follows:

Waterbody	Pollutant	Pollutant	Pollutant	Pollutant
Lower Salinas Watershed				
Alisal Creek	Fecal Coliform	Nitrate		
Gabilan Creek	Fecal Coliform			
Old Salinas River Estuary	Fecal Coliform	Nutrients	Pesticides	Dissolved Oxygen
Salinas River (Estuary to Gonzalez)	Fecal Coliform	Nutrients	Salinity/TDS/ Chlorides	Pesticides
Salinas River (upper)	Chloride	Sodium		
Salinas River Lagoon South	Nutrients	Pesticides	Salinity/TDS/ Chlorides	
Tembladero Slough	Fecal Coliform	Nutrients	Pesticides	
Blanco Drain	Pesticides			
Espinosa Slough	Nutrients	Pesticides	Organics	
Salinas Reclamation Canal	Fecal Coliform	Nitrate	Pesticides	Dissolved Oxygen
Salinas River (Gonzalez Rd to Nacimiento River)	Pesticides		Salinity/TDS/ Chlorides	Sedimentation
Salinas River Lagoon North	Nutrients	Pesticides	Sedimentation	
San Lorenzo Creek	Fecal Coliform	Boron		
Upper Salinas Watershed				
Atascadero Creek	Fecal Coliform			
Las Tablas Creek, N. Fork	Metals			

Nacimiento Reservoir	Metals
Las Tablas Creek	Metals
Las Tablas Creek, S. Fork	Metals

General Watershed Description

The watershed of the Salinas River and its tributaries covers approximately 4,600 square miles (nearly 3 million acres) and 2 Hydrologic Units, the Salinas River Hydrologic Unit (HU 309) and the Estrella River HU (317). The Salinas watershed is completely within San Luis Obispo and Monterey Counties. The Salinas River originates in San Luis Obispo County, flows northwest into Monterey County, through the entire length of the Salinas Valley and empties into Monterey Bay. The watershed's main tributaries are the Arroyo Seco, Nacimiento, San Antonio, and Estrella Rivers. The Salinas forms a large lagoon at its mouth, closed to the ocean by a sandbar much of the year.

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 and grazing now primarily occurs in foothill regions of the watershed. Irrigated cropland is predominant in the lower Salinas watershed. Row crops such as lettuce, celery, broccoli and cauliflower are cultivated on the valley floor. 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. Additional land uses include two military facilities (Fort Hunter Liggett and Camp Roberts), mineral and oil extraction in the San Ardo area and a few other locations throughout the watershed, and some public land and open space.

The watershed has three dams, 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, 1999a).

Water Quality Findings

A general overview of Salinas watershed water quality findings follows. For the purposes of this summary the upper and lower watershed (divided at Bradley) are discussed separately.

UPPER SALINAS WATERSHED, ABOVE BRADLEY:

Conventional Water Quality:

Most of the nutrient data for the upper Salinas watershed area prior to 1999 comes from a 1981 review of Basin Plan Water Quality Standards for the Salinas River that included a significant data and literature review. The authors report that in general, nutrient levels and associated problems with dissolved oxygen fluctuations were not a concern in the upper Salinas River as of 1981 (Jagger et al. 1981). These data show that Salinas River nitrate concentrations near Bradley averaged 0.22 to 0.45 mg/L NO_3 as N from 1958 to 1980, with a maximum level of 4.4 mg/L NO_3 as N in 1961 (Jagger et al.

1981). Neither ammonia nor dissolved oxygen levels were considered a water quality problem in the upper Salinas watershed as of 1981. Nitrate concentrations at the Bradley bridge in CCAMP data from 1999 ranged from 0.22 to 0.72 mg/L NO_3 as N.

TDS, sodium, boron, and chloride were within Basin Plan objectives in 1981 at Bradley Bridge (Jagger et al. (1981). During this same time period, sulfate levels were moderately higher than existing Basin Plan objectives, but the suggestion at that time was to raise the Basin Plan objective (Jagger et al. 1981). CCAMP data collected in the upper watershed in 1999 shows that site specific objectives for chloride, sodium and total dissolved solids were exceeded on multiple occasions in the upper Salinas watershed, including main stem sites in Atascadero, Paso Robles, Bradley and San Ardo. San Lorenzo Creek, which enters the Salinas River from the east side of the watershed, also has elevated boron and total dissolved solids.

A 1971 survey by the State Health Department found that fecal bacteria levels in the Salinas River near Bradley were below levels of concern (Jagger et al.1981). CCAMP data collected monthly in 1999 show that fecal coliform levels in Atascadero Creek and Salinas River at Atascadero were elevated, relative to Basin Plan Objectives, on multiple occasions.

Pesticides & Metals

No historic data on pesticides or metals in water or stream sediments is available for the upper Salinas watershed. In 1999, CCAMP collected sediment samples throughout the watershed. There were no exceedances of available criteria for organic chemicals or metals in sediments from upper-watershed sites.

LOWER SALINAS WATERSHED:

The known water quality problems and the majority of past water quality data for the lower Salinas watershed are concentrated in the area downstream of the town of Chualar (approx 10 miles upstream from the city of Salinas).

Conventional Water Quality

Elevated nutrient levels and associated problems with algal blooms and dissolved oxygen extremes in the lower Salinas watershed have been well documented since as early as 1965 (SWRCB 1965). Prior to the construction of the Monterey regional wastewater treatment plant (in 1990), dry season flow in the lower Salinas River was almost entirely a combination of wastewater discharge and agricultural return flows. Jagger et al. (1981) documented that nitrogen and phosphorus levels increased dramatically below the wastewater treatment plant inputs and were accompanied by large algal blooms and associated extreme diurnal swings in dissolved oxygen in the Salinas River. At these locations unionized ammonia levels greatly exceeded levels of concern for toxicity to fish on a regular basis (Jagger et al.1981). Limited data for the Tembladero Slough prior to 1990 suggests that it had elevated nitrate and phosphate levels similar to the lower Salinas River, and increasing below wastewater treatment plant discharge points. However, ammonia levels were significantly lower (Jagger et al.1981).

The long-term water quality monitoring program for Elkhorn Slough and the tributaries to Moss Landing Harbor found that nitrate (as NO_3) in the Old Salinas River, Tembladero Slough, and Salinas

River Lagoon averaged 30 mg/l for the period 1988-1995, with highest concentrations during the low flow dry season (Caffrey et al. 1997). A more recent analysis of nutrients in the Salinas watershed examines nitrate, ammonia, and phosphate data spanning the last decade in Salinas and Pajaro watershed areas, from Central Coast Watershed Institute (CCoWS), CCAMP, and USGS sampling stations (Anderson et al. 2003). This analysis shows that the agricultural return drains in the lower Salinas watershed, including Chualar Creek, Quail Creek, Tembladero Slough, the Salinas Reclamation Canal and Blanco Drain, have extremely high levels of ammonia, nitrate, and phosphate, with numerous sites averaging greater than 20 mg/L NO_3 as N. The main stem Salinas River sites have much lower nutrient levels, but are clearly influenced by the input of the agricultural return drains, with increasing nitrate and phosphate concentrations in the sites downstream of these inputs. Nutrient levels tend to be lower during high flow events than during base flow conditions.

<u>Bacteria</u>

Bacterial contamination in the lower Salinas River has been a chronic problem since at least 1969, when the Monterey County Health Department began regular sampling that led to continuous posting of the river below Spreckels as unsafe for water contact recreation. The county emphasized that the problem was worst in the summer when agricultural return flows and wastewater treatment plant outputs were the primary sources of water in the lower Salinas. Like nutrients, coliform bacteria concentrations were generally lower above the wastewater treatment plants and higher below them. Coliform levels measured in Alisal Slough and Blanco Drain (agricultural return drains) in 1980 indicated that high levels of coliform were also entering the Salinas from these drainages (Jagger et al. 1981).

More recent bacterial monitoring data from the lower Salinas Watershed show elevated fecal coliform levels year round in San Lorenzo Creek, Quail Creek, Salinas Reclamation Canal and a storm drain input at Airport Road, the Salinas Storm drain near Davis Road, and Tembladero Slough. These data are from monthly monitoring between January 1999 and March 2000. In wet weather flows the Salinas River at Chualar and David Road also had elevated fecal coliform levels during this period (CCAMP 2003).

<u>Minerals and Salts:</u>

Limited data on minerals and salts in the water bodies of the lower Salinas watershed suggests that TDS, sodium, boron, and chloride in the lower Salinas were moderate to low above Spreckles, but increased significantly from Spreckles downstream. Because no specific water quality objectives for minerals or salts were listed for the water bodies below Spreckels at the time of the analysis, only a brief discussion of TDS was presented in the report (Jagger et al. 1981). TDS was found to peak at the Blanco Drain input, and separate sampling in Blanco Drain confirmed that it had much higher conductivity and salinity than the main stem Salinas River. This suggests that agricultural return drains in the lower Salinas watershed were increasing the TDS levels in the main stem river at that time (Jagger et al. 1981).

CCAMP data collected in the lower watershed shows that site specific objectives for Boron were exceeded on multiple occasions in the Old Salinas River and Tembladero Slough. These sites are in the lower watershed and are tidally influenced.

<u>Pesticides</u>

Row-crop agriculture is the dominant land use in the lower Salinas watershed. Intensive pesticide usage associated with agriculture is common throughout this area, and has probably been so since the development of pesticides for commercial agriculture in the 1940s. A wide variety of both legacy pesticides and currently used pesticides have been detected in water, sediment, and tissue samples from the lower Salinas watershed. Available data on pesticides in the Salinas Watershed begins in the early 1970s and includes tissue data from the State Mussel Watch Program (SMWP) and Toxic Substances Monitoring Program (TSM), water samples from the Department of Water Resources (DWR), sediment and toxicity testing by the Bay Protection and Toxic Cleanup Program (BPTCP), sampling by Burae (1981) taken in 1972, and sampling by the Regional Water Quality Control Board in 1980 (Jagger 1981).

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. Tembladero Slough and numerous agricultural return drains that flow into the Salinas have shown the highest toxicity, with some sites exhibiting 85-100% mortality 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). CCAMP sediment chemistry monitoring, conducted in 1999, identified elevated DDT in sediments (relative to ERM values) from the Salinas River Lagoon, the Old Salinas estuary and Tembladero Slough.

<u>Metals</u>

Extensive sampling of stream sediments for heavy metals as described in Burau et al. (1981) was conducted in large portions of the Salinas watershed in 1972. This sampling effort identified the marine sedimentary deposits on the southwest side of the Salinas River between King City and San Ardo as naturally high in cadmium, arsenic, copper, and zinc. Metals were found at generally low levels in sediments and soil samples throughout the sampled areas. The only criteria exceedance was for lead, in Salinas River sediments near San Ardo exceeding the Probable Effects Level at 102 ppm.

The sampling effort by Burau et al. (1981) did not include any portion of the Nacimiento River drainage. This area is naturally rich in mercury, and was commercially mined for mercury in the past. Metals concentrations in water samples from these water bodies consistently exceed narrative and numeric water quality objectives for mercury (RWQCB 1999b). In addition, a number of fish tissue samples collected from fish in Lake Nacimiento between 1981 and 1994 exceeded US Food and Drug Administration standards for human consumption (Rasmussen and Blethrow 1990). Inactive mercury mines in the Las Tablas Creek drainage are thought to be the primary source of the high mercury levels found in water, sediment, and fish tissue from these water bodies (Rice et al. 1994 and RWQCB 2002).

CCAMP sediment chemistry monitoring, conducted in 1999, identified elevated nickel concentrations in sediments from Tembladero Slough, Old Salinas River, the Salinas River at Davis Road, and the Salinas Lagoon. In addition, elevated nickel concentrations were measured in the channel that conveys storm drain water from the City of Salinas to the Salinas River above Davis Road.

Estero Bay Hydrologic Unit 310

The coastal watersheds of the Estero Bay Hydrologic Unit are in western San Luis Obispo County. San Luis Obispo Creek is the largest of the watersheds in this Unit, at 54,150 acres. Steelhead trout are an important resource in most of these creeks, and the southern portion of this Unit is often considered the southern extent of their viable range. TMDL listings in this area include Morro Bay (for metals, pathogens, and sedimentation), Chorro Creek (for metals, nutrients, and sedimentation), Los Osos Creek (for nutrients, priority organics, and sedimentation), and San Luis Obispo Creek (for nutrients, pathogens, and priority organics).

Several urban areas including San Simeon, Cambria, Cayucos, Morro Bay, Los Osos, San Luis Obispo, Pismo Beach, Arroyo Grande, and Oceano are found in the area. Major land uses in the area include grazing, agriculture and residential. In the watersheds of San Simeon, Santa Rosa, Villa, Cayucos, Old, Toro and Morro Creeks the primary land uses are grazing, vineyards, avocado and orange orchards on multiple ranch properties. In recent years an increasing number of ranches are converting to vineyards and avocado orchards. Some areas include intensive agricultural cropping activities, particularly in the lower watersheds of Chorro Creek, Los Osos Creek, San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek. There are additional land uses that have affected water quality in several of these watersheds, these are discussed in more detail in the following paragraphs.

In the San Simeon Creek watershed the creek mouth is located within the boundary of San Simeon State Park Campground. Upstream of this location there is gravel mining on the stream terraces. Also located just upstream from the campground are Cambria Community Services District wastewater percolation ponds and spray fields. The San Luis Obispo Waste Water Treatment Plant (WWTP) discharges directly to San Luis Creek, resulting in consistently elevated phosphate levels downstream. A similar situation is found in Chorro Creek downstream of the California Men's Colony WWTP discharge. During some months of drier years the lowest reaches of these creeks are dominated by effluent flows.

Impoundments in several watersheds in the Unit have significantly altered stream hydrology and are barriers to fish passage. Old Creek historically flowed to Estero Bay between Cayucos Creek and Toro Creek. Whale Rock Reservoir is located less than a mile from the ocean on this creek, creating a complete fish barrier for the majority of the watershed. Native steelhead trout populations are currently maintained in the reservoir by artificial spawning and rearing. Chorro Creek flows to Morro Bay Estuary at Morro Bay State Park. Morro Bay is recognized as both a State and National Estuary. The headwaters of Chorro Creek drain to Chorro Reservoir, which both impounds Chorro Creek water and serves as a terminal reservoir for Whale Rock Reservoir. Chorro Reservoir is located above the California Men's Colony facilities on California National Guard property. Low volume year-round releases from the reservoir are maintained. The dam at Lopez Lake divides the Arroyo Grande watershed, with more than half of the watershed above the dam. Lopez Lake maintains continuous releases to the lower Arroyo Grande Creek channel. The dam represents a complete barrier for steelhead trout and has resulted in a significant reduction in anadromous spawning in this watershed. A small dam on Prefumo Creek, a tributary to San Luis Obispo Creek, has created Laguna Lake, which provides recreation for local residents as well as habitat for wildlife. It is not a barrier to steelhead passage in higher flows.

San Luis Obispo Creek has been channelized through the downtown areas of San Luis Obispo, and in one segment flows underneath the City. Creeks in the area with extensive channelization include Pismo Creek and Arroyo Grande Creek. Pismo Creek is contained in a cement box channel between Highway 101 and the ocean through the City of Pismo Beach. Arroyo Grande Creek is completely channelized below Fair Oaks Boulevard and the channel is maintained for flood control through annual removal of vegetation. Flood control in lower Arroyo Grande Creek is an ongoing local problem.

Soda Lake Hydrologic Unit 311

The Carrizo Plain Hydrologic Unit is located in the eastern portion of San Luis Obispo County. This is a geologically and biologically unique area. A large portion of the land is protected in the "Carrizo Plain Natural Area (CPNA), a cooperative effort since 1985 between the Bureau of Land Management (BLM), the California Department of Fish and Game (CDFG), and The Nature Conservancy (TNC).

The Carrizo Plain is a basin-shaped watershed with no outlet to the ocean, formed by the Temblor Mountains to the northeast and the Caliente Mountains to the Southwest. The San Andreas Fault cuts along the base of the Temblor Range, resulting in striking geological features such as displaced streambeds and sheared hillsides. The Pleistocene uplift of the Temblors resulted in capture of runoff within the central Carrizo Plain to form Soda Lake, a 3,000 acre ephemeral alkaline lake at the center of the Plains. Soda Lake provides important habitat for migratory birds and is one of the largest undisturbed alkali wetlands in California. Without an outlet, water from the lake evaporates, leaving behind residual sulphates and carbonates. The lake is currently identified as impaired by ammonia on the Clean Water Act section 303(d) list.

Erosion by southern tributaries of the Salinas River has resulted in capture of the more northerly portions of the Plain, so that this area now drains to the Salinas River.

The CPNA is 250,000 acres of cattle ranching and dryland farming, rural residential and large areas of relatively undisturbed habitat. The Carrizo Plain supports many endangered, threatened and rare plant and animal species and contains some of the last remnants of the once vast San Joaquin Valley grassland habitat.

Santa Maria Hydrologic Unit 312

The Santa Maria River Hydrologic Unit includes all areas tributary to the Cuyama River, Sisquoc River, and Santa Maria River. At 1,880 square miles (1.2 million acres) the Santa Maria River watershed is one of the larger coastal drainage basins of California. The Cuyama River and Sisquoc River originate in north and south slopes of the Los Padres National Forest wilderness areas. The Santa Maria River is formed by the confluence of the Cuyama and Sisquoc approximately 7 miles southwest of Santa Maria.

The upper Sisquoc River is in a reasonably natural state with much of the watershed located in National Forest and large ranches. Within the Los Padres Forest Service boundary, the upper 33 miles of the Sisquoc is listed as a National Wild and Scenic River and is important spawning habitat to steelhead trout (*Oncorhynchus mykiss*). Major tributaries to the Sisquoc River include La Brea Creek, Horse Canyon Creek and Tepusquet Canyon Creek.

The Cuyama River headwaters are in Ventura county where it is also in reasonably natural state (above Highway 33) and National Forest areas and large ranches are the primary land use. Below Sierra Madre Road and throughout its length in San Luis Obispo County the channel of the Cuyama has been highly altered to better align with State Highway 166. Much of the upper Cuyama watershed is made up of sedimentary marine deposits that are naturally erosive. As a result, the river carries a heavy sediment load. The Twitchell reservoir (completed in 1958) is located on the Cuyama River six miles above the confluence with the Sisquoc River. The dam traps much of the sediment contained in the Cuyama flows and prevents migration of steelhead upstream to tributaries of Alamo Creek and Huasna River where they historically spawned.

The Santa Maria valley is a broad flat valley, protected from flooding by levees and a series of flood control channels and basins. The lower Santa Maria River Watershed, including the Santa Maria River, is highly altered. The river has a very sandy, braided channel and is levied along much of its length. It is a "losing" stream, meaning that surface water flow tends to rapidly infiltrate into underlying permeable layers. The river is the major source of recharge to the Santa Maria groundwater basin. Urban runoff and associated pollutants also tend to infiltrate, rather than flow to the Santa Maria River.

Nipomo Creek drains the Nipomo valley and joins the Santa Maria River just west of US Highway 101. Solomon (Orcutt) creek drains the Orcutt area and joins the Santa Maria River near its outlet to the Pacific Ocean. Oso Flaco Lake and its drainage, though not part of the Santa Maria watershed, are included in Hydrologic Unit 312.00 and will be included in this sampling rotation. Oso Flaco is north of the Santa Maria Estuary.

Major activities in the Santa Maria watershed include irrigated and dryland agriculture, oil production, and urban development. Twitchell Reservoir serves important flood control and water recharge functions. Sedimentation of this reservoir is reducing its water storage capacity, and if allowed to continue will affect the reservoir's flood control capacity. Pollutants of known concern in the watershed include nitrates and total dissolved solids in groundwater, organochlorine pesticides in the estuary, and petroleum production byproduct (diluent) in ground and surface water of the Guadalupe Dunes and nearby areas. Currently TMDLs for nitrate and coliforms are being prepared by Regional board staff for the watershed. Those waters that are identified as impaired and are included on the Clean Water Act section 303(d) list are identified below. The majority of these impairments were identified as a result of CCAMP monitoring in this watershed between January 2000 and March 2001. These data can be viewed on the CCAMP website (http://www.ccamp.org/ca0/3/312/312BySiteProj.htm).

Clean Water Act section 303(d) listed waters in the Santa Maria Hydrologic Unit

Waterbody	**Pollutant / Stressor**
Alamo Creek	Fecal coliform

Bradley Canyon Creek	Ammonia Nitrate Fecal coliform
Bradley Channel	Nitrate Fecal coliform
Cyuama River	Boron
Main Street Canal	Ammonia Nitrate
Nipomo Creek	Fecal coliform
Oso Flaco Creek	Ammonia Nitrate Fecal coliform
Oso Flaco Lake	Dieldrin
Orcutt Solomon Creek	Ammonia Nitrate Fecal coliform Chlorpyrifos Dieldrin DDT
Santa Maria River	Ammonia Nitrate Fecal coliform Chlorpyrifos Dieldrin Endrin DDT

San Antonio Creek Hydrologic Unit 313
San Antonio Creek watershed drains approximately 17,000 acres (Cal Water v. 2.2) in Santa Barbara County, and is the only watershed in the San Antonio Creek Hydrologic Unit. The creek flows to the ocean on Vandenberg Air Force 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 Vandenberg AFB water quality program is monitoring several sites on this creek. However, that data is not yet available for inclusion in this report.

Santa Ynez River Hydrologic Unit 314

The Santa Ynez River watershed drains approximately 574,885 acres originating in the Santa Ynez Mountains of Los Padres National Forest, and is the only watershed within the Santa Ynez River Hydrologic Unit. Three reservoirs have been created along the river course. The Jamison and Gibraltar Reservoirs are both located within 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. Cachuma Reservoir is located along Highway 154, and major tributaries to the River between

Gibraltar 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, rural residential (including a large number of horse facilities) and the urban and residential areas of Solvang, Buelton and Lompoc. The City of Lompoc's wastewater treatment plant discharges to the River below the City, and at times the flows in the vicinity are effluent-dominated.

Summary of Existing Data for Hydrologic Unit 314

Water quality data has been collected by several entities in this watershed. Vandenberg Air Force Base staff monitor the river at the 13th Street Bridge; this is also a CCAMP site. Data collected by VAFB staff is not yet available for inclusion in this report. Data is collected by Lompoc WWTP staff in Santa Ynez River at two sites above and below the effluent discharge. WWTP monitoring data shows no toxicity below the discharge. However, temperature is elevated and dissolved oxygen and pH are both depressed downstream of the discharge relative to the upstream site. Phosphate is not monitored by the WWTP staff. Santa Barbara County has collected bacteria data at Surf Beach at the mouth of the River. This data is summarized by Heal the Bay. The report card shows that in dry weather the beach water quality is good (grade A+); no grade is reported for wet weather.

South Coast Hydrologic Unit 315

The South Coast Hydrologic Unit is made up of small coastal watersheds originating in the southern Los Padres National Forest and draining to the Santa Barbara coast. All watersheds in this Unit are completely within Santa Barbara County. Approximate sizes of sampled watersheds are listed below.

South Coast Hydrologic Unit watershed acreages (from Cal Water 2.2).

Waterbody Name	Watershed Acreage
Jalama Creek	16,270
Canada de la Gaviota	10,900
Canada del Refugio	5,500
Canada del Capitan	5,200
Dos Pueblos Creek	5,375
Bell Canyon Creek	3,300
Tecelote Creek	4,350
Los Carneros Creek	4,500
Glen Annie Creek	4,500
San Pedro Creek	4,500
San Jose Creek	4,500
Atascadero Creek	13,000

Arroyo Burro	6,200
Mission Creek	7,800
Sycamore Creek	5,600
San Ysidro Creek	4,000
Romero Creek	4,300
Toro Creek	3,800
Arroyo Paradon	4,500
Santa Monica Creek	4,000
Franklin Creek	3,000
Carpinteria Creek	9,400
Rincon Creek	9,300

Most of these creeks originate in steep chapparal, southern coastal scrub and woodland habitat, flow through mid-elevations which often support estate homes and other rural residential uses, and then through flat coastal terraces to the ocean. In the northwestern part of the Unit coastal terraces are predominately used for grazing and agriculture. From Goleta southeast through the communities of Santa Barbara and Carpinteria, the terrace is largely urbanized. The lowest reaches of several of these creeks flow through County and State Park campgrounds, these include Jalama County Park, Gaviota, Refugio, El Capitan and Carpinteria State Parks.

Channelization is common in the Unit, as many of these creeks flow through the urbanized flood plains. These watersheds include Arroyo Burro, Mission, Sycamore, San Ysidro, Romero, Toro, Arroyo Paradon, Santa Monica and Franklin Creeks. In the Carpinteria area, Franklin and Santa Monica Creeks are contained in cement box channels as they flow through intensive multi-use agriculture in the form of greenhouses and nurseries, as well as residential and light commercial development. Several of the nurseries and greenhouses in these watersheds have direct discharge points to the creek channels. Arroyo Paradon Creek is located just north of the city of Carpinteria and flows primarily through rural residential and greenhouse areas. The groundwater in this watershed is known to have extremely elevated levels of nitrate and a sump pump discharges groundwater to the creek at the Highway 101 bridge. The Goleta Slough watershed includes Los Carneros, Glen Annie, San Jose, San Pedro, Atascadero and Maria Ygnacio Creeks. Each of these creeks is channelized to some extent as they flow through the urban areas of Goleta. Los Carneros, Glen Annie, San Pedro and San Jose creeks have been converted to cement box channels in the lowest reaches and sediment is mechanically removed annually. Gaviota Creek has been completely channelized as it flows along Highway 101. Several streams and beaches in the Unit have previously been identified as impaired and are listed on the 303(d) list.

Impaired waterbody 303(d) listings in the South Coast Hydrologic Unit.

Water Body / Beach	**Listing**
Arroyo Burro Creek	Pathogens
Mission Creek	Pathogens
	Toxicity
Carpinteria Creek	Pathogens
Water Body / Beach	**Listing**

Carpinteria Marsh	Pathogens
	Low dissolved oxygen
	Priority organics
Goleta Slough	Pathogens
	Metals
	Priority organics
	Sedimentation
Refugio Beach	Pathogens
Rincon Beach	Pathogens
Jalama Beach	Pathogens
Gaviota State Beach	Pathogens
East Beach	Pathogens
Carpinteria State Beach	Pathogens
Arroyo Burro State Beach	Pathogens

Summary of Existing Data for Hydrologic Unit 315

Santa Barbara coastal creeks have been the subject of monitoring by several agencies and researchers. California State Parks staff and volunteers monitor sites within the Gaviota, Refugio, El Capitan and Carpinteria State Parks. State Parks data for dissolved oxygen, nutrients and benthic macroinvertebrates has been collected since 1997. However, this data is not reviewed here.

The County of Santa Barbara coordinates monitoring at several beaches where there are creek mouths. As a result of known impairment and inclusion on the 303 (d) list of for pathogen indicators, the County of Santa Barbara was recently awarded a grant to install a UV treatment system at the Arroyo Burro creek mouth. Coliform data for beach water quality is summarized on the Heal the Bay web site (see the report card link at www.healthebay.org). Heal the Bay report card grades for beaches where creeks are flowing to the ocean are summarized below.

Heal the Bay report card scores for Santa Barbara beaches. Dry weather data includes AB 411 monitoring conducted between 4/02-10/02 and wet weather grades reflect county monitoring conducted between 10/02-3/03.

Beach and creek name	**Dry 4/02-10/02**	**Wet 10/02-3/03**
Jalama Beach at Jalama Creek	A	F
Gaviota State Beach at Canada de las Gaviota	A	F
Refugio State beach at Canada del Refugio	A	D
El Capitan State Beach at Canada del Capitan	A	A+
Arroyo Burro Beach at Arroyo Burro Creek	C	F
East Beach at Mission Creek	C	F
East Beach at Sycamore Creek	B	F
Hammonds Beach at Montecito Creek	B	F
Carpinteria State Beach at Carpinteria Creek	A	A
Rincon Beach at Rincon Creek	A+	F

The Long Term Ecological Research (LTER) program has collected ambient water quality data from several creeks in the Unit. LTER sites on Rincon, Carpinteria, Franklin, Santa Monica, Mission and Arroyo Burro creeks are also CCAMP sites. Data collected on Mission and Arroyo Burro creeks has not yet been published. However, data from Carpinteria area creeks has shown consistently elevated nutrient levels, especially in Franklin Creek. LTER data collected as part of a study on nutrient loading estimates that 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 more than four times the load estimated by the LTER program from any other creek on the Carpinteria Coast. Carpinteria Creek, at over three times the watershed area, contributes less than half the load, at over 4000 kg/yr of nitrate (as N) and 700 kg/yr of phosphate (as P) (Robinson et. al. in 2003).

The County's Project Clean Water storm water volunteer monitoring program has collected storm water samples at many coastal creek sites between 2000 and 2002. Monitoring has been conducted at many of the same sites monitored by CCAMP. Project Clean 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 when compared to non-storm levels. Glyphosate concentrations are near criteria levels in all samples, and chlorpyrifos and diazinon levels are elevated in all samples.